An Evaluation of the Multiple and Interrelated Factors Shaping Evidence-Based Practice Implementation in Forensic Radiographic Practice

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Abstract

Background: Forensic radiography is an indispensable but less well-known element of forensic science. This has the primary role of assisting the criminal justice system using medico-legal radiographic imaging. It must be underpinned by evidence-based best practices through the full implementation and application of guidelines and protocols. Essential to this process is the support of the organisations delivering forensic imaging services.

Aim: To identify and explore the multiple and interrelated factors impacting guideline and best practice implementation in forensic radiography in international and United Kingdom contexts, from the perspectives of diagnostic radiographers.

Methods: A multi methods study design comprising three phases was conducted. The data collected was analysed through inductive content analysis, inductive narrative and thematic approaches respectively.

Results: Findings demonstrated a complex picture of current working practices with variation in levels of guideline implementation. Organisational, community and personal barriers underpinned implementation. Three synthesised themes comprising organisational awareness and support, radiographic community practice and perceptions, and research and best practice dissemination were developed from the data. These culminated in a conceptual model of the acceptance of adversity premised on the concepts of intractable organisational factors and the normalising of negative conformity.

Discussion: Issues such as staffing and resource shortages lie outside the direct control of organisations, but this was not the case for all issues identified. Others may potentially be addressed through a change in organisational practice behaviours, personal mindsets, and the enhanced recognition of the diagnostic radiography profession and its forensic role. These can only be achieved through a fundamental shift in healthcare organisations and their leadership approaches to the role of evidence-based practices.

Dedication

To my mum and dad who sadly never lived to see the completion of this latest adventure. I hope this makes you proud, wherever you both may be.

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I have been supported in this PhD adventure by so many wonderful people. I would firstly like to thank all those who volunteered to participate in this research, without your support this would not have been possible.

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Publications and Dissemination

Publications:

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Conferences:

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MacGregor, F., Breckons M, Swainston K. (2023) Organisational barriers, and facilitators to the implementation of best practice within forensic radiography practice: Phase 2 Questionnaire as presented at the SORSA 2023 Congress, Cape Town, South Africa. DOI: ResearchGate DOI: 10.13140/RG.2.2.35982.33607

Additional publications during this period:

Powlesland, C., **MacGregor, F.,** Swainston, K. (2023) Women's experiences of information, education and support when undergoing pelvic radiotherapy for gynaecological cancer: An exploratory qualitative study. *Radiography*. 29(1): 70-75. (Open access) https://doi.org/10.1016/j.radi.2022.10.004.

Camilleri, S., Swainston, K., **MacGregor, F.** (2023) A qualitative exploration of the experiences of post-mortem forensic imaging in Malta: A psychological perspective. *Radiography*. 29(1): 84-89. (Open access) https://doi.org/10.1016/j.radi.2022.10.007.

Cutler, S., **MacGregor, F.** (2021) Book chapter "Contrast Media" in Carver E, Carver B, and Knapp K (2021) *Carvers' Medical Imaging*. Third Edition, Elsevier.

Additional conferences during this period:

Achieving Excellence in Radiography Education and Research Nov 2023

Role of AI in Medical Imaging March 2023

Forensic Imaging Symposiums x 2 with UiTM

Additional research activities during this period:

Successful research funding bid awarded from CoRIPS (College of Radiographers) for a research project jointly led by **MacGregor, F** and Swainston, K.
"Clinical radiography practice: The psychological effects on radiographers in the UK."

Impact on education:

As course leader for the Teesside University **Post-Graduate Paediatric Forensic Radiography module**, and senior lecturer on other modules within the **Pg Certificate, Pg Diploma and MSc Forensic Radiography** courses, the findings of this research have fed directly into the learning and teaching material.

I have and continue to encourage postgraduate students doing their **MSc Forensic Radiography dissertations** to undertake research that either feeds into this research topic or explores certain aspects of the findings generated. This activity is reflected in the publication of one student's work (Camilleri, Swainston & MacGregor, 2023).

The findings of this and the secondary research stemming from this, are continually disseminated to colleagues in the Medical Imaging Team delivering **Pre-Registration BSc and MSc Diagnostic Radiography** at Teesside University. This has resulted in the research-enhanced delivery of the need for the recognition of the professional identity and role of radiographers within multi-disciplinary teams, the radiographer's role in the safeguarding of vulnerable adults and children, and the essential role of best-practice guidelines and protocols in this.

To be built into the BSc and MSc Diagnostic Radiography (Pre-Reg) courses is the introduction of activities premised on the findings of the ‘Clinical radiography practice: The psychological effects on radiographers in the UK‘ research. The key aims of this are to explore the psychological impacts of current practice in diagnostic radiography, what support mechanisms are currently available, and to identify meaningful approaches to the delivery of resilience and psychological well-being, as sought by practising diagnostic radiographers.

The findings from this research thesis and the secondary research will also be disseminated to the Society and College of Radiographers. This is to enable the building of these research recommendations into future guidance and policy documents.

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Forensic and General Radiography Abbreviations

ACR	American College of Radiology
CoR	College of Radiographers
CPD	Continuing Professional Development
CT	Computed Tomography
DVI	Disaster Victim Identification
EBP	Evidence-Based Practice
ESPR	European Society of Paediatric Radiology
FUSS	Follow-up Skeletal Survey
IAFR	International Association of Forensic Radiographers
ICA	Inductive Content Analysis
ISFRI	International Society of Forensic Radiology & Imaging
ISRRT	International Society of Radiographers and Radiological Technologists
JBI	Joanna Briggs Institute
MDT	Multi-disciplinary Team(s)
MRI	Magnetic Resonance Imaging
NAI	Non-Accidental Injury (term still used internationally, but not in UK since November 2017)
NHS	National Health Service
NPT	Normalisation Process Theory
PCC	Population, Concept, Context
PM	Post-mortem
PMCT	Post-mortem computed tomography
PMMRI	Post-mortem Magnetic Resonance Imaging
PPIE	Patient and Public Involvement and Engagement
RCR	Royal College of Radiographers
SCoR	Society and College of Radiologists
SEM	Socio-ecological Model
SOPs	Standard Operating Procedures
SoR	Society of Radiographers
SPA	Suspected Physical Abuse

Concepts and Definitions Used Within Forensic and General Radiography

Best practice: For this research, this is defined as radiographic practice premised on clinical expertise combined with high-quality research-based evidence, and the availability of resources.

Continuing Professional Development: The means through which post-registration healthcare practitioners continue to learn and develop their practice, to keep their knowledge and skills current and effective, throughout their career.

Diagnostic Radiographer: Also known as radiologic technologists, and medical radiation technologists in other countries. Diagnostic radiographers are Allied Health Professionals registered with the Health and Care Professions Council (HCPC), specialised in imaging the human anatomy to facilitate the diagnosis, treatment and management of fractures and pathologies.

Forensic Radiographer: A qualified diagnostic radiographer who undertakes the radiographic imaging of the human anatomy for medico-legal (court proceedings, or law enforcement). This can be for victim identification, suspected physical abuse, cause of death, drug smuggling, body packing and age estimation.

Medico-legal: Pertains to both medicine and the law.

Non-accidental injury: The term formerly used in the UK before November 2017, to describe the deliberate physical hurting or injuring of a child or vulnerable adult. This term is still used in many nations outside of the UK.

Radiologist: A qualified medical doctor specialised in diagnosing, evaluating and treating medical conditions using radiology examinations and procedures.

Suspected Physical Abuse: Formerly referred to as non-accidental injury (see definition above). This term is currently only applied in the UK, since November 2017.

Value-based judgement: Decision-making and processing premised on the individuals' values. These may have a positive or negative weighting towards patient care. This may be used in complex or challenging situations when faced with conflicting opinions or values.

Titles and Links to the Key Forensic Imaging Guidelines Referenced

Doyle *et al*., (2020) **IAFR Guidelines for best practice: Principles for radiographers and imaging practitioners providing forensic imaging services.** https://doi.org/10.1016/j.fri.2023.200540.

Doyle *et al*., (2019) **Guidelines for best practice: Imaging for age estimation in the living.** https://doi.org/10.1016/j.jofri.2019.02.001.

Royal College of Pathologists, Royal College of Paediatrics and Child Health (2016) **Sudden unexpected death in infancy and childhood: Multi-agency guidelines for care and investigation.** https://www.rcpath.org/static/874ae50e-c754-4933-995a804e0ef728a4/Sudden-unexpected-death-in-infancy-and-childhood-2e.pdf.

Royal College of Radiologists and The Society and College of Radiographers (2018) **The radiological investigation of suspected physical abuse in children. Revised First Edition**. https://www.rcr.ac.uk/media/nznl1mv4/rcrpublications_the-radiological-investigation-of-suspected-physical-abuse-inchildren-revised-first-edition_november-2018.pdf.

Royal College of Radiologists and The Society and College of Radiographers (2017) **The radiological investigation of suspected physical abuse in children.** https://www.rcr.ac.uk/publication/radiological-investigation-suspectedphysical-abuse- children. (Superseded by the 2018 revised first edition cited above).

Royal College of Radiologists, Royal College of Paediatrics and Child Health (2008) **Standards for radiological investigations of suspected non-accidental injury.** https://www.rcr.ac.uk/docs/radiology/pdf/RCPCH_RCR_final.pdf.

Society of Radiographers (2024) **Forensic and Post-Mortem Radiography Guidance. First Edition**. https://www.sor.org/getmedia/ee63bd32-3d07-425a-99ea-49571a5f847d/Society-of-Radiographers-Forensic-and-Post-Mortem-Radiography-Guidance_Final.

Chapter 1 – Introduction

1.1 Chapter overview

This doctoral thesis seeks to determine the multiple and interrelated factors shaping guidelines and best practices implementation in forensic radiography practice. This introductory chapter will define and outline the parameters of forensic radiography, where this sits within the broader spectrum of forensic science, and to establish the background to best practices implementation within this area of clinical practice. Through this, the research rationale is determined together with its specific aims, objectives and questions. The thesis overview will constitute the final component of this chapter.

1.2 Definition of Implementation in the context of this research

Implementation in the context of this research is defined as the putting to use or adoption of evidence-based interventions (Rabin & Brownson, 2018) such as guidelines and protocols within the forensic radiography setting. This is with the intention of proactively changing or updating professional practices to ensure currency of practice in light of research findings.

1.3 Forensic science and forensic radiography

Forensic science may be considered a discipline comprising many scientific disciplines with the overarching aim of assisting the criminal justice system (Roux, Crispino & Ribaux, 2012). Although, as stated by Margot, (2011), there are alternate definitions that could be considered, this thesis will use the following widely accepted definition: “a group of scientific disciplines concerned with the application of the respective scientific areas of expertise to law enforcement, criminal or civil, legal, or judicial matters” (Tarini, 2016: p.59). Typically, the core disciplines included are those involving computer and digital forensics, chemistry, biology, and physics (Roux, Crispino & Ribaux, 2012). Within these are further subspecialties, including, but not exclusively, forensic pathology, forensic anthropology, forensic medicine, forensic

odontology, and forensic radiography (Tarini, 2016). It is this latter subspeciality that will be the focus of this thesis.

1.4 The concept of forensic radiography and practice

The inclusion of civil, legal, and judicial matters is important when discussing forensic radiography since its remit can encompass the full spectrum of legal processes. When referring to forensic radiographic imaging practices, it is essential to consider a definition, since, although widely used, is not a well-known area of medico-legal practice outside the remits of forensic investigation (Decker *et al.*, 2019). In the context of this research and regarding the forensic radiography element specifically, this can be defined as the "use of diagnostic imaging in legal enquiries or court cases" (Society of Radiographers (SoR), 2024: p.11).

1.4.1 The historic development of forensic radiography

Forensic radiography has developed exponentially in its application in recent years, stemming from its humble origins in 1895. This is an important date for radiology generally and forensic radiography specifically in that it was in this year that William Röntgen "incidentally discovered" a new form of ray (Decker *et al.*, 2019; Brogdon & Lichtenstein, 2011). This ray was to form the basis of all present-day radiographic imaging using ionising radiation, such as projection radiography (more commonly referred to simply as x-ray) and Computed Tomography (CT), enabling the imaging of foetuses, neonates, children, and adults, living and deceased.

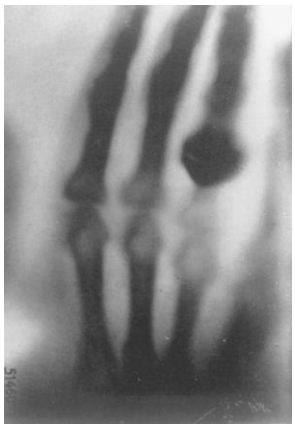

Figure 1.1 The first roentgenogram (x-ray) of a human obtained in November 1895 (Brogdon, 2011)

This newly discovered X-ray was used only a matter of weeks after its inception to aid in solving a murder case, and less than a year later for the examination of an Egyptian mummy (Lagalla, 2020). Although it was not until 1919, in North America, that X-ray became established as a credible tool for forensic identification in criminal cases by the courts. This was famously achieved through the submission of a radiograph (X-ray image) as evidence, demonstrating the bullet lodged in a fractured rib of Theodore Roosevelt following a failed assassination attempt in 1912 (Sharma, Aggarwal & Paliwal, 2011). This was the first step in a crucial area of forensic radiographic work in detecting gunshot wounds and the trajectory of such injuries through being able to trace the path of the bullet(s) within the body (Brogdon, 1998). X-ray was rapidly adopted within the medical setting as an effective and non-invasive means of examining a patient, but its forensic role was slower to develop (Brogdon & Lichtenstein, 2011).

In 1945 the first documented case of forensic odontology (the radiographic imaging of teeth), being used as a means of identification was seen; in this instance, the identification of the remains of Adolf Hitler (Charlier *et al.*, 2018; Perrier, 2011). This example, together with those previously highlighted, demonstrates the established application for forensic imaging within the criminal system, however, technologically, this was developmentally static (Flach, Thali & Germerott, 2014). It was not until the invention of computed tomography (CT) by Sir Godfrey Hounsfield in 1967, with the support of the Electronic and Music Industries (EMI), (Maizlin & Vos, 2012) and its rapid application within the medical field (Hsieh & Flohr, 2021) that this opened an entirely new way of examining the living body or remains of the deceased (Conlogue, Beckett & Posh, 2009). When combined with the opportunities presented by using magnetic resonance Imaging (MRI) developed in 1974 by Lauterbur and Mansfield independently (Geva, 2006), the application of a systematic and coordinated approach to forensic radiography was necessitated (Viner, 2020).

1.4.2 The roles and remits of forensic radiography

This need for a systematic and coordinated approach to the undertaking of forensic radiography was never more clearly demonstrated than through the role many radiographers undertook during the rise in terrorism attacks in mainland UK between

1980 and 1995 (Viner, 2020) and again in more recent years, with events such as the London and Manchester Arena bombings, and Grenfell fire (Black, 2019). Such incidents resulted in multiple mass casualties and fatalities, defined as 10 or more, (Carroll *et al.*, 2017). In these instances, radiographers were required to image for clinical diagnostic purposes, and importantly, from the context of this research, some also undertook forensic imaging examinations. In such instances, scanning the bodies of the living and deceased to locate any shrapnel, pathologies, injuries, or surgical implants (Venables & Hollington, 2016) that could aid in the identification of the victim. Where these incidents result in mass fatalities, the primary aim of the forensic radiography team must be victim identification (Argo *et al.*, 2020). Whilst offering a measure of respect and dignity to the deceased and comfort to the relatives of the deceased, this also has an important legal purpose, enabling; the final settlement of inheritance or estate, a living spouse to remarry, and aid any criminal proceedings (de Boer, Blau, Delabarde & Hackman, 2019).

The indispensable role that forensic radiography has within forensic science (Buccelli, Niola & Di Lorenzo, 2020) and the remit of mass fatalities and disaster victim identification (DVI) has perhaps never been more effectively demonstrated than in the events following the catastrophic tsunami that devastated the coastlines of much of Southeast Asia on Boxing Day, 2004 (Black, 2019). This saw hundreds of thousands of deaths in which the final number remains unknown. In this instance, as with those previously identified, radiology was used extensively through odontological (dental) imaging of the post-mortem remains, which, could then be compared with those obtained antemortem (before death) and in the anthropological examinations of the bony and soft tissue remains. Within this remit, clinical radiography also holds a significant role in aiding the establishment of a biological profile for each victim, encompassing race, skeletal sex, height, pathologies, trauma, surgical interventions, prostheses, and congenital abnormalities (Aalders *et al.*, 2017; Viner *et al*., 2006), and the identifying and reassociating of dismembered body parts (Blau, Robertson & Johnstone, 2008). Whilst many of these are useful factors, such approaches can only be fully successful if there are antemortem images for comparisons to be made (Beck, 2011).

Forensic science and radiography are, for most people, associated with postmortem imaging to identify the cause of death and victim identification as discussed above. A perception gained largely through popular TV shows such as Bones, CSI and NCIS (Mobley, 2021). However, its scope also extends to many other medico-legal areas, including evaluation of injuries and or death, for criminal, civil and insurance proceedings, education, research and administration.

Whilst the extensive scope of forensic practice is indicated above, it is also necessary to consider those other areas where radiographers may undertake forensic imaging, (see Table 1.1). This table highlights that almost all aspects of jurisprudence in which individuals are involved may fall within the remit of requiring forensic radiography. Of those areas demonstrated, the imaging of children for suspected physical abuse antemortem (living) and post-mortem, together with the post-mortem imaging of adults for the cause of death, rather than identification are those aspects most commonly undertaken in day-to-day practice settings (Smith *et al.*, 2022; Decker *et al.*, 2019).

Area of Practice	Purpose
Paediatrics	To aid in identification of suspected physical abuse (SPA), formerly known as non-accidental injury (NAI)
Narcotics smuggling/body packaging	To establish if a suspect drugs courier has ingested or inserted drugs
Person identification (living)	To identify unknown victims of human trafficking and age assessment (to determine if adult or child)
Person identification (deceased)	In cases of an unknown fatality and mass fatalities
Post-mortem imaging	To aid in establishing cause of death

Table 1.1 Areas of Forensic Radiographic Practice

1.4.3 Forensic Radiography and the Legal Context: A UK Perspective

In the UK as with most other countries, there are two primary legal systems, which can be defined as *civil* and *criminal*. In addition to these that apply to all members of the population; medical, healthcare, and scientific practitioners are also bound by specific legislation, applicable to their areas of practice. To facilitate this, additional profession-specific training and qualifications are mandated to enable these

practitioners to register with their profession and practice using protected titles (SOR, 2024; Doyle *et al.*, 2020; Payne-James, 2011).

Forensic radiographic practice in the UK is seen as a subspeciality and extended role to that of diagnostic radiography. Extended roles in this context can be defined as the acquisition of skills and responsibilities beyond the statutory skills and competencies required for professional registration (Hardy & Snaith, 2005). In forensic radiography, this necessitates the undertaking of additional relevant post graduate qualifications enabling the radiographer to carry out further roles associated with greater professional accountability (Miller, Price & Vosper, 2011). Although as established by Henderson *et al.*, (2016: p.263) the implementation and support for role extension in radiography has been 'patchy and often incoherent' based primarily on 'professional preference or opposition'. However, this role is not recognised as a protected title in the same way as an Advanced Clinical Practitioner (ACP) for which additional remuneration is received. This being premised on the 'assumption' that this requires the acquisition of a higher level of professional knowledge and attainment (Hardy & Snaith, 2005: p. 329), A requirement also recommended for the undertaking of forensic imaging (SoR, 2024; Doyle *et al.*, 2020, RCR, 2018).

Given the extensive remits and scope of forensic radiography, the role each has within the medico-legal setting, all professionals involved in the imaging pathway i.e., radiologists and radiographers, must have an awareness, knowledge and understanding of the guidelines, standard operating procedures (SOPs) and protocols applicable (SoR, 2024; HCPC, 2023). These guidelines, SOPs and protocols must be meaningful and relevant to the procedures, interventions, and techniques required and premised on high-quality evidence (Melnyk & Fineout-Overholt, 2022). It is these requirements that define best practices within this setting.

As early as 1997, Baker & Hughes (1997) identified through a small-scale survey study that the required level of knowledge for appropriate evidence collection and forensic imaging for suspected physical abuse was lacking among radiographers. This finding was reflected in the research of Brown & Henwood, (1997), with most participating radiographers unaware of the legal implications encompassed in

imaging paediatrics for non-accidental injury (NAI) as it was then called in the UK. It should be acknowledged though that there was very little guidance available to support radiographers at this time, despite the significant medico-legal role they play in this scope of practice (Viner, 2020).

From the 1980s to the late 1990s, guidelines for undertaking any aspect of forensic imaging were scant, comprising two brief documents from the College of Radiologists (CoR) dated 1985 and 1999. These provided an overview of the basic requirements for this provision but, gave little guidance on the roles and responsibilities of those involved and the specific medico-legal requirements of this role. In recognition of the increasing requirement for diagnostic radiographers to undertake forensic imaging for cases of suspected physical abuse in children, additional guidance by the CoR (2005; 2009), SoR (2014; 2024), and Royal College of Radiographers (RCR), (2017; 2018) has been provided over the years reflecting the changes in practice and imaging technologies in the intervening years. This guidance was further substantiated in the UK by the collaboration between the CoR and the International Association of Forensic Radiographers (IAFR) and its predecessor the Association of Forensic Radiographers (AFR) (2008), leading to several publications providing generic guidance for forensic imaging (2010; 2014; 2024), post-mortem imaging (2015) and imaging for age estimation in the living (Doyle *et al.*, 2019). With such extensive established legislation, forensic imaging guidelines and protocols available, the UK could be considered more advanced than many other international countries (Primeau, Marttinen & Pedersen, 2022).

1.4.4 Forensic Radiography: An International Perspective.

From an international perspective, many nations such as India (Patyal & Pandey, 2023), the Nordic countries (Primeau, Marttinen & Pedersen, 2022), Australia, New Zealand (Smith *et al.*, 2022), Malta (Camilleri, Swainston & MacGregor, 2023) and Nigeria (Sangonuga, Kekana & Eze, 2022), could be considered to be in their infancy in terms of their forensic radiography provision. For such nations, the primary challenge lies in establishing guidelines based on best practices through which future practice development may be premised. This challenge can be compounded

by the lack of consistency in current protocols within those nations where forensic imaging protocols have been long established, such as the UK, the Netherlands, Switzerland and Germany (Shelmerdine *et al.*, 2019). This is exemplified in the protocols for the post-mortem imaging of children in the Netherlands and the UK. The former has offered CT as standard since 2010 (van Rijn *et al.,* 2017), and the latter only as part of the post-mortem process on a case-by-case basis (Royal College of Pathologists, 2016).

This need for an international consensus within forensic imaging, particularly regarding the imaging for suspected physical abuse has been highlighted in several research studies (Paddock *et al.*, 2023; Blangis *et al.*, 2021; Hulson, van Rijn & Offiah, 2014). A similar debate has come to the forefront concerning post-mortem imaging with the increased availability and uptake of CT (and MRI) as an adjunct to the traditional full autopsy. Recent research by Khmara *et al*., (2024), reflected previous research findings (Doyle *et al.*, 2023), whereby noticeable regional variations were evident regarding post-mortem imaging practices and technologies used.

In acknowledgement of the lack of consensus in imaging practices across the many scopes of forensic radiography practices nationally and internationally, there has been a concerted drive by international organisations such as the IAFR and International Society of Forensic Radiology and Imaging (ISFRI) to develop, issue, and proactively promote evidence-based guidance to those radiographers involved in forensic radiography practices for medico-legal purposes (Doyle *et al.*, 2020). These have been written with both national and international audiences in mind, whilst also recognising that there are differences in local legal systems within and across nations.

1.5 Current forensic radiography practice and research rationale

All qualified diagnostic radiographers are expected to acquire the knowledge of the relevant legislation and guideline knowledge applicable to their scope of practice through additional post-graduate training and documented evidence of their

maintenance of continuing professional development (CPD), (SoR, 2024; Doyle *et al.*, 2020; Doyle *et al.*, 2019; RCR, 2018; Payne-James, 2011). Then follows local expectations that this acquired knowledge be disseminated among colleagues, the wider department, and multi-disciplinary teams (Viner, 2020). Such peer-to-peer learning strategies in radiology can be advantageous as established by Awan (2021), whereby active and interactive learning without 'power' barriers between teacher and learner in situ can be facilitated. However, whilst perceived as a practical solution, given staffing and budget constraints within radiography and other healthcare departments, particularly but not exclusively within the NHS, reliance on dissemination as a means of learning is not without risk. Such risks can perhaps best be demonstrated through the Chinese whispers game, and how quickly information may become misheard or misinterpreted. Such misinterpretation can rapidly result in poor misinformed practice that is difficult to rectify (Addis, 2002). This can potentially have significant implications for the collection and continuity of radiographic evidence within the forensic medico-legal pathway. To be effective, the method of colleague-to-colleague dissemination must be appropriate, use the correct mechanisms, and have sufficient time allocated to it, which can be challenging within busy and short-staffed departments (Curtis *et al.*, 2016).

1.5.1 Current best practices and associated challenges

This current approach to learning premised largely on peer-to-peer knowledge acquisition and dissemination could also be challenged by the hypothesis presented by Wiersma (2007) and supported by Morland, Breslin & Stevenson, (2019) who identified that effective learning opportunities can only have validity if premised on their being sufficient slack in resources, and that an organisation has employees with diverse skills and experiences. This latter requirement is lacking across most NHS radiography settings due to high vacancy levels (NHS, 2022). Whilst not explicitly acknowledging the limitations of dissemination as a means of knowledge acquisition, the Society of Radiographers (SoR, 2024) has stipulated that this would not be appropriate as the core method of learning for the lead radiographer handling a forensic radiographic examination. For these individuals, it maintains that appropriate post-graduate education must be evidenced together with CPD relevant to this setting.

It is essential when considering knowledge acquisition and dissemination that although some diagnostic radiographers have the option to become specialists, undertaking only forensic imaging such as non-invasive postmortems for cause of death, most undertake this role as part of their day-to-day working practices (Camilleri, Swainston & MacGregor, 2023; Smith *et al.*, 2022). Such practice expectations and likely unfamiliarity with procedures can present additional challenges and knowledge requirements if their radiographic evidence is not to be opened to challenges in court (Viner, 2020). This issue was highlighted by Smith *et al.*, (2022) whereby radiographers in Australia and New Zealand are often unknowingly exposed to forensic cases, with many lacking knowledge and awareness of how these cases differ from clinical diagnostic cases, whether guidelines exist to support them, and where such guidelines and protocols may be located. This is not a finding unique to Australia, New Zealand and in other countries where forensic imaging could still be considered in a developmental stage (Camilleri, Swainston & MacGregor, 2023; Primeau, Marttinen & Pedersen, 2022), but also in the UK where these are well established. If this aspect of practice is to be effective and of value within the fields of both science and medicine, this must be underpinned by the evidence, thus ensuring its precision, viability, and reliability within medico-legal investigations (Aalders *et al.*, 2017).

Despite the efforts of organisations such as the IAFR and ISFRI to address the many discrepancies and gaps in guideline implementation within forensic radiography practices through the adoption of evidence-based research, its implementation remains piecemeal. This is not a situation that should be considered unique to forensic radiography but rather one that is seen across most highly developed implementation execution plans (Damschroder *et al.*, 2022).

When considering the healthcare sector and the NHS specifically within the UK, this exemplifies the challenges faced when seeking to implement new guidelines and protocols premised on the latest evidence-based research. It is widely acknowledged that the NHS is a complex environment for new practice implementation due in part to the turbulence and anxieties that change evokes (Burgoyne, 2002, cited Brook, 2010). A further compounding factor is the perceived lack of resonance between these best practice guidelines and the radiographers, associated MDT and other

factors, including opportunities, resources (Decker *et al.*, 2019) and poor distribution (Snaith, 2016). These are exemplified by the current debates regarding the most appropriate imaging modalities, and guidelines produced. One such example is the RCR (2018) guidelines in which some recommendations even at the time of publication were based on outdated research.

It is necessary to remain cognisant of guideline currency, given that, although the introduction and knowledge transfer of forensic radiography practice through the transition of research evidence into policy, guidelines and practice can become an established one, it can never be considered complete, due to practice leading to changes in roles, identities and over time education (Lindberg, Walter & Raviola, 2017). This is an essential consideration in a practice setting which continues to see rapid technological advancements within applications and associated knowledge specialisation. In acknowledgement of these points, recognition of the ever-changing scene is also needed across all forensic radiography practices, which may be disrupted by poor interprofessional education, communication, cooperation and collaboration (Martin & Turner, 1986).

The value of interprofessional practices cannot be dismissed within this setting: a principle established by Lewin and Reeves (2011). They evaluated communication in an interprofessional setting through applying a modified version of Sinclair's (1997) interpretation of Goffman's (1956) theory of impression management. Perhaps, most noteworthy within their findings was that key interprofessional communication was more likely to occur on an ad hoc, short, and unstructured basis in the 'backstages' of the hospital environment, such as corridors, ward spaces and the nurses' station, rather than what may be considered the preferred formal communication forums of MDT meetings or ward rounds. These latter formal settings were found to be superficial, through which only a visible "ritualistic" rather than functional setting and role in interprofessional teamwork was created (Lewin & Reeves, 2011: p.1600). It is essential to acknowledge the hidden nature of these ad hoc knowledge transfer systems through which the effective knowledge transfer and implementation of best practice guidelines and protocols can be difficult. Whilst the authors recognised that there is scope for such practices to be changed by the guideline and policy writers,

this can only be possible via changes at the grassroots level and ownership of the spaces and interactions by those professionals and management alike. However, such requirements can only be met if the diverse disciplines and specialities' respective and potentially conflicting goals are met simultaneously (McDonald, 2004).

1.5.2 An overview of the research within this setting

Academic literature such as that of Bordieu and Good (1977) and Sinclair (1997) explored the interplay and concepts of the habitus of individuals within practice settings. Through this work it is believed that the righteousness of their practice has become default through time, thereby being considered more dependable than the guidelines and protocols. Encompassed with this is the need to consider the role of professionalism as a singular concept but also within the context of the MDTs, interprofessional working, culture and the relationships within these, if the efficacy of best practice implementation is to be fully understood. Past examples of such research include Goffman's (1956) Presentation of Self, the Theory of Impression Management as explored by Lewin and Reeves, (2011) and negotiated order by Gabe, Bury and Elston (2004). More recent research such as Yielder and Davis, (2009) examination of the struggle of emerging professions to attain autonomy; Nugus *et al.*, (2010) interactional study of health occupational relations and the 'negotiated order', have raised significant questions regarding professional collaboration, development, and the practice settings workplace dynamics (Lindberg, Walter & Raviola, 2017).

There are few examples of academic research into the impacts of complex workplace cultures, boundary work, and professional identity, from either their singular or collective impact upon the implementation of best practices within the clinical setting. Research, such as that of Lin, Chaboyer, Wallis, and Miller (2013), explored the environmental influences, such as, the practitioners' roles on specific interactions within the workplace dynamics. Others, including Lindberg, Walter and Raviola, (2017) examined this through impacts of new technology implementation and Goopy, (2005) through the perspectives of a local nursing culture.

To date, there has been no research into any aspect of working culture, multi and interdisciplinary working, organisational and associated environmental factors within the forensic radiography setting. There is also a lack of research regarding the influences not typically associated with human interactions, such as forensic radiography guidelines and protocols.

1.6 Research Aim, Objectives, and Research Questions

This chapter has described the historical development of forensic radiography and its extensive roles within the medico-legal remit of forensic science. However as demonstrated the healthcare sector in which forensic radiography sits is complex and challenging, exacerbating the issues faced in addressing the current piecemeal implementation and application of best practices in forensic radiography. Essential to gaining an initial understanding of these issues is the exploration of the cultural and multidisciplinary research underpinning this setting.

There is an established lack of research specifically addressing the complex concepts entailed in best practice implementation in forensic radiography. As such, this research seeks to explore these concepts as part of evaluating the many and interrelated barriers and facilitators to the effective implementation of best practices within forensic radiography.

This research aims to identify the multiple and interrelated barriers and facilitators to the effective implementation of best practices within forensic radiography from a UK and international perspective. To facilitate this, the following objectives were identified:

i. To conduct a scoping review and synthesis of published and unpublished literature examining the perceived factors impacting on best practice facilitation within those professions involved in the forensic imaging pathway, including radiographers, radiologists and referring clinicians.

ii. To gain insight into current forensic radiography practice from the perspective of radiographers directly involved in any scope of forensic radiography practice via an online questionnaire.
iii. To draw upon the findings of the scoping review and questionnaire to formulate the semi-structured qualitative interview questions, that will be posed to those diagnostic radiographers involved in the forensic radiography practice.

To enable these objectives to be addressed, the following questions were posed and worked through:

1. What role does the organisation's physical environment, and technology have on best practices implementation in forensic radiography?
2. What can be considered the weak or breakdown points within current radiography and forensic radiography teams, the MDTs and wider organisations impacting upon effective best practice implementation?
3. What are the implications of the perceived 'power plays' (Raven 2008), specialist knowledge hierarchical dynamics within the MDTs (Nugus, 2019) and 'negotiated orders' (Apesoa-Varano, 2013; Reeves *et al.*, 2009) on best practice implementation within the forensic radiography setting?
4. How is the role of forensic radiography perceived and managed within the organisations' understanding and management of diagnostic radiography?
5. What strategies are adopted within clinical settings to ensure the effective dissemination of best practices within forensic radiography settings?
6. What strategies could be considered to ensure the effective dissemination and implementation of evidence-based best practices within forensic radiography?

1.6.1 The Research Context

This research has been set within the context of those diagnostic radiographers involved in forensic imaging within any of the scopes of practice referred to previously. This has sought to include international and UK-based radiographers working within this remit. This was considered essential to the research due to the

widely recognised need for international best-practice standards to be developed and adopted by all nations undertaking forensic radiography as highlighted by organisations such as the International Association of Forensic Radiographers (IAFR) and International Society of Forensic Radiology and Imaging (ISFRI).

1.7 Thesis overview

This section provides an overview of the chapters within this thesis.

Chapter 2: This presents the results of the scoping review, garnered through the synthesis of the key findings from the papers that met the inclusion criteria. The process of paper selection and data synthesis are presented in detail, together with a summary of the included studies. Due to the lack of literature explicitly focusing on the research question posed, this review explored the factors impacting the implementation of best practices across the wider remit of forensic radiography. Through application of inductive content analysis (ICA) these have been highlighted, along with the identification of further research areas.

Chapter 3: This explores the theoretical and methodological underpinning of the research project together with a rationale and explanation of the paradigm and methods employed.

Chapter 4: The first phase of primary data collection; a mixed methods online questionnaire is explored in this chapter together with its findings. The rationale for this method is given and ethical approval demonstrated, in conjunction with the process of inductive analysis of the data collected. The findings generated are discussed along with their implications and identification of further research required.

Chapter 5: The findings of the second phase of primary qualitative data collection, that of semi-structured interviews, are explored in this chapter. Through this, in-depth data could be gathered from those participants involved in forensic imaging. A rationale is given for the method used, together with evidence of the ethical

requirements being fulfilled. The process of data collection and analysis through a thematic approach has been fully outlined, with the findings presented.

Chapter 6: This sees the integration, analysis and subsequent discussion of the collated findings from the scoping review, and two primary data collection phases. Each theme developed is explored in conjunction with any connections between them. This enables a presentation of the researcher's conceptualisation of the factors impacting on the effective implementation of best practices within forensic radiography, resulting in an overarching conceptual model. This chapter discusses this conceptual model in the context of the wider literature through which recommendations for forensic radiography practices, radiology departments, the MDTs involved, healthcare organisations and future research will be made. The strengths and limitations of this research thesis are presented together with the researcher's final reflections and concluding thoughts from the process of this research undertaking.

Chapter 2 – Literature Review

Aspects of this chapter have been published:

MacGregor, F., Breckons, M., Swainston, K. (2024) Organisational Barriers and Facilitators to the Implementation of Best Practice within Paediatric Forensic Radiographic Practice - A Scoping Review. Radiography. 30(1): 45-51 (Open Access). DOI: 10.1016/j.radi.2023.09.011.

2.1 An Overview

This chapter presents the methods employed to systematically explore current literature applicable to the scope of this research, together with the analysis and synthesis of the findings. This commenced with a presentation of the aims and objectives of the first phase of this research project. Essential to this process was a critical evaluation of the methodological stance taken, together with a reflection by the researcher on the strengths and limitations of this literature review. Consideration was given to how the findings from this review would inform the subsequent research phases.

2.2 Aim and Objectives

The key aim of this literature review was to explore factors impacting the implementation of best practices within forensic radiography from the perspectives of those practitioners (radiographers, and radiologists) involved. To facilitate this, specific objectives were identified, these being

- To apply a systematic approach to identifying and selecting qualitative peer-reviewed published papers and grey literature relevant to this research question.
- To undertake an inductive content analysis of the data collated from relevant sources.
- To identify gaps within the current literature related to the implementation of best practices within forensic radiography.

2.3 Methodology

2.3.1 Rationale for undertaking a scoping review

Chapter 1 (Introduction) outlined areas of research undertaken within healthcare settings in which best practice implementation has been considered from strategic and intervention perspectives, through which implementation would be more effective. These established that factors such as healthcare organisational structure, workplace cultures, multidisciplinary teamwork, individual roles and professional identity may play an important role and must be considered. However, such work explored these from a general clinical, caring, diagnostic and therapeutic perspective, primarily relating to nursing and or medicine rather than through a medico-legal construct applicable to forensic radiography. As such it is necessary to establish whether the factors stated above were equally relevant to forensic radiography, or whether other factors unique to this setting must also be identified.

To establish a firm grounding for this research, a rigorous synthesis of current knowledge pertaining to the research question was essential (Paré & Kitsiou, 2016). This would serve three key purposes, the synthesis of existing research, the identification of any gaps within this literature (Tricco *et al*., 2016; Sylvester, Tate & Johnstone, 2013), and the contribution of an original piece of research to the wider research project (Paré *et al.*, 2015). Such an approach would also enable the formation of a platform from which other interested parties may wish to develop further research. This synthesis of current knowledge was considered important to inform the two subsequent primary data collection phases of this research thesis (Chapters 4 and 5).

Several methods can be used to review literature, including narrative, systematic, evidence synthesis and scoping. Due to the paucity of research studies examining the factors underpinning the efficacy of best practice implementation within healthcare generally, and forensic radiography specifically, a scoping review methodology was deemed the most appropriate approach for this literature review. Whilst described as a relatively recent form of literature review (Munn *et al.*, 2018), with the first published format in 2004 (Arksey & O'Malley, 2005), this method is

widely recognised as being focused on identifying “broader and more descriptive” aspects within the literature (Peters *et al.*, 2022), enabling the selection of many possible sources of applicable data or evidence (Munn *et al.*, 2018).

2.3.2 An evaluation of the scoping review methodology

Whilst considered a rapidly growing method of evidence synthesis (Peters *et al.*, 2022), the scoping review methodology is not without its critics due largely to a lack of consistency, and transparency in the terminology and methods used within the review process (Cooper, *et al.*, 2019; Colquhoun *et al.*, 2014). In acknowledgement of this critique, measures have been taken by the JBI Scoping Reviews Methodology Group to enhance the guidance available for those undertaking scoping reviews in 2014 (Khalil *et al.*, 2016) and most recently in 2020 (Peters *et al.*, 2021). However, whilst these measures provided clarity of process, there were still issues regarding the definition of a scoping review and thus its purpose (O’Brien *et al.*, 2016). This was eventually reconciled through much deliberation as; a form of evidence synthesis “that aims to systematically identify and map the breadth of evidence available on a particular topic, field, concept, or issue, often irrespective of source” (Munn *et al.*, 2022: p.951). It is this definition that formed the premise of this literature review.

2.3.3 Protocol development and registration

An essential stage in undertaking this scoping review was the development of a protocol before commencing the review itself (Peters *et al.,* 2022). This was considered integral to the development of a “roadmap” that the subsequent full review could follow (Peters *et al*., 2022: p.954), and as a means of ensuring there was no duplication of reviews previously undertaken on the topic (Shamseer *et al.*, 2015). Thus, the JBI and Cochrane databases were searched, confirming that no previous scoping or systematic reviews had been undertaken, and no protocols were lodged concerning the research question posed. On verifying this, the review protocol was completed following the JBI guidelines (Peters *et al.*, 2020) and PRISMA-P Checklist, (Moher *et al.*, 2015; Shamseer *et al*., 2015), (Appendix A). The

specific steps such as search strategy, inclusion criteria study selection, are discussed in detail within the following subsections. Application of the guidelines and checklist was considered a valuable strategy to enhance the quality and undertaking of the scoping review (McGowan *et al.*, 2020). On completion of the protocol, this was registered with the JBI (Appendix B).

2.4 Full Scoping Review Methods

2.4.1 Search strategy and inclusion criteria

To inform this scoping review, the JBI's updated methodological guidance for the conduct of scoping reviews 2020 (Peters *et al.*, 2021) was used in conjunction with the Population, Concept and Context (PCC) mnemonic and approaches of Arksey and O'Malley, (2005) and Levac, Colquhoun and O'Brien, (2010) (Table 2.1).

PCC		Inclusion Criteria
Population	➨	Professionals involved in the forensic radiography process, i.e., radiologists, diagnostic/forensic radiographers, consultants, pathologists, coroners
Concept	➨ ➨ ➨ ➨	Guidelines, protocols Knowledge and awareness Workplace culture Multi-disciplinary team working
Context	➨ ➨	All geographical settings (UK and International) rural and urban, hospital, airport, mortuary, makeshift sites on location (for mass fatality incidents) Facilities

Table 2.1 PCC mnemonic and inclusion criteria

A systematic search was undertaken using the following databases: CINAHL, EMBASE-OVID, Medline, PsychINFO, Scopus, MedNar, Web of Science, Worldwide Science, Directory of Open Access Journals (DOAJ), Prospero, OpenGrey, OpenMD, EThOS, Medscape and Grey Literature Report. Searching a broad scope of databases is recommended to enable the maximum recall of relevant literature (Bramer *et al.*, 2017), enabling the capturing of both peer-reviewed published and grey literature. The grey literature could comprise artefacts such as conference abstracts, presentations, theses, that have not gone through a peer-reviewed process. Whilst considered challenging to access (O'Brien *et al.*, 2016), inclusion of

grey literature is considered important as not all research or findings may be published but rather be in the form of meeting minutes or other formats (Lefebvre & Clarke, 2001).

Due to the lack of literature specifically addressing the research question, as established within the introductory chapter, it was considered essential to broaden the scope of the literature to be included in this review. Therefore, in addition to diagnostic and forensic radiographers, the decision was taken to include all professionals potentially involved in the forensic imaging pathway, such as pathologists, radiologists, consultants and coroners. These professions were included since they can have a potential role within the forensic imaging pathway, through referral processes and guidance. The extent of their roles is dependent on the specifics of each individual case.

A preliminary or pilot search using the terms (Forensic Imaging OR Forensic Radiography) AND (best practice OR guidelines) AND (Implementation) AND Barriers or facilitators) was found to be too broad in scope, resulting in no relevant studies identified. This necessitated an amendment to the search strategy by the researcher to reflect the specific areas of forensic radiography practice, as demonstrated in Table 2.2.

Forensic Area of Practice	**Key Search Terms**
Paediatrics	(Paediatric OR pediatric OR children) AND (Non-accidental injury OR Suspected Physical Abuse) AND (Imaging OR radiography OR radiology) AND (best practice OR guidelines) AND (skeletal survey) AND (Adherence OR Compliance).
Post-mortem imaging	(Forensic) AND (Post-mortem) AND (Imaging OR Virtual autopsy) AND (Best practice OR guidelines).
Narcotics smuggling/packing	(Forensic imaging OR Forensic radiography) AND (Narcotics OR drugs) AND (Smuggling OR Packing) AND (Best Practice OR Guidelines).
Person Identification (living or deceased)	(Forensic imaging OR Forensic Radiography) AND (Person Identification) AND (Best Practice OR Guidelines)

Table 2.2. Examples of Forensic Practice Subspecialties and Keywords Used

Working on this premise, the specific search terms were combined with the Boolean operators “AND” and “OR”. Using these operators enabled the terms to be combined or excluded as required (Davies, 2019) thereby enhancing the sensitivity and specificity of this search strategy (Gusenbauer & Haddaway, 2019). To ensure the currency of the selected literature to the research question, only those sources published between 2008 and 2023 were included, thereby also ensuring relevance to the implementation of the primary guidance published within this timeframe (Doyle *et al*., 2020); RCR, 2018; Doyle *et al*., 2019; SoR, 2014; RCR and Royal College of Paediatrics and Child Health (RCPCH) 2008).

Given the international scope of two of these guidelines (Doyle *et al*., 2020; Doyle *et al.*, 2019), and the stated aim of forensic imaging organisations such as the IAFR, ISFRI, the European Society of Pediatric Radiology (ESPR) and other international organisations for standardised international guidelines, it was considered essential to include sources from the UK, Europe and the wider global perspective where applicable.

To ensure the thoroughness of the search strategy, hand searches of those journals considered most relevant to the research topic were also searched, as listed in Table 2.3.

Journal	Publisher
Forensic Imaging (formerly the Journal of Forensic Radiology and Imaging)	Elsevier, ScienceDirect.
Forensic Science, Medicine and Pathology	Humana Press.
Journal of Forensic Science	American Academy of Forensic Sciences, Wiley Online Library
Journal of Forensic and Legal Medicine	Elsevier, Science Direct.
Clinical Radiology	Royal College of Radiologists, Elsevier, ScienceDirect.
Radiology	Elsevier, Science Direct.
Pediatric Radiology	Springer

Table 2.3: Specific journals identified for hand searching.

In addition, snowballing by reference checking of selected papers was undertaken. These measures were applied to minimise the risk of research being missed through 'miss filing' in those databases searched, or through searching an insufficient number of, or incorrect databases (Bramer *et al.*, 2017).

2.4.2 Study selection strategy

Where the papers or literature were unavailable in the English language, these were excluded from this review together with those sources that solely addressed the need for or standardisation of guidelines or were an evaluation of implementation tools and strategies. This was due to a lack of consideration of the root cause of those factors impacting the efficacy of best practice and utilisation.

Two reviewers, the researcher, Fee MacGregor (FM) and Director of Studies, Katherine Swainston (KS) independently screened the search findings, initially by their title and abstract for inclusion or exclusion. Both reviewers subsequently reviewed the remaining papers (n=15) on full read for final inclusion selection. Had there been a lack of consensus on any of these, a third reviewer, PhD Supervisor, Matthew Breckons (MB) would have been asked to decide as an independent party. The full selection process can be seen in Figure 2.2, PRISMA-ScR Flowchart (Tricco *et al.*, 2018).

2.4.3 Data Extraction

The data collated from the papers selected was charted using an adapted version of Arksey and O'Malley's (2005) data charting form (Table 2.3). As with the study selection, two reviewers (FM and KS) independently reviewed the effectiveness of this form concerning its consistency with the research objectives (Levac, Colquhoun & O'Brien, 2010). This form, in conjunction with the selected papers, was used to facilitate the identification of themes and categories using inductive content analysis (ICA) (Elo & Kyngäs, 2008).

2.4.4 Data Analysis

Inductive Content Analysis (ICA) is described as well-suited to healthcare practice and policy-related research, particularly where this is on a relatively small scale (Vears & Gillam, 2022). This involved an iterative process of grouping the broken-down data (codes) extracted from the charted data, and reforming this into groups based on their shared concepts (categories), as demonstrated in Figure 2.1, followed by a narration of the factors impacting best practice implementation within forensic radiography practice.

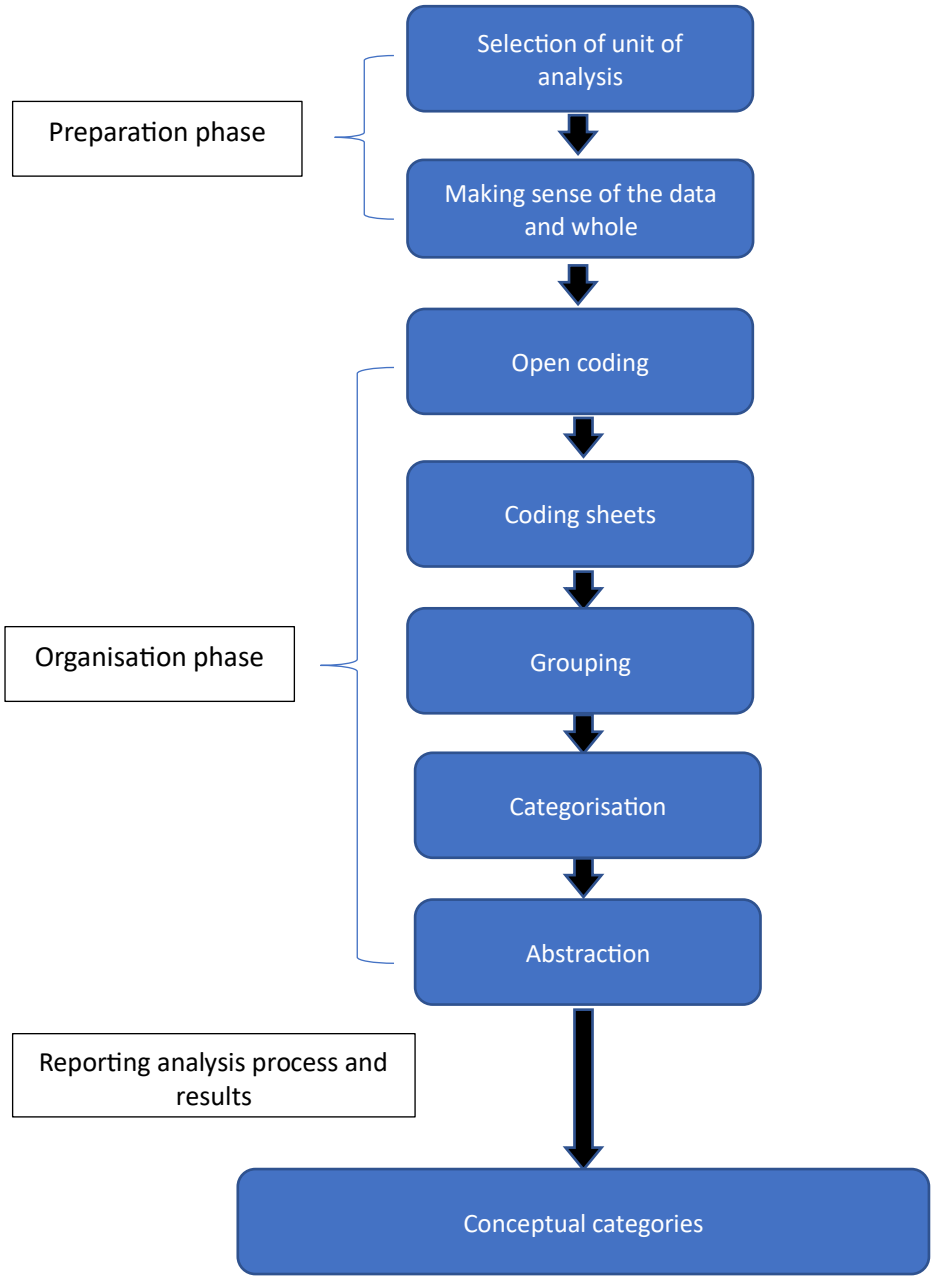

Figure 2.1: Inductive Content Analysis Phases Adapted from Elo and Kyngäs (2008)

By repeatedly revisiting each phase of the ICA, the researcher ensured that no new codes were missed. Thus, enhancing the validity and reproducibility of the inferences gathered across the data and understanding of the research phenomenon, where this may be lacking or fragmented (Vaismoradi, Turunen & Bondas, 2013; Levac, Colquhoun & O'Brien, 2010; Arksey & O'Malley, 2005). To minimise the potential for researcher bias, these processes were conducted independently by two reviewers (FM and KS)

2.5 Results

This section presents the selection of studies, together with an overview of these, and a full breakdown of the ICA characteristics drawn from the data collected.

2.5.1 Study selection

Figure 2.2 (p.26) demonstrates the selection process comprising the fourteen searched databases, which resulted in 1055 papers found, together with an additional three papers identified through hand-searching. Of this combined number, 1031 were removed based on duplication, title and abstract. Following a full read and in-depth interrogation of the remaining 27 papers, fifteen were identified as eligible for inclusion based on the criteria.

2.5.2 Description of the selected papers

The results of the final selection can be seen in Table 2.4 (pp.27-28). The papers selected were published between 2009 and 2021 and reflect a rich international data source. This comprises the USA (n=3) (Berger and Lindberg, 2018; Hatch, 2015; Stavas *et al.*, 2020), Australia/New Zealand (n=1) (Doyle & Vuong, 2019), Europe-wide (n=3) (Arthurs, van Rijn, & Sebire, 2014; Blangis *et al.,* 2021; Hulson, van Rijn & Ofiah, 2014), Europe - country-specific (n=1) (van Rijn et al., 2009), Scandinavia (n=1) (Vollmer-Sandholm *et al.*, 2021), the UK (n=3) (Imtiaz, 2014; Leung *et al.,* 2009; Patel, Swinson & Johnson, 2017), and three that were undesignated due to being editorial articles (Pekarsky & Botash, 2014; Pierce, 2019; Ruder, 2015).

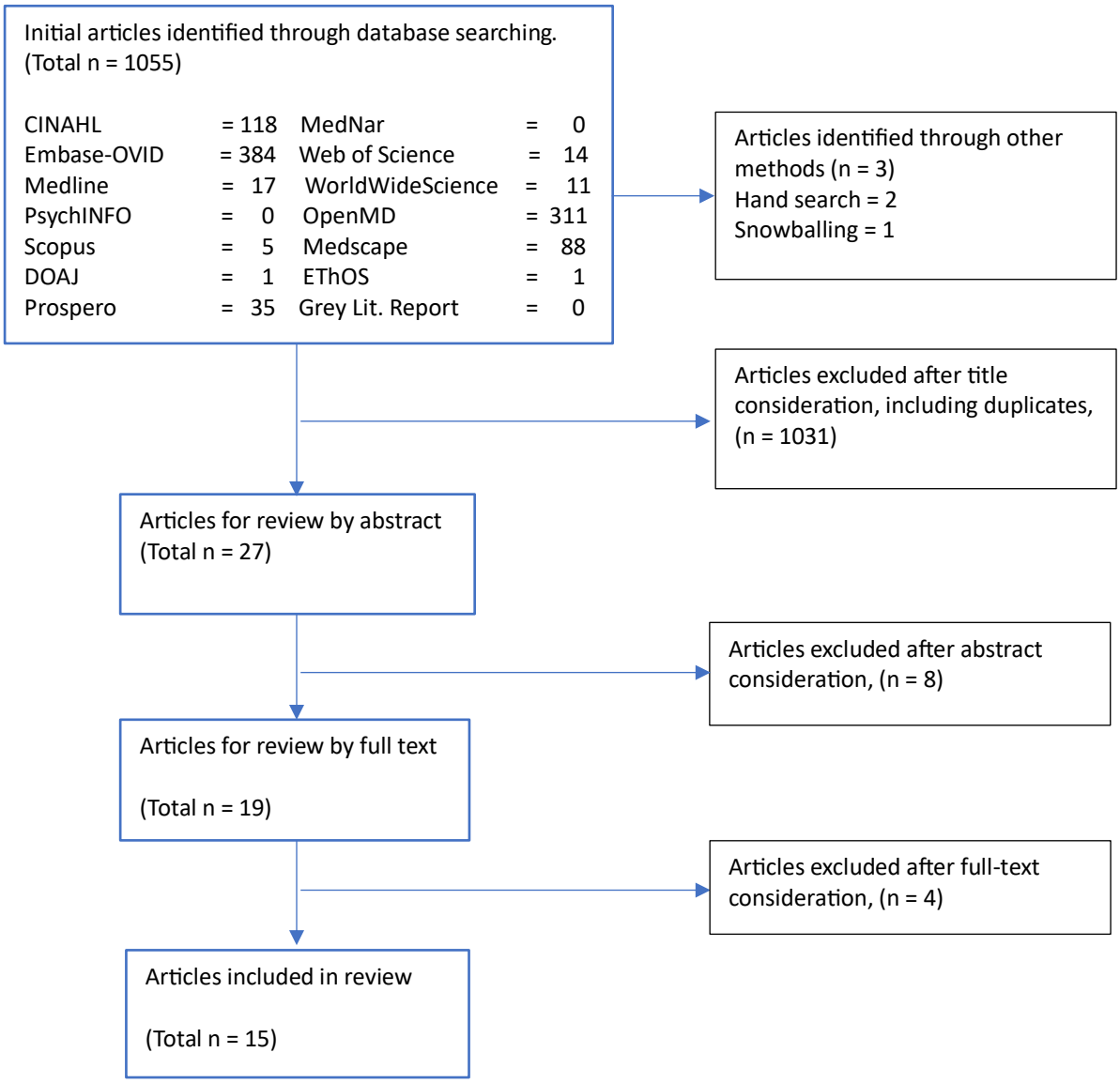

Figure 2.2: PRISMA-ScR Flow Chart (Tricco et al., 2018) demonstrating the selection process.

Although the search strategy sought to identify papers across the diverse scope of forensic imaging practice, all papers selected related specifically to practice and guideline application within suspected physical abuse in paediatrics. Of these, three explored this from the perspective of post-mortem imaging (Hatch, 2015; Ruder, 2015; Arthurs, van Rijn & Sebire, 2014), with the remaining twelve exploring the general radiological imaging of suspected abuse in paediatrics.

Table 2.4: Data Charting of selected studies

Author, Year, Country	Study design	Study population	Study aims	Methodology	Key Findings
Arthurs *et al.*, (2014) Europewide	Quantitative	79 members of European Society of Paediatric Radiology. (Majority response from UK).	Gather overview of current post-mortem (PM) imaging practices among ESPR members. Identify inconsistencies.	Online questionnaire	Need for standardised evidence approach to PM of paediatrics. Wide variation of imaging. Lack of guidance & protocols for infrequently seen cases.
Berger & Lindberg, (2019) USA	Review	Child abuse paediatricians (CAP)	Not stated.	Commentary	Need for person centred focus on the present, rather than past experiences. Shift needed in clinical thinking, treat SPA as medical diagnosis, not judgement call.
Blangis *et al.*, (2021) Europe	Review	Systematic reviews, national and local guidelines (2010-2020).	Evaluation of the completeness, clarity and consistency of guidelines for SPA in high-income countries.	Systematic review	20 guidelines across 15 countries. Guidelines for diagnosis of SPA generally clear but lacking completeness. Wide variations on major issues, i.e., definition of sentinel injuries, imaging modalities to use and Follow-up skeletal survey (FUSS).
Doyle & Vuong, (2019) Australia and New Zealand	Review	18 papers, 1 from Aus/NZ. The remaining from elsewhere.	To establish 'best practice' in the investigation of non-accidental injury (NAI) / SPA.	Literature review	No published guidelines in either Aus or NZ. Inconsistencies in required imaging and image quality standards. Clear differences in protocols across countries.
Hatch, (2015) USA	N/A	Post-mortem imaging in paediatrics.	To highlight the barriers impeding inclusion of advanced imaging in paediatric forensic death investigations.	Editorial	Many process in medico-legal death investigations are not evidence-based. Current habits are difficult to change even with guidelines. Need for practitioners to step outside comfort zones.
Hulson, van Rijn & Offiah, (2014) Europe (24 countries)	Quantitative	ESPR members	To establish the current practice by ESPR members for imaging SPA.	Web-based survey	Issues with FUSS, not consistently carried out. UK practice relatively uniform, less so Europe. Significant discrepancies in undertaking and reporting for SPA. Lack of concerted approach to neuroimaging.
Leung *et al.*, (2009) UK	Quantitative	Radiologists within the UK.	Determine current practice and perceptions of the adequacy of training and support in the reporting of SS in paediatric SPA	Questionnaire	General radiologists lack adequate training and education in SPA reporting. Lack of tertiary centres. Poor access to paediatric radiologists. Deficiencies in knowledge base of trainees and consultants in medico-legal aspects of child abuse.
Imtiaz, (2014) England, UK	Quantitative	40 hospital trusts, random sample of 426 hospitals.	Identify any national variations in SPA forensic imaging. Establish whether guidelines are implemented in accordance with guidelines.	Online survey	Medico-legal recommendations not were followed. Variations in amount of documentation completed. Non-compliance in many areas of documentation. Neurological imaging not given same priority as other imaging.

Table 2.4: Data Charting of selected studies (Continued)

Author, Year, Country	Study design	Study population	Study aims	Methodology	Key Findings
Patel, Swinson & Johnson (2017) England, UK	Review	100 consecutive skeletal surveys (SS) performed in England between 2013-14.	To reassess the content and quality of SS undertaken for SPA.	Online questionnaire	Improvement noted in quality and content of SS performed. Considerable variation noted in practice. Consensus is needed for roles of each imaging modality.
Pekarsky & Botash, (2014) N/A	Editorial	Reference made to USA Paediatric SPA guidelines.	To clarify the approach taken towards the imaging of children for SPA.	N/A	Skeletal surveys undertaken based on clinical judgement in children aged 24-60 months old. Minimal injuries may be considered sentinel for abuse. Physicians concerned CT and skeletal surveys overused.
Pierce, (2019) N/A	Editorial	Clinicians involved in referral for imaging for SPA.	Explore medical professions' resistance to change.	N/A	Substantial obstacles to translation of research into sustainable healthcare practice improvements. Learning from research not often implemented into practice. Translation hurdle problematic. Barriers caused by clinical intuition, anecdotal experience and overconfidence.
Ruder, (2015) N/A	Editorial	Post-mortem imaging in paediatric radiology.	To identify the primary factors prohibiting application of PM imaging in paediatric radiology.	N/A	Lack of best practice standards. Reliance on local habits, jurisdictions, financial resources. Impacts of these on images and report quality
Stavas *et al.,* (2020) USA	Retrospective	Data from 41 children's hospitals Paediatric Hospital Information System from 2004-2015.	To determine whether the presence of child abuse pathways decrease disparities in skeletal survey performance.	Retrospective study	Differences in pathway followed but SS followed where physical abuse suspected. Lack of standardised practice in accessing pathway. Insurance states influence SS referrals. Social intuition and information play role in evaluation for SPA.
van Rijn *et al.*, (2009) Netherlands	Mixed methods	Paediatric radiologists, departmental members, Forum Edcatief, Utrecht.	Evaluation of radiological imaging in SPA in children under 2-years old, in Netherlands.	Mixed methods questionnaire and retrospective analysis	Essential to involve paediatric radiologists for accurate image interpretation. Extensive variations in number of images obtained. Babygrams continue to be undertaken. Only a minority of radiologists apply guidelines, despite availability online.
Vollmer-Sandholm, (2021) Norway	Quantitative	Clinical physicians involved in referral for children for SPA.	To investigate physician knowledge and practice in cases of suspected physical, sexual abuse and neglect.	Patient vignette questionnaire	Inadequate knowledge and inconsistencies within management of cases. Gaps between recognition, treatment, and follow-ups. Insufficient initial and on-going education. Lack of and underuse of existing guidelines.

The weighting of research in paediatric forensic radiography, as opposed to other areas of forensic imaging, reflects historically more research in this setting. This is due to this being the first area of forensic radiography that saw the introduction of subject-specific standardised guidelines for the UK in 2008 (RCR & RCPCH, 2008). These were to form the basis of those guidelines adopted and referred to within many other international locations and included papers within this review.

Of the fifteen studies selected, six comprised primary questionnaire-based research, in which the demographics of recruited participants comprised paediatricians (Vollmer-Sandholm *et al*, 2021), paediatric radiologists (Arthurs, van Rijn & Sebire, 2014; van Rijn *et al.*, 2009), generic radiologists (Hulson, van Rijn Offiah, 2014; Leung *et al.*, 2009), and radiology managers or senior lead radiographers (Imtiaz, 2014).

2.5.3 Development of Inductive Content Analysis (ICA) conceptual categories

Through the application of ICA, five conceptual categories were developed, comprising: ineffective organisational governance, education and the 'translation hurdle', system 'brakes', default practice, and value-based judgement. The full process for this category development can be seen in Appendix 4, with the final phase demonstrated below in Figure 2.3 (p.30).

2.5.4 Ineffective organisational governance

Issues comprising this category were commonplace within most of the papers selected, primarily being described as a lack of standardised guidelines, protocols and approaches to forensic imaging (Doyle & Vuong, 2019; Stravas *et al.*, 2020; Arthurs, van Rijn & Sebire, 2014; Ruder, 2015). This resulted in substantial variations in the practice undertaken, for what should be standardised procedures (Patel, Swinson & Johnson, 2017).

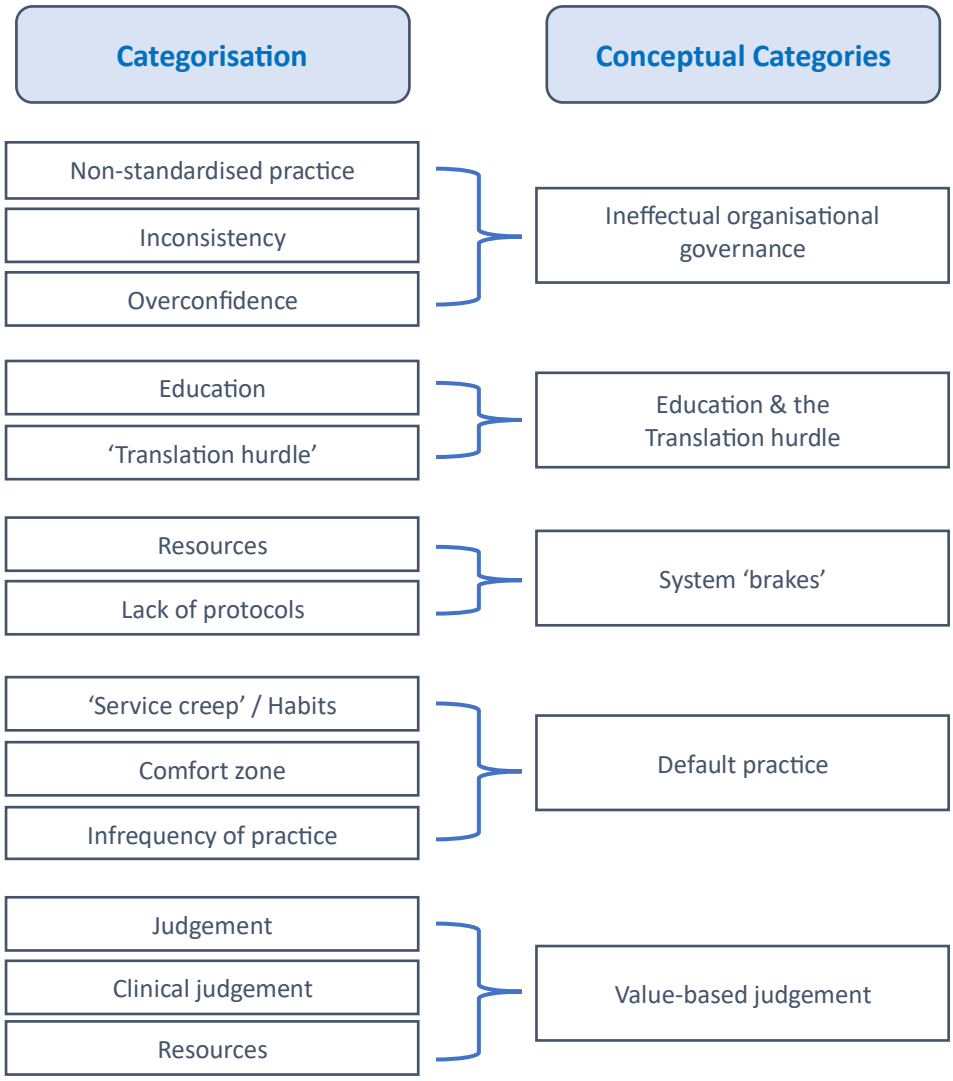

Figure 2.3: Demonstration of the final phase of the ICA characterisation process.

Inconsistencies were also evidenced in the application of the imaging modalities to be used, particularly concerning cross-sectional imaging (CT and MRI), neurological imaging (Arthurs, van Rijn & Sebire, 2014; Hulson, van Rijn & Offiah, 2014; Ruder, 2015), specifically the brain and skull (Pekarsky & Botash, 2014). It was noted that, even in those cases where clear guidelines were established as being in practice, there remained significant issues with completing the full process. This was especially evident in the medico-legal components, the documentation and process of image and evidence collation and storage, which are essential to demonstrating continuity of evidence (Imtiaz, 2014; Leung *et al.*, 2009).

Although, like the UK, there are established guidelines in situ for the undertaking of skeletal surveys in the United States of America (USA) (ACR, 2021; Wootton-Gorges *et al.*, 2017), variations were noted in those populations imaged for suspected physical abuse, and how these cases were managed. Clinical decision-making for suspected physical abuse was found to be heavily influenced by the patient's socioeconomic status, and level of public and private health insurance (Stravas *et al.*, 2020; Vollmer-Sandholm *et al.*, 2021). This may be due in part to the lack of standardised mechanisms for the referral pathways for the imaging of children for suspected physical abuse (Stravas *et al.*, 2020).

2.5.5 Education and the 'translation hurdle'

Through the development of this category, many factors relating to education within forensic radiography and the challenges in overcoming the hurdle of translating best practice guidelines into day-to-day clinical practice within this setting were identified. The primary issue noted, was the under-use of guidelines that were in existence (Arthurs, van Rijn & Offiah, 2014; Hulson, van Rijn & Offiah, 2014; van Rijn *et al.*, 2009; Imtiaz, 2014; Patel, Swinson & Johnson, 2017; Vollmer-Sandholm *et al.*, 2021; Pierce, 2019). This was determined through the reported gaps in recognising sentinel injuries (i.e., bruising, burns, that research suggests are indicative of SPA), (Berger & Lindberg, 2019; Petarsky & Botash, 2014), and their inappropriate management of such cases, treatment, and follow-up (Stravas *et al.*, 2020; Hulson, van Rijn & Offiah, 2014; Vollmer-Sandholm *et al.*, 2021).

This category was also exemplified through the poor standards seen in image quality and image acquisition, as evidenced by the persistence in obtaining babygrams, (Figure 2.4: p. 32) in which the whole newborn child or infant is imaged on one projection or film. This is a practice that has been discredited in the UK for many years, due to its suboptimal image quality for the evaluation of suspected physical abuse injuries, particularly the metaphyseal growth plates, (Doyle & Vuong, 2019; van Rijn *et al.*, 2009; Patel, Swinson & Johnson, 2019), as demonstrated in Figure 2.5, (p.32).

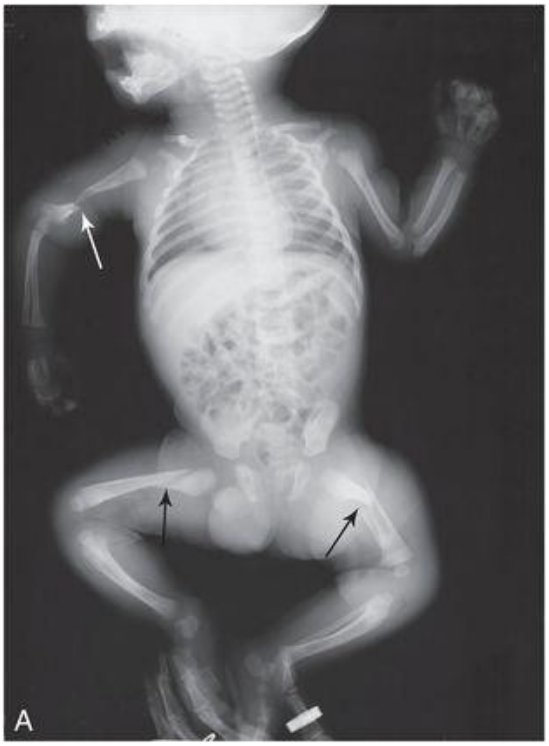

Figure 2.4a: Babygram of a six-week-old infant unable to move their right leg, demonstrated some gross mid-shaft fractures (arrows) (Image Courtesy of Radiology Key).

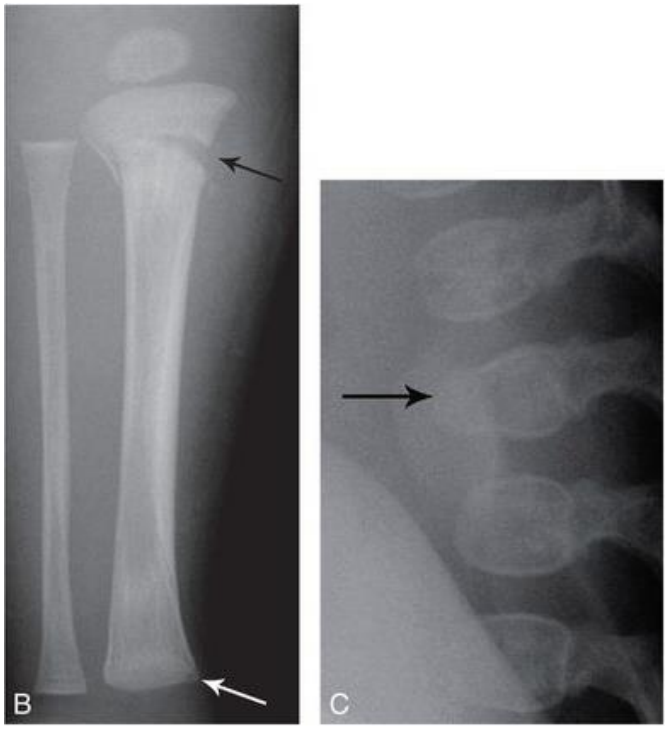

Figure 2.4b: Demonstration of the need to undertake a full skeletal survey encompassing multiple views of all joints. These images were obtained as part of a subsequent full skeletal survey for SPA demonstrating additional fractures in this same infant as Figure 2.4 that were unseen (arrows), (Image Courtesy of Radiology Key).

An over-reliance by clinicians on their intuition (Stravas *et al.*, 2020; Ruder, 2015) and local habits (Pierce, 2019; Ruder, 2015), rather than applying standardised guidelines and protocols was noted. These were established as contributing to the poor and outdated practices highlighted within this category. Regarding radiologists' practices, it was identified that this could be linked to the reported lack of adequate training, particularly in paediatrics and suspected physical abuse generally (Leung *et al.*, 2009; Ruder, 2015) and suspected physical abuse post-mortem cases specifically (Ruder, 2015).

2.5.6 System 'brakes'

This conceptual category can be defined as those factors reported within the studies as putting the brakes on effectively implementing best practices within forensic radiography. These fell within three key components, a lack of best practice standards (Berger & Lindberg, 2019; Arthurs, van Rijn & Offiah, 2014; Hulson, van Rijn & Offiah, 2014; Imtiaz, 2014; Ruder, 2015), a lack of national guidelines, (Doyle & Vuong, 2019; Berger & Lindberg, 2019; Hatch, 2015; Stravas *et al.*, 2020; Arthurs, van Rijn & Offiah, 2014; Hulson, van Rijn & Offiah, 2014; Imtiaz, 2014; Ruder, 2015), and a lack of resources (van Rijn *et al.,* 2009; Leung *et al*., 2009; Patel, Swinson & Johnson, 2017; Vollmer-Sandholm *et al.*, 2021).

In those instances where best-practice standards were found deficient, this resulted in a lack of standardised clinical pathways for the referral, treatment and management of cases of suspected physical abuse, (Stravas *et al.*, 2019), a lack of local published protocols (Doyle & Vuong, 2019; Arthurs, van Rijn & Offiah, 2014; Vollmer-Sandholm *et al.*, 2021), and a poor evidence-base for many death investigations (Hatch, 2015). These issues can be linked to those factors identified within the 'ineffectual governance' conceptual category.

On further consideration of this category, several issues were found to contribute to those factors identified. These were listed as, the accessibility and retrieval of existing protocols (Leung *et al.*, 2009; Patel, Swinson & Johnson, 2017; Vollmer-Sandholm *et al.*, 2021), particularly by radiologists when these were only available on-line, (van Rijn *et al*., 2009), a lack of, or limited funding, (Arthurs, van Rijn &

Offiah, 2014; Ruder, 2015), a lack of paediatric radiologists for the reporting of images (van Rijn, 2009), and the lack of shared infrastructures, (Berger & Lindberg, 2017; Vollmer-Sandholm, 2021). A further compounding factor was insufficient initial and ongoing education within forensic radiographic practice (Vollmer-Sandholm, 2021), exacerbated by a lack of staff and funding opportunities.

2.5.7 Default practice

The primary factor established within this category was practitioners' overreliance on local habits and jurisdictions, (Berger & Lindberg, 2019; Stravas, *et al.*, 2020; Pierce, 2019; Ruder, 2015). This practice was often premised on a mindset of "that is how it's always been done", which has proven challenging to overcome (Hatch, 2015: p.480). In those instances where guidelines were lacking, an issue of 'service creep' was evidenced through the variations in imaging techniques employed, and the quality of the continuity of evidence documentation (Imtiaz, 2014), particularly in those locations where forensic imaging was infrequently practised (Arthurs, van Rijn & Offiah, 2014).

2.5.8 Value-based judgement

This category is premised on the reported reliance on 'gestalt' or experience (Berger and Lindberg, 20119) and clinical judgement (Stravas *et al.*, 2020; Pierce, 2019), rather than the application of evidence-based guidelines, even when these were in situ and accessible. This was particularly a factor in the American papers (Stravas *et al.,* 2020; Pierce, 2019), where social influences and social intuition together with the socioeconomic status of the family or caregivers were found to be the primary factors. This was evidenced through the level of public or private insurance influencing judgements on whether clinicians would refer a child for imaging for SPA.

Clinical overconfidence premised on factors such as the number of years qualified, were also found to strongly influence clinical judgement, particularly in referral decision-making (Pierce, 2019), as evidenced in the undertaking of the follow-up skeletal survey (FUSS), (Hulson, van Rijn & Offiah, 2014). Without the FUSS, the full survey is considered incomplete (Doyle *et al.*, 2020; RCR, 2018) which may have

potentially serious ramifications for the child and their caregiver, should injuries fail to be imaged, and the child be returned to a high-risk environment.

2.6 Discussion

This scoping review sought for the first time to identify the multiple and interrelated factors shaping implementing best practices within forensic radiography. Through the search strategy demonstrated, fifteen papers were selected as meeting the inclusion criteria. Although none of the selected papers explicitly answered this research question, each identified pertinent factors regarding the efficacy of guideline implementation within the forensic imaging setting. Five conceptual categories were generated from the findings of these studies and the application of inductive content analysis, regarding the referral, assessment, and management of suspected physical abuse (SPA). This encompassed the recognising and acting on the initial sentinel injuries (indicators) of SPA, the referral for forensic radiographic imaging, the reporting of the subsequent images and the completion of the continuity of evidence documentation. It is acknowledged that although the selected papers were focussed on paediatric forensic imaging, parallels could potentially be drawn between these categories and the clinical and associated professions involved in the wider forensic imaging pathways. These possible similarities will be explored further within the primary data collection phases of this research.

It has been established that there are significant variations in forensic radiographic practice internationally, nationally and often at local levels (Doyle & Vuong, 2019; Stravas *et al.*, 2020; Arthurs, van Rijn & Offiah, 2014; Ruder, 2015; Otterman *et al.,* 2017; Albeak, Kinn & Milde, 2018). It should be noted, however, that this is not a situation unique to forensic radiography but is also found in other areas of diagnostic radiography (Ramazan, Aarts & Widdowfield, 2022) and healthcare (Li *et al.*, 2018: Fischer *et al.*, 2016; Fleuren *et al.*, 2014). This scoping review has identified that the reasons underpinning this are multi-faceted and complex but are all fundamentally linked to the issues with ineffectual organisational governance. In the context of this review and overarching research question, organisational governance can be defined as, being responsible for the effective management of an organisation, enabling it to fulfil all legal and care-related obligations in all aspects of its respective

jurisdictions, primarily the improvement and quality of clinical services (Som, 2004; Department of Health, 1999).

The interlinking of the categorical factors generated within this current review has been reflected in other areas of health-related research (Li *et al.*, 2018). This determined that both behavioural and attitude changes (Cabana *et al.*, 1999), in conjunction with an understanding of the practitioners' experiential world (Albeak *et al.*, 2018) must be established for guidelines to be effectively assimilated into current practices (Kastner *et al.,* 2016). However, for this to be feasible, best practice guidelines and protocols must be readily available (Konijnendijk *et al.*, 2016), address the specific aims and needs of the users, and communicate their aims effectively. In those situations where this is not the case, practitioners have reportedly been left feeling ‘ill-equipped and inadequate’, somewhat akin to “traversing a minefield without knowledge of the safe routes or necessary diffusion tools’ (Albeak *et al.*, 2018: p. 236). Such challenging situations can result in clinicians defaulting to their value-based judgement calls, based on either their own or others’ clinical influences and experiences, leading to significant variations in practice (Pierce, 2019; Berger & Lindberg, 2018; Albeak, Kinn & Milde, 2018; Li *et al.*, 2018; Otterman *et al.,* 2017; Hulson, van Rijn & Offiah, 2014; Petarsky & Botash, 2014). Given such fundamental requirements, it is essential that these issues are identified at an organisational level and addressed not solely within the imaging department, but across the wider multidisciplinary teams (MDTs) and their departments.

This review has established that education is an integral element for ensuring the currency of research and the evidence base for those practitioners undertaking studies within the forensic radiography setting. It is a means through which the evidence base can be disseminated widely across diverse settings through activities such as post-graduate training as recommended in the current guidelines (SoR, 2024; Doyle *et al*., 2020, RCR, 2018), and ongoing continuing professional development (CPD) training. For such an approach to be effective, buy-in and support from departmental managers within radiography and the wider MDTs is essential. This will only be feasible if departmental managers understand the specific role of forensic radiography, its medico-legal requirements, and how this differs from the generic tasks of diagnostic radiography. This is essential together with the need

to support those practitioners involved in forensic imaging to access appropriate mandatory post-graduate training and opportunities thereafter, to access relevant CPD.

Where a learning culture is absent (Cabana *et al.*, 1999), and understanding, awareness and insight at managerial levels are lacking, this resulted in significant discrepancies in the knowledge base of consultants and trainees. This was evidenced in the medico-legal aspects of child abuse case management (Hatch, 2015; Imtiaz, 2014; Leung *et al.,* 2009), and within radiographers undertaking forensic radiography. A finding correlated with poor training opportunities and departmental support. This has significant implications for the efficacy and integrity of the medico-legal requirements of forensic imaging practice, due to the potential for 'service creep', whereby unsubstantiated practice premised upon local habits and jurisdictions become firmly established under the radar (Snaith, 2016; Arthurs, van Rijn & Offiah, 2014). This has been identified as a particular risk in those settings where forensic radiography is infrequently undertaken (Doyle *et al.*, 2023; Arthurs, van Rijn & Offiah, 2014), and where there is inertia or unwillingness to change, thus resulting in defaulting back to practices based on their initial education and or clinical experiences (Ramazan, Aarts & Widdowfield, 2022; Cabana, 1999).

In those instances where support has been provided together with a research-orientated approach to their practice, whereby appropriate training and CPD have been encouraged, research has demonstrated that the translation of education into practice has been largely overcome, with significant improvements in best practice implementation across all departments (Ahonen & Liikanen, 2010). Such enhancements were achieved through a shared collaborative approach from all professions involved, enabling practitioners to have confidence in their individual and collective roles, responsibilities and actions (Otterman, *et al.,* 2017). It is important to acknowledge that whatever the understanding and support available from departmental managers, there remain barriers that lie outside their and practitioners' control. Examples include the ongoing nationwide shortage of radiographers, and radiologists (Kalidindi & Gandhi, 2023; RCR, 2020), particularly those specialising in paediatrics and post-mortem imaging (Hatch, 2015; van Rijn, *et al.*, 2009), for whom sufficient training provision continues to be a barrier (Karalis & Denton, 2016).

Where specialist paediatric and post-mortem radiologist support is lacking, this can impact the radiographers' abilities to implement the guidelines in their entirety, due to the need for close liaison, before, during and after the completion of each forensic examination. Many departments have sought to address this through the sharing of resources and the outsourcing (Kalidindi & Gandhi, 2023) of forensic images to other specialist sites for reporting. However, these strategies create additional challenges, particularly the increased workloads of the receiving sites, and the cost implications for NHS Trusts buying this in, and locum support, as exemplified in Figure 2.6 (Denton & McCaughey, 2019).

Figure 2.5: A breakdown of the outsourcing and insourcing total cost (Source: National Imaging Data Collection 2017/18, NHS Improvement, in Denton & McCaughey, 2019)

This review identified concerns raised regarding the credibility of some of the guidelines currently in situ (Doyle & Vuong, 2019), a concern supported by other literature including, Otterman *et al.*, (2017), Fleuren *et al.*, (2014), and van Konijnenburg *et al.*, (2014). Questions were raised by Doyle and Vuong (2019) regarding the recommendations made within the ACR-SPR Practice (2016) guidelines regarding their developmental rigour and applicability. Whilst these guidelines have since been revised (ACR, 2021), some issues remain, due to the use of words such as "may", which are subjective and open to interpretation.

Concerns can also be found within the UK equivalent guidelines, the RCR, revised 2018 edition, regarding the currency of some of the data relied upon to inform the guidance given. Due to the perceived outdated data used, the evidence base is left open to question, thus impacting the integrity of the recommendations. These guidelines were due for renewal in 2021, but at the time of writing this review (August 2023) remains unpublished.

For implementation, and adoption of these and future guidelines to be effective, the scope for misinterpretation and concerns regarding currency must be addressed. Without this, their credibility and validity cannot be assured, both of which are fundamental (Otterman *et al.*, 2017; Krippendorf, 2004; if they are to be meaningful to the user (Blangis *et al.*, 2021; Pawson, 2003).

2.7 Reflection

Although a comprehensive search strategy was used to identify papers pertinent to the scoping review question, through which the full scope of forensic radiography was addressed, it was frustrating to find only studies addressing paediatric and paediatric post-mortem forensic practice. Whilst this could be deemed a significant limitation of this researchers' review findings, this has proved valuable in identifying the gaps in the literature pertaining to the other scopes of forensic imaging in the context of guideline implementation efficacy. This presented a challenge for me as the researcher given my insider knowledge and experiences as a diagnostic and forensic radiographer and educator in paediatric forensic imaging, through which I know the evidence exists anecdotally. Essential to this research activity was to be cognisant of this insider knowledge (Green, 2014), and experiences and minimise the potential for this to influence my decision-making and judgements in the data selection and analysis. Having a second, and if necessary, a third review available to assist in these phases, ensured this risk of bias was minimised.

2.8 Chapter Summary

This scoping review has been the first to explore the potential issues impacting the successful implementation of evidence-based best practices within forensic radiography. Whilst none of the fifteen papers selected addressed the research question in full, they were able to provide insight into issues prevalent within paediatric and post-mortem forensic radiography. Through inductive content analysis, five categories were identified, 'ineffective organisational governance', Education and the translation hurdle', 'system brakes', 'default practice', and 'value-based judgement'. Although it was possible to demonstrate the relevance of these categories to other areas of forensic imaging practice, this scoping review has

highlighted the many gaps within the current literature regarding the factors impacting the effective implantation of best practices across forensic radiography, particularly from the radiographers' perspectives. This has proved a useful precursor to guide the next phase of the overarching research project, through which the researcher begins to ascertain the experiences of the radiography practitioners themselves. To facilitate this, the next research phase comprises primary research data collection through an online questionnaire inviting diagnostic radiographers involved in any aspect of forensic radiography to share their insights and experiences.

Chapter 3 – Methodology

3.1 Introduction

The previous chapter presented a scoping review of the current literature relating to the issues surrounding the implementation of best practices encompassing the guidelines and protocols within forensic radiography practice. As was evidenced through the review process there is a dearth of research through which the root causes underpinning the issues of full implementation are explored. This was particularly evident when considering the experiences of the radiographer, or medical imaging technician involved with the image acquisition process. The focus of the existing literature has been premised on identifying potential barriers from the perspective of clinicians making the initial referral for forensic imaging or the views of the radiologists whose role it would be to report on the subsequent images obtained. Given the medico-legal role of forensic radiography (Doyle *et al.*, 2020) and the necessity to demonstrate continuity of evidence collation throughout the imaging process, it is imperative that an understanding of the issues is obtained.

3.2 Methodology Rationale

This research sought to identify, explore, and evaluate the specific causes through those approaches considered best able to facilitate these aims, thereby enabling consideration of the means through which these issues may begin to be addressed.

To facilitate this, the research was undertaken in three phases (Figure 3.1: p.42). The first of these, the scoping review (Chapter 2) was an effective method through which the specific gaps within the literature on this research topic could be identified (Pham *et al.*, 2014). This therefore established a platform for further exploration through the subsequent primary studies, commencing with a mixed methods questionnaire as phase two. This second phase sought to gain an overview of the organisational barriers and facilitators to best practice within forensic radiography from the practitioners' perspectives. This was considered to be an effective means of ‘fact finding’ (Anakin, Robertson-Smith & Wilkinson, (2024: p.16) through which information regarding this specific population could be gathered, to enable insights about this group in respect of the research question posed. By using open and

closed questions within the questionnaire, difficult-to-measure unobservable constructs such as beliefs, attitudes and opinions could be measured and evaluated (Schwarz, 1999). This method, underpinned the subsequent interview phase, guiding and informing the structure of the questions used within the semi-structured interviews undertaken as phase 3.

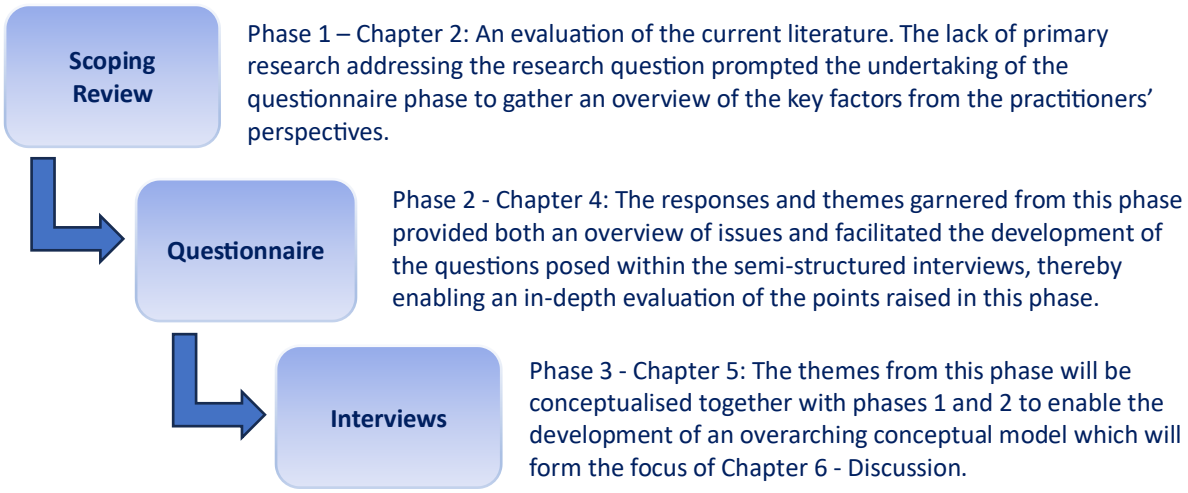

Figure 3.1: Demonstration of the interconnectedness and outcomes of the three research phases

This research has sought to explore and evaluate the factors impacting on the implementation of best practices within forensic radiography practice from an organisational perspective as experienced by the 'actor' (radiographer) through a mixed methods approach. The average radiographer undertaking forensic radiography works as one component of a wider multi-disciplinary team, as such, an understanding of the complexities and challenges that this may bring to enabling effective implementation of best practices is needed. From a general perspective, extensive literature exists evaluating interprofessional working and collaboration. These include Goffman's (1956) theory of impression management and performance disruptions in which it is suggested that people present a different persona in front of others than they would in their own homes (Goffman, 2004). Loxley's (1997) cooperation theory and social exchange theory is also extensively applied, enabling an understanding of the social behaviours involved in social exchanges and the motivations behind these. Understanding these social interactions and drivers is essential given the complex and rapidly changing environment within the NHS (Brook, 2010) from where most radiographers undertaking forensic radiography in

the UK are drawn. However, this does not tell the full story in terms of best practice implementation within this setting.

There is a need to also consider the role, efficacy, and extent of informed learning within the pedagogical delivery of forensic radiography and how this translates into the practice setting. These considerations are essential for an environment of ongoing forensic advancements, applications, and increased knowledge specialisation.

3.2.1 The research paradigm – the key elements

Consideration of these factors and the research methods selected can only become possible by applying a research paradigm. This can be defined as a set of beliefs and practices common to communities of scientists or researchers through which the means of understanding and addressing problems can be shared (Bunniss & Kelly, 2010; Healy & Perry, 2000). Within this is the need to recognise that paradigms are not fixed or "incommensurably bounded positions" but are "relationally constituted" and can alter when aspects of situations or events change (Nespor, 2006: p. 123). Paradigms will always comprise four key elements: ontology, epistemology, methodology, and methods (Patel, 2015). Based on this premise, the selection of an appropriate research paradigm must be determined by their respective ontological and epistemological standpoints, assumptions of reality and knowledge, as enacted in their methodology and methods approaches. This is essential since, as stated by Scotland, (2012: p.10) it is impossible to engage in any form of research "without committing to ontological and epistemological positions".

3.2.2 Ontology

In the context of this research, the ontological element represents the nature of the reality, world, or setting in question, that of forensic radiography practice, and the truth of this from the actors' (radiographers) place within it (Bleiker *et al.,* 2019; Guba & Lincoln, 1994), as demonstrated in Figure 3.2 (p.44). This can be considered the starting point from which this research aimed to locate reasons and explanations for the factors purporting to be the reasons for the ineffectual or incomplete

implementation of best practices in this practice setting. However, as identified by Everest (2014) the truth sought through this element may be provisional and changing, thus justifying the selection of the pragmatism paradigm.

The ontological relativist position for this research was one of constructivism, whereby the actors' perceptions are valued as a means through which the researcher could view the world or reality beyond individual perceptions (Healy & Perry, 2000). Through this, the individual realities may be in the form of many constructions that are socially based, being specific and local in nature as reflecting their own beliefs and experiences (Guba & Lincoln, 1994) within their specific setting. Whilst these may be individual experiences, they could be shared by others and may also reflect conflicting social realities.

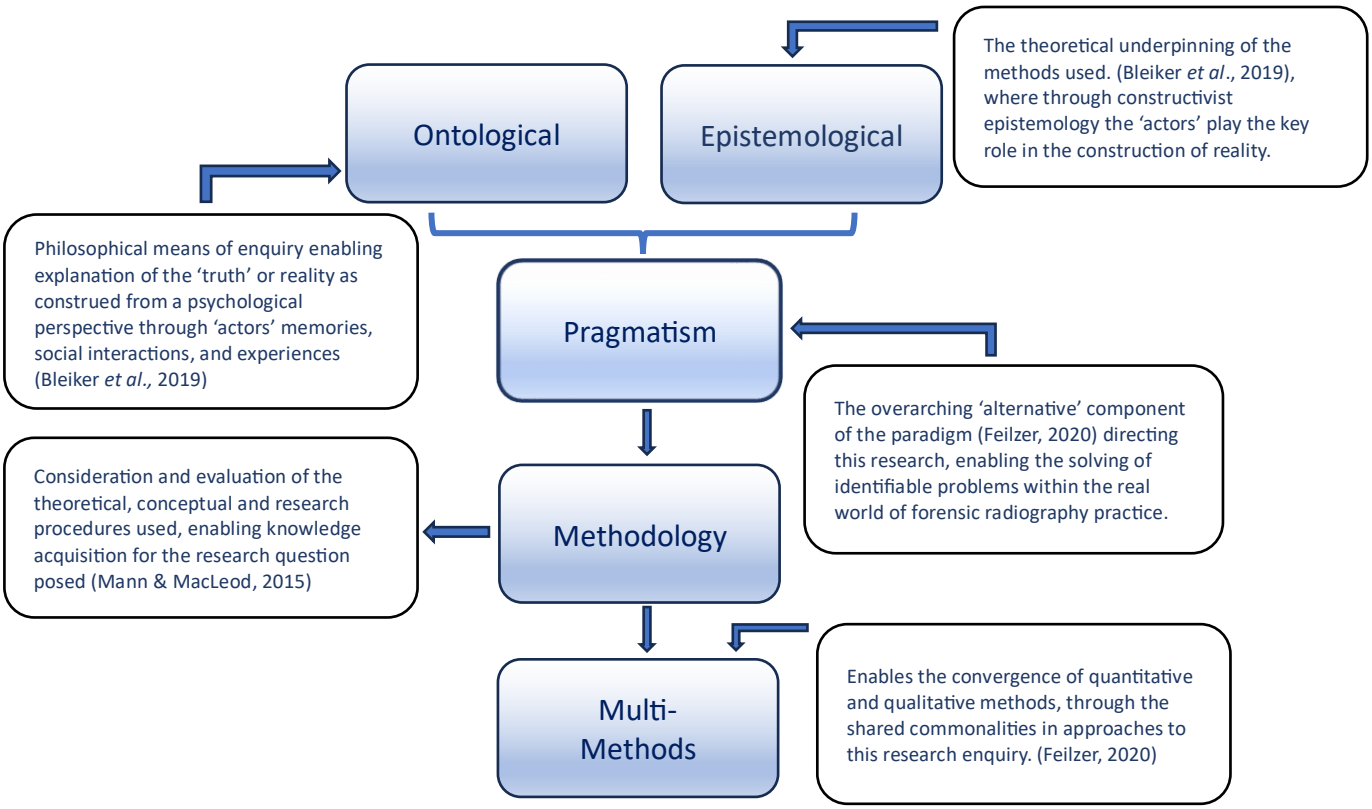

Figure 3.2 The research paradigm, comprising ontology, epistemology and methodology – An overview

3.2.3 Epistemology

The epistemological component of this research can be defined in its most simple terms as an exploration or theory of the nature of knowledge, how individuals can know what they know (Hesse-Biber & Leavy, 2004) or the relationship between the 'knower' and what can be known (Guba & Lincoln, 2004). To ensure the coherence of this research, the constructivist ontological stance taken above was linked to the constructivist epistemological approach, which recognised the differences in participants' realities premised on their contexts (Mann & McLeod, 2015) thereby informing the research methodology and methods utilised throughout (Bleiker, *et al*., 2019).

3.2.4 Pragmatism paradigm and rationale for application

Premised on the ontology and epistemology outlined above and the fact that there are many different methodological approaches, each with different foci that could be utilised to address this research question, consideration of the most appropriate research paradigm was essential within the specific context of the research environment and question posed. Identification of the paradigm applied is important as this sets out the concepts, language and practices used, thereby defining the scientific stance taken (Varpio & MacLeod, 2020).

Given this, the researcher has utilised the principles of the pragmatism paradigm which aligns with the constructivist ontological and epistemological elements through the application of a sequential qualitative multi-methods study design (Teddlie & Tashakkori, 2006). This paradigm enabled the ability to adopt a flexible approach to the rapidly changing, constantly renegotiated (Patel, 2015) contexts of forensic radiography settings (Long, McDermott & Meadows, 2018). Further, this facilitated the ability to recognise and address complex issues that require a multi-faceted approach through the lived experiences of the primary participants (radiographers), throughout the research (Allemang, Sitter & Dimitropoulos., 2022).

Pragmatism has both a philosophical and methodological stance (Clarke, 2021), which has been much debated over the years since its early conception in the 20th

century, with a range of versions developed. This has been particularly evident concerning the criticism faced by the ‘classical pragmatism’ approach as espoused by those such as John Dewey and George Mead, which is seen by some as simply a “doctrine of meaning or theory of truth”, (Denzin & Lincoln, 2018). The basis for the critique lies primarily in its overly simplistic, optimistic, and complacent views of democracy based on biased perceptions of classless, race-less, and genderless principles (Vannini, 2008).

Further critiques of the pragmatism paradigm are that it is simply a justification for taking any approach to research without the need for a rationale, or as an explanation for poor research practices (Bryant, 2017), applied when nothing else fits (Dillon, O’Brien & Heilman, 2000) or to quote Boisvert (1998: p.11) using “a terminal lightning rod” that has been overused and misconstrued. It has also been argued that researchers using this paradigm, “simply push aside philosophical arguments, to get their research done” (Kaushik & Walsh, 2019: p.5). However, in response to such critiques, the adoption of pragmatism enables the avoidance of issues such as the supposition that all knowledge stems from a specific ideological, social, or personal stance and the fostering of individualism (Murray & Campbell, 2003). These issues can be seen within realism and relativism associated with constructionism (Cornish & Gillespie, 2009), where there is an inability to effectively address the epistemological questions of how participants know what they know, the relationship between them and what can be known (Marks, 2002), the heavy focus on language and discourse (Speer, 2000) and the measurement and reason associated with positivism (Feilzer, 2010). Recognition of this is essential, given the findings of the researchers' literature review (Chapter 2) in which it was established that the issues with best practice implementation within the organisational provision of forensic radiography are complex and multidimensional. Such issues included ineffective organisational governance, challenges in overcoming the education translation hurdle, breaks within the system both mentally and physically, defaulting to practice always undertaken and application of value-based judgements.

In the context of this research, pragmatism provided a paradigm in which a dynamic approach to addressing the research aim could be taken; with outputs informing subsequent data collection and analysis; ultimately remaining in line with the

practical aspirations of producing ‘actionable knowledge’ Kelly & Cordeiro (2020). This enabled the application of a methodology and methods that took this thesis researcher from the world of theory to practice and vice versa with a view to the consideration of future consequences (Kelemen & Rumens, 2012).

3.2.5 Researcher’ positionality and influence on paradigm selection and methods

A further consideration when selecting the research paradigm is the researcher’s own background perspective or lens, and motivation for pursuing the research (Kivunja & Kuyini, 2017). In the case of this research topic, it was the researchers’ reflection on their insider knowledge, experiences and anecdotal awareness that created the drive to explore the real factors underpinning the issues experienced and observed in effectively implementing evidence-based research and practices in forensic radiology settings. A stance that was strongly in keeping with the pragmatic tradition (Kelly & Cordeiro, 2020; Kelemen & Rumens, 2012).

The findings of the literature review stated above, are ones that the researcher could relate to through the double-edged sword (Mercer, 2007) of being an insider both as a diagnostic and forensic radiographer, and senior lecturer in medical imaging and paediatric forensic radiography. This insider position could be considered an advantage by some whereby there is an understanding of both the research and phenomena examined as a passionate participant (Healy & Perry, 2000). However, there is a need to acknowledge and reflect on the potential for bias and a loss of objectivity (Saidin & Yaacob, 2016). This will be considered in greater depth in Chapter 5: Reflection.

Regarding the selection of an appropriate method, it could be argued that this insider knowledge and the complexities and multidimensional factors impacting best practice implementation would be better addressed through an ethnographic approach (Taylor, 2011). Such an approach would enable direct observation and immersion in the ‘field’ or workplace of a specific community or population (Dikomitis & Wenning, 2024; Aburn, Gott & Hoare, 2021), that of radiographers undertaking forensic radiography. However, due to the medico-legal aspects of forensic radiography, where, as a witness to the imaging of forensic cases there lies the

potential to be called to attend court, and the unpredictability of when such cases are referred for imaging, this was not considered a viable or ethically appropriate methodology in this instance.

3.2.6 Concept application

The application of the pragmatism paradigm enabled the placing of the individual 'actors' involved towards the forefront of this research based on the consequences of the actors' actions (Denzin & Lincoln, 2018) in which they have a role in the construction of their reality. This worked on the premise that all meanings identified are subjective, created through the actors' dynamic fluid interactions with their peers, colleagues, and the wider MDT. The importance of this is acknowledged by Kelly and Cordeiro (2020), who identify the recognition of 'interconnectedness' between experience, knowledge, and action, as a key principle of the pragmatist paradigm. The researcher utilised more than one pragmatist approach to this research, that of constructivism where the 'reality' is subjective and differs between individuals (Scotland, 2012), and aspects of Deweyan pragmatism within the methodological construction of this research. The adoption of the Dewey-informed principle of 'inquiry,' enabled the researcher to address one of the widely recognised challenges in researching organisations, that of acquiring a mediated understanding of the complexity of the organisational processes encompassed within this area of research (Lorino, Tricard & Clot, 2011). These approaches were considered justified since they provided an appropriate means through which knowledge acquisition could be maximised, and a wider range of questions addressed (Bishop & Holmes, 2013).

Applying the pragmatist ethos, knowledge can be considered a tool for action (Cornish & Gillespie, 2009), a point mirrored by Kelly and Cordeiro (2020). They identify pragmatism's attention to the production of 'actionable knowledge' and facilitation of critique as particularly meaningful in the evaluation of organisations. This is an important consideration since although an understanding of individual intentions and preferences is essential, these cannot on their own be enough to explain collective actions (May & Finch, 2009). This stance has therefore been adopted following the acknowledgement that the application of multiple paradigms can enable a 'diffractive" approach (Uprichard & Dawney, 2016) whereby the

researcher can both explore and hold a range of viewpoints regarding the subject examined (Ghiara, 2020). Such a stance is particularly valuable where integration and cohesion of findings may not be attainable.

3.3 Research design methodology and methods

The principles of the pragmatism paradigm facilitated the application of a sequential multiple methods study design from both a philosophical methodological perspective, and a more technical methods stance (Creswell & Clark, 2009), whereby the components were undertaken sequentially (Bishop & Holmes, 2013), (Figure 3.3. This approach enabled recognition of and the ability to address the complex issues identified through the lived experiences of the primary participants, the radiographers (Allemang, Sitter & Dimitropoulos, 2022). This meant a focus could be placed on the implications of the research through the questions of 'what, why, where, and how' and the methods used to facilitate these being posed. (Kaushik & Walsh, 2019; Guba & Lincoln, 1994).

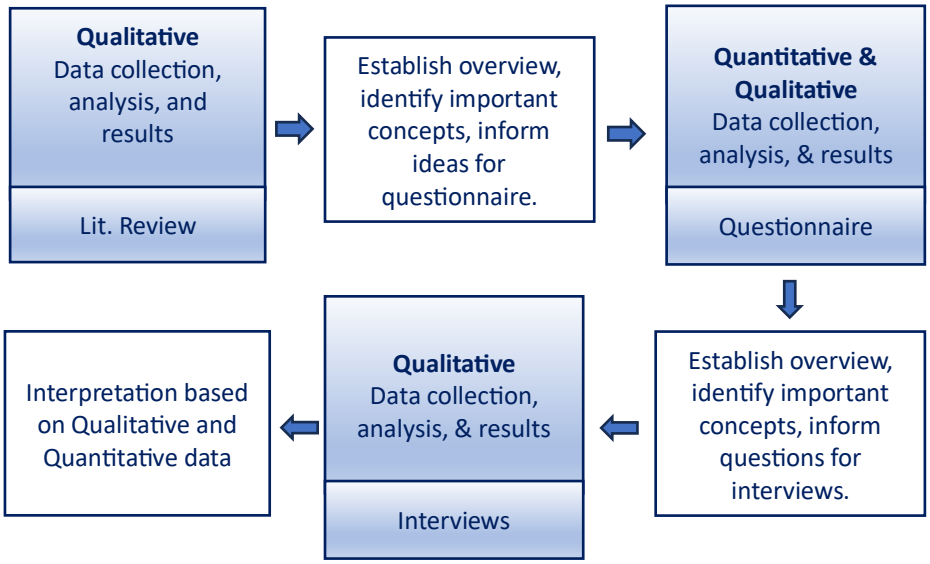

Figure 3.3: Demonstration of the sequential explanatory multi-methods design applied. (Adapted from Bishop & Holmes (2013)

A convergent approach could have been taken whereby each phase could have been directly compared thereby demonstrating triangulation or cross-validation of the data (Morgan, 2014). It is acknowledged that such a strategy would have formed a

rebuttal of many pertinent criticisms thrown at qualitative methods concerning validity (Patton, 2002), however, due to the lack of research within the research area the researcher considered a sequential approach to be more appropriate. This strategy meant that the strengths in terms of the findings from each phase could be applied to the next phase thereby enhancing their respective performances, as demonstrated in Figure 3.3.

3.3.1 Multiple methods - qualitative, quantitative or mixed: The debate

Within this research, consideration of the methods, techniques and procedures used was essential, particularly in terms of whether this should be through qualitative methods, quantitative methods, or a combination of both. Contrary to the perceptions of many, these need not be mutually exclusive (Silverman, 2019; Everest, 2014). Whilst multiple methods were used to better capture the 'nuances of the social reality' (Hesse-Biber, 2010) from the actors' (radiographers') perspectives, these encompassed a primarily qualitative approach, in which quantitative methods played an "auxiliary role" (Howe, 2003). Although considered "auxiliary" in the wider context of this research, the quantitative data was used to aid the researcher in gaining a perspective of the scale of key issues as identified in Chapter 4. This data subsequently aided the design of the interview topic guide in the final primary data collection phase of the research as discussed in Chapter 5. The decision for this overarching qualitative approach was premised on the methodology outlined above and the nature of the research question posed, reflecting the constructivist ontological and epistemological stance discussed previously. This approach provided the opportunity for "deep listening" (Howe, 2004: p.54) between the participants and the researcher as a "passionate participant" (Healy & Perry, 2000: p.119). Through this, a greater understanding of the meanings and purposes of the participants' behaviours, particularly in the interview phase, could be established (Guba & Lincoln, 2004). This would not be possible using quantitative data alone.

Whilst the many positive attributes and strengths of a primarily qualitative approach to this research have been demonstrated, qualitative research methods are not without their opponents. They are often misunderstood and indeed disparaged (Leung, 2015), being portrayed as merely 'anecdotal, conjectures, and personal

subjective interpretations of the researcher' (Everest, 2014). Additional negativity towards their application includes, the sample size often being small thereby impacting upon their generalisability, and the lack of perceived precision in its undertaking, thus impacting on the replicability of the research and its findings (Leung, 2015). It can however be argued that many of these criticisms levelled can be negated and presented rather as a means of affirming or complementing the role of quantitative approaches. An example of this can be seen concerning the generalisability of quantitative data. As conjectured by Guba and Lincoln (2004) this can be presented as statistically meaningful to a population but has no application or relevance to any one individual, thus rendering its validity questionable (Rank, 2004). Rather when applied in combination with quantitative methods, qualitative data can minimise or avoid potential ambiguities. This said, it has been suggested that qualitative data can be 'theoretically generalisable' to extend beyond an individual, to topics and or populations within certain settings. A notion that may be facilitated through a demonstration of "conceptual clarity" and "interpretative rigour" (Toye *et al*., 2013), as exemplified within this research process.

3.4 The research methods applied

3.4.1 An overview

Within this section, the methods used within each primary phase of the research project is outlined here together with a rationale for their selection. Further methods detail together with the findings and subsequent discussion of each phase, are explored in-depth under their respective chapter headings.

3.4.2 Literature review

This method, outlined in Chapter 2, although treated as a single entity leading to the publication and dissemination of its findings (See Publications and Dissemination: p.v) this also formed the preliminary phase of the overarching research sequence (Figures 3.3: p.49), being used to inform the questionnaire (Figure 5.3: p. 92).

3.4.3 Questionnaire

Based on the findings of the scoping review and the significant gaps identified in the knowledge of this research topic, a questionnaire was considered the next appropriate step due to its established role within social research (Braun *et al.,* 2021). It was felt that by using this method, an overview could be garnered of the issues pertaining to the implementation of best practices within forensic radiography from the realities as perceived by the forensic radiography practitioners themselves. This approach had the additional value of facilitating the development of the final research phase whereby the interview questions drafted could delve deeper into the data collated through the quantitative and qualitative questionnaire (Creswell & Hirose, 2019).

As with all data collection methods for research purposes, the use of a questionnaire comes with pros and cons. From a positive perspective, many more potential participants could be reached simultaneously (Patten, 2014), particularly if using an online means of distribution. Such an approach is also more cost-effective and environmentally friendly when compared to the more traditional paper and mail options (Nayak & Narayan, 2019), although using an online method alone can be considered less effective in gaining satisfactory response rates (Lee, Fielding & Blank, 2017). The use of questionnaires can present some unique challenges regarding data protection and the maintenance of anonymity (Bender *et al*., 2017). These require important ethical considerations, particularly given the frequency and ease with which data breaches can occur and the impacts of such breaches on all involved (Bender *et al*., 2017). In the context of this research, anonymity is defined as the collection of data from participants without the disclosure of identifying information (Hoft, 2021). Further consideration was required in the handling and presenting of demographic data that could comprise unique characteristics, i.e., age, gender, ethnicity, culture etc, through which an individual may still be identifiable (Morse, 1998). This was addressed within the ethics applied for as outlined in Section 3.5.

3.4.4 Semi-structured interviews

This second phase through which primary data was collected, sought to undertake an in-depth exploration of participants' individual experiences and insights as perceived from their world or reality. The questions posed to facilitate this were premised upon the findings of the questionnaire phase, thereby providing additional insights to aid the fulfilment of the study objectives (Galletta, 2013).

The use of qualitative interviews using semi-structured open-ended questions is considered "a conversation with a goal" (Hijmans & Kuper, 2007) enabling insights to be gained into participants' experiences and opinions from their perspectives (Busetto, Wick & Gumbinger, 2020). In the context of the research's overarching pragmatic paradigm, qualitative interviews were considered a valuable method in this pragmatic inductive applied approach (Morgan, 2014). If conducted through rigorous development, the validity and trustworthiness of this method can be enhanced (Kallio *et al.*, 2016).

Whilst perceived by some as a simple method of data collection, careful consideration was required for the structuring of the questions used, to avoid the risks of over-simplification whereby only superficial responses were gained and 'idealisation' of the interview setting occurred (Qu & Dumay, 2011). Such idealisation could take the form of assuming that all interview participants are acting in the best interests of the research, providing data that will reveal their experiences and those of the organisations of which they are a part (Alvesson, 2003).

Semi-structured rather than structured questions were selected as this offered versatility within their formatting, in terms of theoretically based questions through to and including fully open questions. As proposed by Galletta (2013) and Busetto, Wick and Gumbinger, (2020), this approach enabled the researcher to address the complexities of the research topic effectively by enabling the researcher to interact with participants. The ability to interact with participants is further supported by the researchers' insider knowledge (Healy & Parry, 2002). Such complexities of this research topic were addressed through the final topic guide which contained questions about the participants' experience of forensic radiography, their

experiences and awareness of best practice implementation in their clinical settings, the training opportunities available and what would be more meaningful to them. The full topic guide can be viewed in Appendix I.

3.5 The ethical approach for this research

A demonstration of the means through which the integrity of data has been maintained was essential for ethical approval to be attained. Underpinning this was the need to demonstrate that the General Data Protection Regulation (GDPR) (2018), as stipulated within the UK's implementation of the Data Protection Act (2018) were being met regarding the use and storage of personally identifiable data. Within the application for ethical approval, there was also a need to consider the wider scope of the research, and the rights encompassed within this, including the rights and value of the knowledge gained in terms of its contribution to public policy, application of best practices and the researchers own rights (Eynon, Fry & Schroeder, 2017). However, such deontological considerations had to be balanced against any potential psychological harm or distress that could be caused by the research topic or the formatting of the questions. Due to the questionnaire being conducted online, it was difficult to assess potential risks. Thus, the ease of being able to withdraw from the research had to be clear and accessible to all participants (Eynon, Fry & Schroeder, 2017). To minimise the risks of potential harm, psychological support was also made readily accessible to participants in both phases of the primary data collection through the provision of links to appropriate support sites, as can be seen in the Participant Information Sheets (PIS) in Appendices E and H.

The final key consideration for the granting of ethical approval from Teesside and Newcastle Universities for both phases of primary data collection was the need to demonstrate that only those participants with the capacity to give informed consent participated in this research. Since all participants meeting the recruitment criteria are practising radiographers registered with the Health and Care Professions Council (HCPC), or international professional equivalents, it was deemed that this was sufficient to demonstrate their capacity to consent. It was a requirement of the questionnaire that all participants indicate online that they had read the participant

information before consenting and participating. Although it must be acknowledged that whilst all appropriate measures were in place, there is no guarantee that the information has been read (fully) and thus the consent attained, was informed (Perrault & Keating, 2018). For the interview phase, each participant was given a consent form (Appendix G), which had to be signed and returned to the researcher before the interview, with questions invited by the researcher prior to commencing the interview itself.

The initial ethical approval for the interview phase was sought before the COVID-19 lockdowns. As indicated by Sim and Wakefield (2019) specific consideration was required for the key factors of consent, confidentiality, and anonymity, due to the limitations of the researchers' control over what may be disseminated by participants outside of the interviews. Acknowledgement of this was made within the ethics application whereby it was highlighted that as professionals registered with the HCPC, participants would be bound by these regulations, particularly those premised on the maintenance of confidentiality and respect within this process (HCPC, 2023).

Within the conduct of the interviews, ten Have, (2004: p.58) highlighted the need for extreme care to prevent these from becoming "deeply moral events" with professional and personal implications and possible consequences for the participants, emotionally or professionally. It was, therefore, important to maintain neutrality and a non-judgemental stance as the interviewer, particularly given the researchers' insider knowledge, thereby minimising the potential for the interview to become more akin to that of an interrogation (ten Have, 2004). Likewise, it was essential within this process not to overly compensate against the risk of becoming too involved in the interview, whereby the researcher becomes both the interviewer and therapist (Bourne & Robson, 2015; Allmark *et al.*, 2009). Although, for the interviews to be meaningful a balancing act was required whereby, a "relational focus", built through respect, tact, and sensitivity was developed (DeJonckheere & Vaughan, 2019: p. 1). To mitigate against these stated risks of the interview becoming either an interrogation or therapy, all potential participants were provided with a PIS (Appendix H), setting out all the essential information regarding the research, its purpose and how this was to be conducted. As with the PIS used for the questionnaire phase, this also included sources of psychological and well-being

support should the participants feel the need for this, which were reiterated upon completion of their interview.

Through the demonstration of due consideration given to these points within the ethics application, ethical approval was sought and granted by the Teesside University School of Social Sciences, Humanities and Law Ethical Review Board (Appendix I) before commencing the data collection phases. Ethical reapproval was later sought and granted by the Faculty of Medical Science Ethical Review Board at Newcastle University (Appendix J), following the transfer of researchers' studies to Newcastle University, ensuring all due requirements continued to be maintained.

3.6 Data analysis

Based on this research topic being one that has not been previously studied, as established within the literature review, an inductive approach to the analysis of the data collected from the questionnaire phase was considered appropriate (Elo & Kyngäs, 2008). Due to the quantitative and qualitative data collected within this questionnaire phase, inductive narrative analysis was selected enabling a dialogue to be developed and presented (Josselson & Hammack, 2021). An essential consideration in selecting this method was the need to establish and demonstrate interpretive validity and believability of the findings developed (Meraz, Osteen & McGee, 2019). However, as stated by Riessman, (2008), this can be a challenge given that there are 'no unified rules' in narrative analysis. That said, it can be enhanced through the robustness of the steps taken by the researcher to take the reader beneath the surface of the data and the development of themes (Meraz, Osteen & McGee, 2019).

As with the questionnaire phase, an inductive approach was taken to analyse the data collected through the semi-structured interviews, using thematic analysis, premised on the approach recommended by Naeem *et al*., (2023). At this juncture, only the first four of the six steps were used, with the final two applied to facilitate the conceptualisation and development of the overarching conceptual model (Figure 3.4). This is explored further within Chapter 6: Discussion.

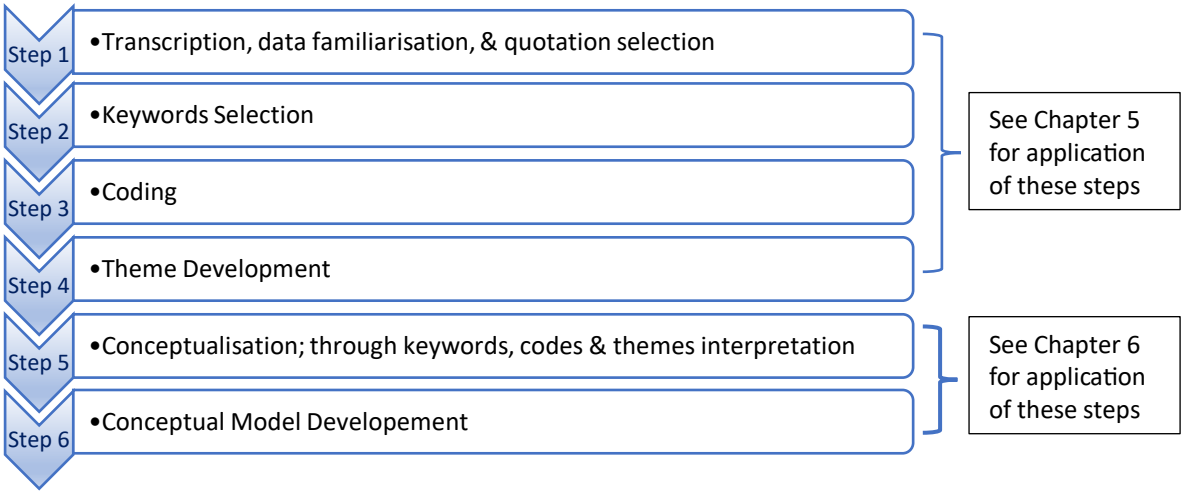

Figure 3.4: Inductive thematic analysis: the six steps used to generate the final conceptual model, (Naeem et al., 2023).

A fundamental aspect of this systematic approach was the production of an output in which rigour and transparency have been demonstrated throughout (Grodal, Anteby & Holm, 2021). Such a stance was considered essential as a means through which the three phases of the research thesis could be encapsulated to address the research aims fully.

3.7 Inductive Analysis and the terminology applied

A systematic inductive approach has been taken to facilitate the analysis of the data collected through each of the three phases of research undertaken. This enabled the development of a meaningful dialogue which is then presented (Vaismoradi, Turunen & Bondas, 2013), guided by the evaluation objectives of this research (Thomas, 2006). This dialogue development took the form of inductive content analysis (ICA), (Chapter 2, Section 2.4.4), which whilst similar to thematic analysis (Vears & Gillam, 2022) uses categories in which the content is described through sub-categories (Elo & Kyngäs, 2008). Both the narrative analysis (Chapter 4) and thematic analysis (Chapter 5) were premised on the inductive development of themes. As discussed, and demonstrated in Chapter 6 these themes together with the ICA categories were conceptualised enabling concepts to be drawn from the collated data, leading to the development of a single conceptual model (Naeem *et al*., 2023).

3.8 A reflection on Implementation Science Theory in the context of this research

In the designing of this research strategy the researcher reflected on the theoretical position of this primarily qualitative, inductive data driven research, in particular the potential role of middle-range theories such as implementation science theory. Middle-range theories can be described as those theories that lie between “minor hypotheses of day-to-day research and unified theory” (Merton, 1968: p.39, cited in Liehr & Smith, 2017: p.51). Consideration was given to implementation science theory, as the underpinning “big” idea that would facilitate the organisation (Collins & Stockton, 2018) and explanation of the many other ideas such as process models, determinant frameworks and intervention outcomes using evaluation frameworks through its application (Kislov *et al*., 2019; Nilsen, 2015). However, based on the premise that implementation science theory is a ‘scientific study of methods’ used to promote the more effective routine adoption of research and evidence-based practices into healthcare practice (Eccles & Mittman, 2006), the researcher felt that this lay out with the remit of this thesis.

This research should be more meaningfully considered as an exploratory study in the form of a scope setting root cause analysis, enabling the study of a subject area previously not explored, which to quote Swedberg (2020: p.17) can be considered “the soul of good research.” However, rather than looking for error and fault, which a root cause analysis is most associated with (Andersen, Fagerhaug & Beltz, 2010), it has sought to create the first analysis (Swedberg, 2020) and actionable knowledge through identification of the many and interrelated factors impacting best practice in forensic radiography.

Although considered to be one of at least 143 theories, models and frameworks in the implementation science field (Wang *et al*., 2023), the researcher decided to utilise the Socio-ecological Model (SEM). Historically, this model was first introduced in the 1970’s as a conceptual model only later in the 1980s becoming an established theory (Kilanowski, 2017).

The researcher acknowledges that this model is most readily applied to public health campaigns, including the prevention of violence and alcohol and substance abuse (CDC, 2015). However, this model can also be considered a theory-based framework as indicated above, enabling the facilitating of a means of structuring the research findings, and an understanding to be gained of the multifaceted and interrelated spheres of influence (Kilanowski, 2017) on individuals. This model can be described as a multilevel conceptualisation which includes individual, intrapersonal, institutional, community and policy components as demonstrated in Figure 3.5.

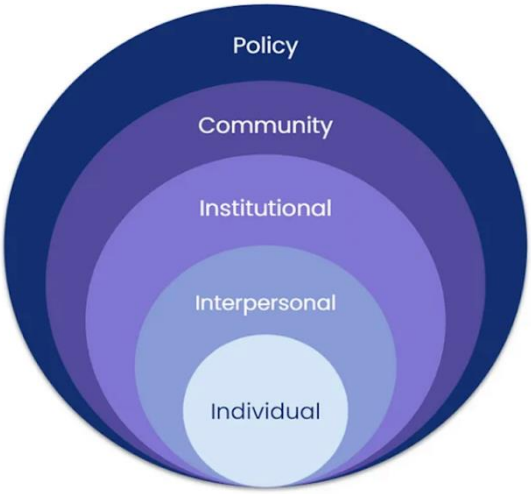

Figure 3.5: An example of the Socio-ecological Model

This was an important consideration for the application of this model in this research, given the model's premise that there are reciprocal interactions between individuals and their environment, whereby one is influenced by the other (Salihu *et al.,* 2015). Based on this premise, the SEM will be used to provide a framework to structure the research findings at the final stage of the contextualisation of the thematic conceptual model, as discussed in Section 6.6 (p.138).

An additional theoretical consideration was given to the cultural work of Douglas (1970) through which she developed her Grid/Group theory. A modified version of this is used to exemplify the radiographic community and the impacts of the components within this as developed through inductive thematic analysis. This enables an evaluation of the 'institutions' constructed by radiographers involved in

forensic imaging and the controls placed on them by organisations and other external forces, as demonstrated in Section 6.1 (p.119) and 6.3.2 (p.125).

3.9 Chapter Summary

This chapter has provided the details, and rationale for the selection of the paradigm, methodology, and methods used for the questionnaire and interview phases of data collection. This research thesis aimed to explore those organisational factors impacting the full implementation of best practices in forensic radiography. This aim drove both the research objectives and the decision-making process behind the paradigm and methodological stance taken. An important consideration in addition to this was the selection of an appropriate approach for the analysis of the collected data. As with the above, a clear rationale and evaluation of the inductive approach taken is demonstrated.

Chapter 4 - Questionnaire

4.1 Overview

The scoping review (Chapter 2), sought to establish the extent of current peer-reviewed and grey literature on the organisational barriers and facilitators to the implementation of best practices within forensic radiography. Based on the findings of this review and the significant gaps identified in the knowledge around this research topic, a questionnaire was deemed the next appropriate step due to its established role within social research for gathering pertinent data (Braun *et al.*, 2021). It was felt that by using this method, through which valid and reliable data may be collected (Dewaele, 2018), an overview could be garnered of the issues pertaining to the implementation of best practices within forensic radiography from the realities as perceived by those radiographers involved in this scope of practice. This approach was considered a valuable asset to the research thesis due to its capacity to enable the researcher to delve deeper into the collected data through interviews in the final phase (Creswell & Hirose, 2019).

4.2 Methods

A questionnaire in the format used in this study could be described as a “fully structured, non-verbal interview” comprising a fixed set of questions with specific answer categories (Panke, 2018: p. 221). However, in this questionnaire, participants were also given the opportunity to add free-text responses. This use of a self-completion questionnaire as a method of data collection for research purposes, has many positive attributes. Many potential participants could be reached simultaneously (Patten, 2014), particularly if using an online means of distribution. Such an approach is more cost-effective and environmentally friendly when compared to the more traditional paper and mail options (Nayak & Narayan, 2019). The feasibility of this was an important factor in taking this online distribution strategy given the population to be sampled, healthcare professionals for whom completion of an online questionnaire would not present an issue. A further positive of this approach was being able to capture original data not available in the literature from those actors (radiographers) in this setting (Panke, 2018). However, it is important to

recognise that this method is not without its limitations, as will be addressed in Sections 4.2.4: p.65 and 4.4: p. 78).

4.2.1 Recruitment

Based on the focus of the research question being on evidence-based practices implementation in forensic radiography practice, recruitment for this questionnaire was premised on those diagnostic radiographers involved in forensic radiography both within the UK and internationally. The inclusion of international participants in this research was considered essential given the stated aims of those key organisations, the IAFR, the International Society of Forensic Radiology and Imaging (ISFRI) and the International Society of Radiographers and Radiological Technologists (ISRRT) involved in guideline development are to facilitate internationally standardised guidelines. As such international participants insights could provide a valuable perspective on the current levels of guideline implementation within their own countries.

4.2.2 Sampling strategy

This method sought to employ a purposive sampling strategy whereby the characteristics were defined by the aim of the research (Andrade, 2021). However, the actual strategy taken was more akin to that of a convenience sampling strategy in which participants fitting this research thesis criteria were recruited (Emerson, 2021) through the International Association of Forensic Radiographers (IAFR) organisation. This gave the researcher a means of identifying a range of potentially 'information-rich' participants applicable to this subject area (Palinkas *et al.*, 2015). This is a strategy advocated by Cresswell and Plano Clark, (2011) and Nayak and Narayan, (2019) in which there is a need to identify only those individuals knowledgeable in this specific area of interest. To facilitate this, criterion sampling as a specific example of purposive sampling was used, thereby ensuring a heterogenous sample in terms of nationality, professional seniority, age, gender, job role, and country working in, from among those participants meeting the desired criterion (Moser & Korstjens, 2018), that of being a diagnostic radiographer (or international equivalent) involved in forensic imaging.

Based on this premise, it was decided to distribute the questionnaire online via the IAFR website (https://forensicradiography.com/). The IAFR has an active membership of around 220 with over 650 people from across the world engaging with the IAFR 'X' (formerly Twitter) and Facebook pages (figures accurate at time of data collection commencement, December 2020). The potential participants were made aware of this research recruitment through its promotion by the IAFR Education Officer within the in-person and online meetings. They advertised the link to the questionnaire via the website and associated social media sites. All information relevant to this study, such as the Participation Information Sheet (Appendix E) and eligibility criteria were stated within the questionnaire link.

4.2.3 The questionnaire format

To facilitate the questionnaire design, the JISC online survey tool was used due to its functionality and because it was approved by the researcher's university (Teesside University) for meeting the required levels of data protection as stipulated by the ethics committee. The questionnaire comprising single and multiple-choice questions, was considered an important strategy to identify emerging trends from within the collated data (Hall, 2020). Response options utilised two response strategies: radio buttons and checkboxes.

Additional free text boxes were made available to invite additional qualitative comments premised on the questions posed. Such a questionnaire strategy has been described by Cresswell and Clark (2018: p.73) as "mixed methods light." Although this qualitative component could be described as not fully embracing the mixed methods concept, it could, with sufficient in-depth responses, facilitate an additional contributary qualitative data set. This can enable the potential development of emergent concepts which could then be used to form the base for the next phase of the primary research. An overview of the questionnaire strategy is demonstrated below. (See also Appendix F).

- The initial questions were designed to establish basic demographics: age, duration of practice, roles within forensic radiography practice, and country of practice.

- The next set of questions sought to establish if and to what extent best practices within forensic radiography practices are implemented. The response to these would then trigger a range of selection options in which factors that have either facilitated or impeded implementation can be identified, and the extent to which these factors impacted this could be determined.

- The final set of questions sought to explore the levels of forensic radiography education, training and CPD participants had engaged with since 2018.

The selection of the year 2018 as the date for engagement in CPD-type activities was considered by the researcher to be an effective means of demonstrating the currency of practice, as required by the (Health and Care Professions Council (HCPC) for the maintenance of professional registration. This was also the year in which the revised RCR guidelines for Paediatric forensic imaging were released. This was considered a useful benchmark, given that most radiographers engaged in forensic imaging carry out paediatric forensic imaging for suspected physical abuse (SPA) on the living and, or the deceased, as highlighted in the Literature Review.

There were several considerations required in the design and formatting of this questionnaire. As indicated by Regmi *et al*., (2016) it must be user-friendly across a range of potential mobile or computer devices, readily accessible, not too time-consuming, and have minimal multiple responses required. Whilst superficial factors such as layout, colour, logos, type font, may be considered important, it is the questions posed, the answering options and the order of these that have the greatest impact on the data that could be obtained (Toepoel, 2017).

A further essential consideration in the questionnaire's design was the length and time it would take to complete it. If overly long, this can result in a loss of interest (Sharma, 2022) and subsequently "careless responding" (Bowling *et al.*, 2021: p.719) or non-competition (SurveyMonkey, 2021), as demonstrated in Figure 4.1 (p.64). This was assessed through the pilot testing phase (See section 4.2.4).

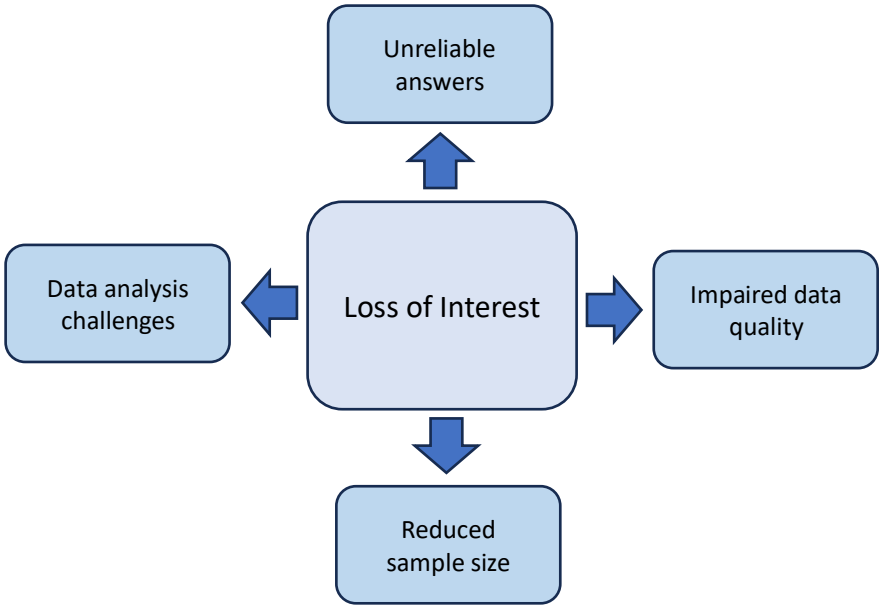

Figure 4.1 The impacts of loss of interest by research questionnaire participants (Sharma, 2022).

4.2.4 Pilot testing

To mitigate against the potential for misunderstanding of the questions posed, pilot testing of the questionnaire was undertaken before its full release. As with the questionnaire itself, it was essential to plan and undertake the pilot testing with care (Brooks, Reed & Savage, 2016; Thabane *et al*., 2010). Such testing provides invaluable information regarding the efficacy and clarity of the questions. It can also aid in determining the length of time the questionnaire takes and provide an opportunity for reflection on this process by the researcher (Brooks, Reed & Savage, 2016). Whilst it was recognised by the researcher that the pilot testing did not have to be online (Regmi *et al*., 2016), it was decided to proceed online as this provided a means of ensuring the required pathway routing worked across the questions.

One established drawback to the use of pilot testing is the risk that it may be used haphazardly with its benefits disregarded, particularly by inexperienced researchers Sampson (2004). There is some debate as to whether this phase should be treated as a separate component of the research or rather, as a prelude to the full questionnaire in terms of the data collected and whether this should be included in the final analysis (Thabane *et al.*, 2010). In this instance, it was treated as the

prelude, from which the final version could be amended if required. Since no further amendments were required, the data collected from this pilot process was used.

4.2.5 Data collection

The online questionnaire was initially made available to access for three months from December 2020, with reminders posted via the IAFR website at monthly intervals. However, as discussed in section 4.3.2 this strategy was amended.

4.2.6 Participant consent

Due to this being an anonymised questionnaire, participants were informed within the participant information provided on first accessing the questionnaire, that they could withdraw their participation at any point before submission of the completed questionnaire. Participants were advised that once submitted, there was no feasibility to withdraw any data. Before commencing the survey, participants were required to select the option stating that they had read the participation information (Appendix F), understood this and gave their consent to participate. It was only through selecting this option that the full questionnaire became available.

4.2.7 Data storage

As stipulated within the ethics application and to ensure the maintenance of appropriate protection of the data collected, this was stored on a secure password-protected University server held by the researcher at their academic institution. To facilitate the required sharing of data with the researchers' supervision team this was placed on a secure Microsoft Teams site that enabled 'Private access' to only this team. The use of two methods of data storage was considered important, enabling protection against the possible loss of data due to the crashing of a server, or it being hacked (Nayak & Narayan, 2019).

4.2.8 Data analysis

As stated by Proudfoot (2022), identifying the most appropriate method of data analysis in multi-methods research is one that this open to considerable debate. One that has been exacerbated by the lack of methodological literature addressing this (Onwuegbuzie & Johnson, 2021). Based on this research topic being one that has not been previously studied, as established within the scoping review, a cross-over mixed method of data analysis for this questionnaire phase was considered appropriate. This approach, in keeping with the pragmatism paradigm, enabled the application of a 'between paradigm analysis' whereby an approach typically used with one form of data i.e., qualitative is applied to another, quantitative (Onwuegbuzie *et al.*, 2007). Based on this premise, inductive narrative analysis was undertaken through which a dialogue could be developed and presented (Josselson & Hammack, 2021). An essential consideration in the selection of this method was establishing interpretive validity and believability of the findings developed (Meraz, Osteen & McGee, 2019). This can be a challenge given that there are 'no unified rules' in narrative analysis (Riessman, 2008). Nonetheless, it can be enhanced through the robustness of the steps taken by the researcher to take the reader beneath the surface of the data and the development of themes (Meraz, Osteen & McGee, 2019).

4.3 Results Overview

This questionnaire sought to gain an overview of the organisational barriers and facilitators to the implementation of best practices within forensic radiography from the perspectives of those involved. Using the IAFR and its social media sites, together with the researcher's professional links, this research was completed by thirty-two participants.

4.3.1 Pilot test input

This research was pilot tested with two participants who had not been involved in any aspect of the research before this point. The purpose of this research was explained to both testers who met the eligibility criteria, and they were each asked to

complete this independently online. This enabled the researcher to establish the efficacy of the questionnaire structure, the questions posed and whether these were interpreted and understood by the participants without issue. Their feedback was sought, and their results were analysed on the completion of the questionnaire by both participants. Based on their results and feedback, no amendments were made to the questionnaire structure, as such, their data was included in the final data set collected. As per the ethical requirements for anonymity, these two questionnaires were fully anonymised with no data traceable to them. In terms of timeframes, the questionnaire was found to last no more than 15 minutes which was not considered to be an excessive time frame for this type of research (Sharma, 2022).

4.3.2 Data collection challenges

With online questionnaires, there is the potential that questions may be misinterpreted, as there is no one available for clarification and participants may not complete the questionnaire fully. It is also felt by some researchers that using an online method alone could be less effective in gaining satisfactory response rates (Hall, 2020; Lee, Fielding & Blank, 2017). As an aid to addressing and minimalizing this risk a pilot testing strategy was used as outlined in section 4.2.3.

The collection of data for this research phase proved to be very challenging for obtaining sufficient participant numbers, this was also a finding reflected in the experiences of Nayak and Narayan (2019) who undertook a questionnaire among public health experts. They stated that in their experience, the online survey produced a very poor response rate. Indeed, this is not a unique experience but one that has been seen across many studies, as established in a meta-analysis by Daikeler, Bošnjak and Manfreda, (2020), and Wu, Zhao and Fils-Aime, (2022). There could be several reasons for this, the population size from which the participants were sought, infrequent or irregular access to their International Association of Forensic Radiographers emails, the email going to their junk folder or simply survey fatigue (Roberts & Allen, 2015). For this researcher, experiencing the same dilemma, this led to the need to consider the frequently posed question for online questionnaires, ‘how much is enough?’ This was not to be treated lightly but considered an important issue within this research method and was not easily

answered. As stated by Barkhuizen (2014), this can depend on many factors, such as the aim of the study. For this component, the aim was to gain an overview of the factors involved and to establish whether these apply to the few or the many within this setting. However, the factors impacting sample size may not be ones that can be controlled by the researcher, including the size of the pool from which the sample may be drawn. As indicated in section 4.2.2, the sample pool was approximately 250 active members of the IAFR community, with an anticipated 20-30% participation rate based on Lindermann's (2021) methodological commentary. Such figures would be sufficient to provide the overview sought. Unfortunately, this was not achieved, necessitating the need to also promote the questionnaire through the researchers' professional social media sites, 'X' (formerly Twitter) and LinkedIn. Although this did result in further responses received, the uptake was still low at 15%. An additional reason for this may have been that many radiographers who undertake medico-legal imaging such as for suspected physical abuse in children, do not recognise this as forensic radiography practice, but rather simply an extension of their current role, which is infrequently undertaken. This is explored further in Section 4.4. Discussion.

A further challenge in this research component was the issue created by some participants not responding to all the questions asked, a risk factor demonstrated in Figure 4.3. Within the designing of this questionnaire, the researcher did consider the inclusion of 'forced response' questions in which the participant must provide an answer before being able to move on. However, from an ethical standpoint, this would not be considered appropriate as this overrides the participant's right to not answer specific questions (Nayak & Narayan, 2019; Baker *et al*., 2015).

4.3.3 Participant demographics

Of the thirty-two participants, twenty-six identified as female with the remainder as male. This gender split is reflective of the diagnostic radiographer population statistics, as seen in the UK (HCPC, 2019) and the USA (Zippia, 2023). The age range of the participants was from 21 years to over 61 years, with the majority (38%) being aged between 21 to 30 years. The next largest age ranges were 41 to 50 years and 31 to 40 years, at 28% and 25% respectively. There was some variation

among the participants regarding the years of clinical practice with between four to seven years being the most prevalent as demonstrated in Figure 4.2.

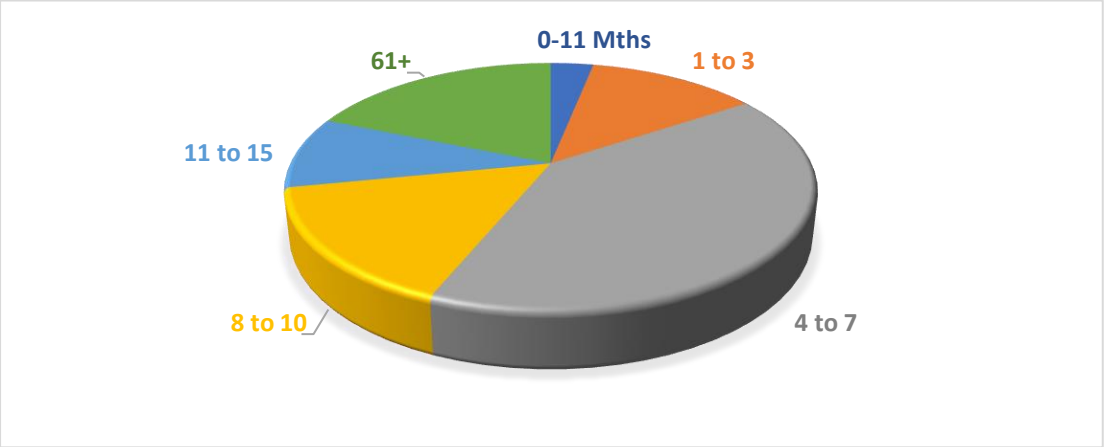

Figure 4.2: Duration of participants' practice experience (in years)

The participants reported having a range of clinical roles. Of these, 63% stated that they were employed as radiographers, where their primary role is diagnostic radiography across a range of settings in which undertaking forensic radiography is an additional role. 28% of the participants have specialist roles encompassing paediatrics, forensic, post-mortem, and computed tomography (CT). 2% held senior roles, which whilst not explicitly stated, could be defined as leading roles within a specialist area of radiographic practice, i.e., paediatrics, CT, MRI, post-mortem practice etc as established within the diagnostic radiography career progression pathway. The remaining 6% of participants held consultant or equivalent-level roles. See Figure 4.3.

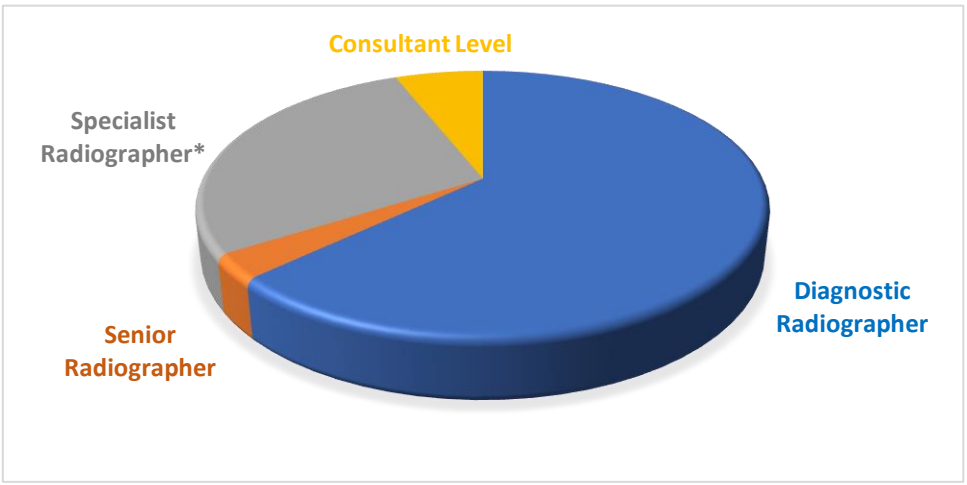

Figure 4.3: The breakdown of the participants' primary professional roles (by numbers)

At the time of completing this survey in February 2024, most participants (75%) were working in the UK, with 9% in Africa, 9% in Europe, and a further 7% based in Scandinavia.

4.3.4 Development of inductive narrative themes

Through the undertaking of inductive narrative synthesis four themes were developed from the combined quantitative and qualitative data, taking the reader below the surface of this collated data. These themes comprised of *guideline and protocol awareness*, *organisational and radiographic community awareness and understanding*, *work-based cultural practices* and *training, education and CPD: the impacts of perceptions and understanding*.

4.3.5 Theme 1 - Guideline and protocol awareness

Participants reported a good knowledge and awareness of the key guidelines and protocols demonstrated among most participants, with 72% stating that they were aware of current best practices within their forensic imaging practice settings. However, 33% of participants whilst involved with forensic radiography practice stated that they did not know current best practices, guidelines, or protocols. One participant did not answer this question.

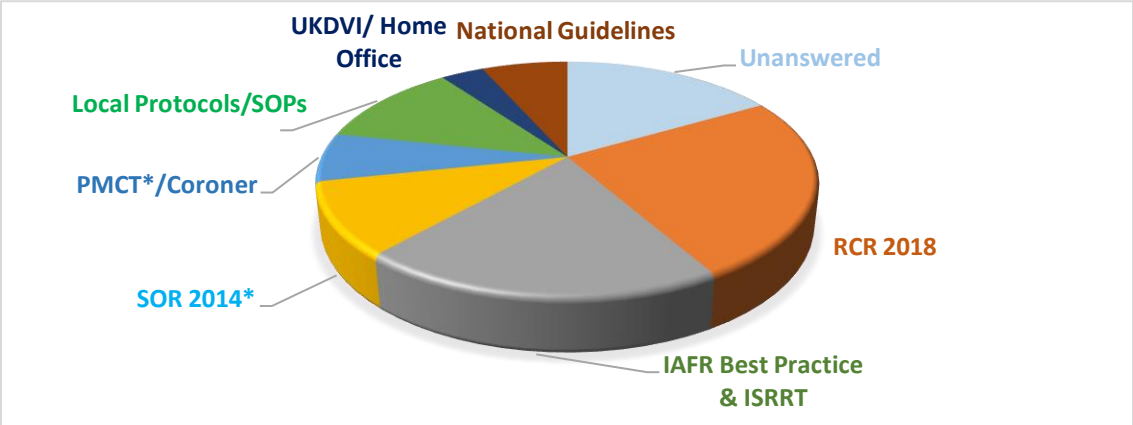

Figure 4.4: Participants' awareness of forensic radiography guidelines and protocols (by numbers cited)

The participants were asked to give examples of the guidelines and protocols that they apply within their practice settings. As with their awareness, a good application baseline was demonstrated with many participants identifying multiple guidelines and protocols (Figure 4.4), although five participants did not respond to this question. A further three referred to imaging techniques, consent, and the need for witness statements to be written, rather than guidelines or protocols. Except for the IAFR (2020) guidelines for best practices in forensic radiography, which are designed to be general and overarching, the guidelines referred to were reflective of the participants' specific areas of forensic practice.

As demonstrated in Figure 4.5 only 28% (n=9) of the participants stated that best practices were implemented in full in their practice settings. Of the remaining participants 50% (n=16) stated that best practices were only partially implemented and a further 22% (n=7) advised that these were not implemented at all in their forensic radiography practice settings.

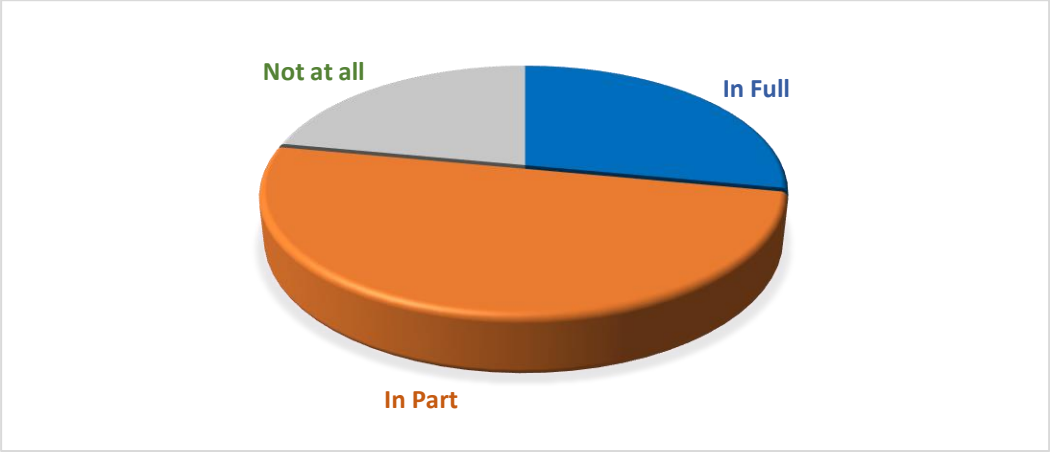

Figure 4.5: Participants stated levels of best practice implementation (%)

When combined, these latter two groups demonstrate that 72% of the participants report undertaking forensic radiographic practice outside of the current evidence-based best practices, to a greater or lesser extent. This issue was exemplified by one participant who stated that they are,

> *"… painfully aware that the official national guidelines are ancient".* (P16)

Based on the responses received from this question, participants were signposted by the logic used in the survey to a series of questions and options through which the facilitators for the best practices implementation or conversely the barriers to this could be explored. Free text boxes were also made available for participants to add anything further within this section as demonstrated previously in Figure 4.2.

4.3.6 Theme 2 - Organisational and radiographic community awareness and understanding

As indicated in section 4.2.2 the participants were offered the opportunity to supplement their quantitative responses with additional qualitative free text comments. Of the thirty-two participants, nine engaged with this option.
There were two key factors highlighted as primary facilitators of the implementation of best practices among those who stated that these were implemented in full. These are departmental knowledge and understanding and having named individuals in specific roles.

> *"Departmental knowledge and understanding of the importance of best practices … and [their] organisation of specific individuals within department who have pushed for best practice in local policies."* (P2)

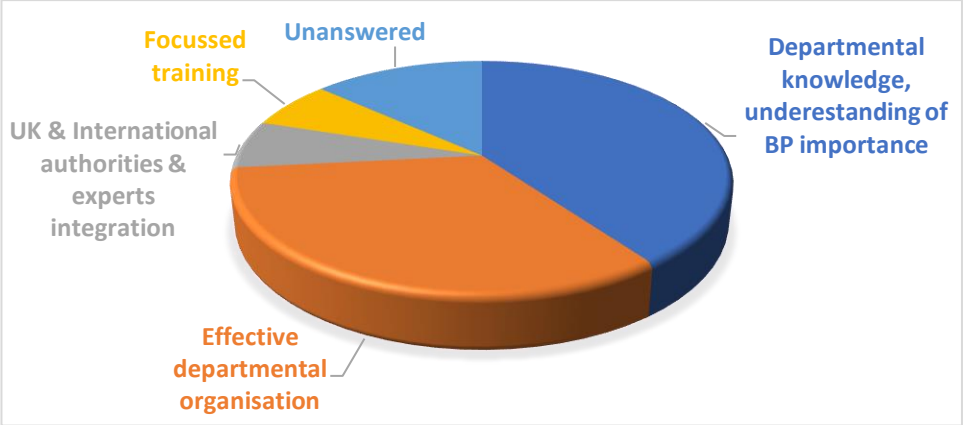

Figure 4.6 Enablers of full implementation of best practices as identified by participants (%)

Other factors identified, included the value of collaboration between the UK and other international authorities and experts (P.13); being the sole practitioner with

relevant training driving forward the guidance, local protocol provision and training (P.10); focused training within their departments, and for the specialist remit of paediatric forensic radiography having specifically named paediatric leads within the department (Figure 4.6).

In those 50% of cases where best practices were found to be only partially implemented, participants were given a range of possible barriers from which they could select as many as were deemed appropriate to their clinical settings and experiences. For those reasons selected, participants were asked to choose the option felt most applicable in terms of whether those barriers were seen as 'minimal and easily overcome; small – requiring some effort; moderate – can be overcome but challenging; very difficult – can be overcome but with significant challenges; and not possible – cannot be resolved'.

Within this category of only partial implementation, three key factors stood out as being 'very difficult to overcome – requiring significant intervention'. These were funding issues and financial constraints within departments (31%); insufficient training, education and CPD opportunities (38%); and resistance within their team and or department (31%). An additional two factors featured strongly as 'moderate – can be overcome but challenging,' were the 'limited resources and equipment' (25%) and 'insufficient appropriately qualified staff, i.e., paediatric radiologists' (38%). These same issues were reflected in the responses from those participants stating that forensic imaging best practices were not implemented at all within their clinical settings.

> *"Forensic radiography is not always seen as an aspect of the [radiography] profession that management wish to invest in."* (P1)

4.3.7 Theme 3 - Work-based cultural practices

The lack of awareness and understanding of individuals' professional roles within their clinical settings from colleagues and others when undertaking forensic imaging was evident in some instances. This was particularly the case with 43% of those who

reported that forensic imaging best practices were not implemented at all stating that this issue was very difficult and challenging to overcome.

> *"Though my department performs forensic imaging, that is not acknowledged as such …"* (P16)

This lack of understanding and awareness, together with 'professional/personal conflicts' was reflected in other ways, being identified by 38% of the 'partial' or 'not implemented at all' categories of participants as 'impossible to overcome.'

> *"In regards to post mortem imaging, there is a huge resistance from practitioners of traditional post mortem techniques due to lack of understanding, fear of losing their own importance in the job and lack of willingness to embrace change"* (P9)

> *"… our service has problems with the engagement of the paediatric consultants and the follow-up arrangements where they seem less willing to take responsibility."* (P18)

A further factor raised was the impact of undertaking forensic cases during busy shifts and the associated disruption to the day-to-day workflow. This was reflected in the lack of understanding from colleagues and managers as to what constitutes forensic radiography and its associated requirements.

4.3.8 Theme 4 - Training, education and CPD: the impacts of perceptions and understanding

Seventeen participants stated that they had undertaken some level of postgraduate education (Masters (MSc), Post graduate diploma (PgD) or Post Graduate Certificate (PgC) in forensic radiography since 2018, in keeping with guideline recommendations (Doyle et al., 2020; RCR, 2018; SOR, 2014). Two participants stated that had engaged in CPD activities rather than post-graduate training since 2018, due to having already attained the mandated post-graduate training in the years before this. A further seven participants had also engaged in CPD/training

activities but did not have any or were currently undertaking post-graduate training related to forensic imaging. One participant was undertaking post-graduate training; however, this was not related to forensic radiography, and as such they had engaged in forensic radiography CPD-related activities instead. Two other participants stated that they had undertaken no form of training, CPD or post-graduate education in forensic radiography at all. The remaining three participants did not answer this question. A pictorial breakdown of the levels of engagement in CPD/training and postgraduate education can be seen below in Figure 4.7.

It was noted that training, education and CPD were found to be primary facilitators or barriers to the effective implementation of forensic imaging best practices. Where best practices were implemented in full, it was noted that managerial and organisational awareness of the need for this, together with their encouragement, enabled practitioners to engage with the training mandated by the *Doyle et al*., (2020) and specialty-specific guidelines.

> *"I found the backing of SoR with their requirements of post-graduate education to be highly influencing in my application for funding within my trust."* (P20)

> *"Radiographers are now being trained at post-graduate level and form a dedicated forensic radiography team."* (P27)

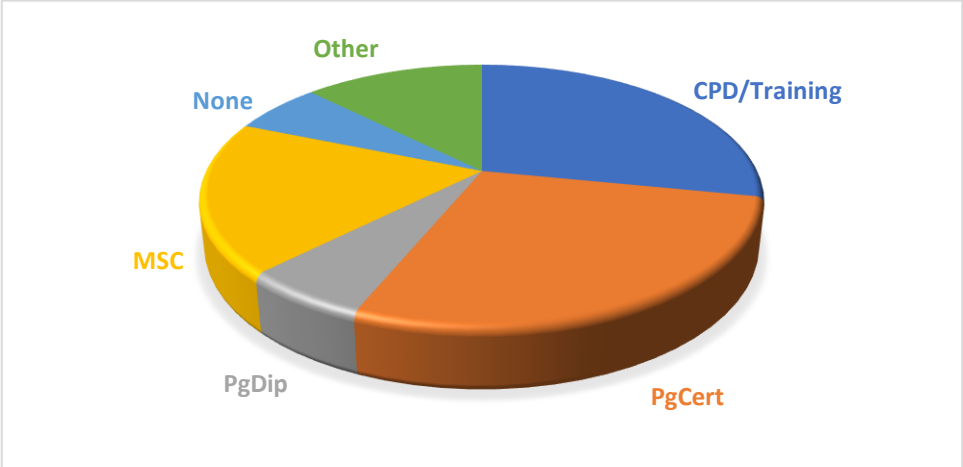

Figure 4.7 An illustration of the participants' reported engagement in forensic training, education and CPD

For those participants who stated that they had undertaken post-graduate training since 2018 (n=17), they were asked to select from a range of motivators or facilitators that applied to them. This selection, together with their prevalence is demonstrated in Figure 4.8.

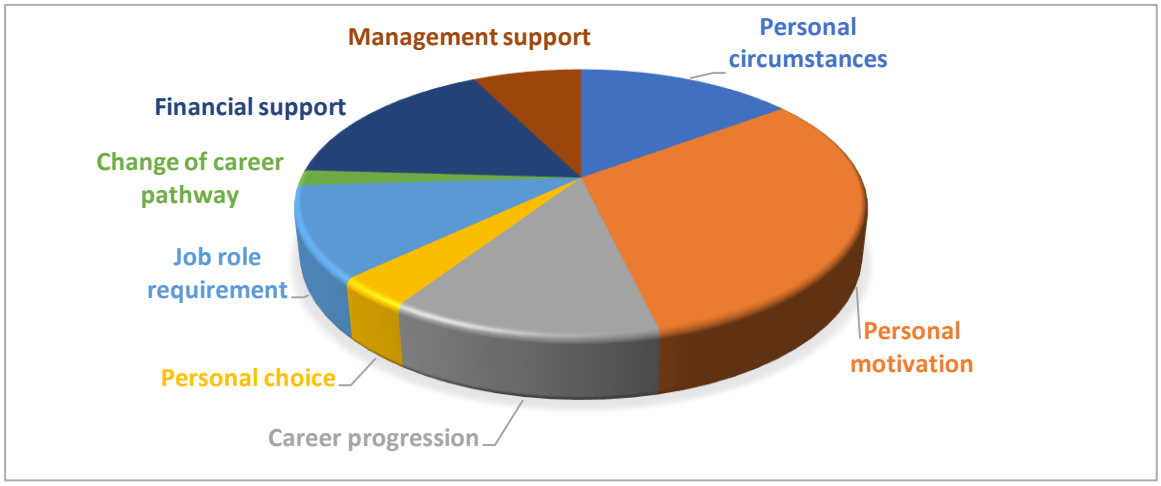

Figure 4.8 The participants stated motivators and facilitators for undertaking post-graduate education

As can be seen in Figure 4.8, the key driver ascribed to by all participants was personal motivation, together with support from their families and work colleagues.

> *"I have been lucky enough to have been supported through my PgD [Post graduate Diploma] by my family and my work colleagues."* (P18)

The primary facilitator was found to be the availability of financial support, be this through their employer, secondment, grant, or bursary. However, for many others, this process was not straightforward.

> *"Due to the nature of my employment, I am required to have support from my employer for post-grad work, … although funding also remains an obstacle."* (P10)

Being unable to fund post-graduate education due to being seen as too expensive was the primary barrier for 71% of those participants who had not undertaken this. Other barriers to engaging with this, were personal circumstances, lack of knowledge regarding the need for this, and lack of employer support.

"Forensic radiography is not always seen as an aspect of the profession that management wish to invest in." (P1)

"…all further education in forensics had to be taken in my own expense and on my own time. Though my department performs forensic imaging, that is not acknowledged as such and hence my wishes to educate myself haven't been seen as an interest of our department." (P16)

Perhaps surprisingly, time constraints as a barrier to effective implementation within departments were identified as a 'moderate issue' which can be overcome – but will be challenging, by only 50% of participants. A further participant saw this as a barrier that could not be overcome, as exemplified below.

"…also give workers more opportunity to take CPD courses in order to keep up to the latest developments in their field.' (P28)

"We don't get any personal CPD time despite it being protected time by the Society. As such our department does attempt group CPD but we don't ever have forensic ones, not even meetings.' (P29)

4.4 Discussion

This research component sought to gain an overview of the facilitators and barriers to the effective implementation of best practices within forensic radiography from the radiography practitioners' perspectives.

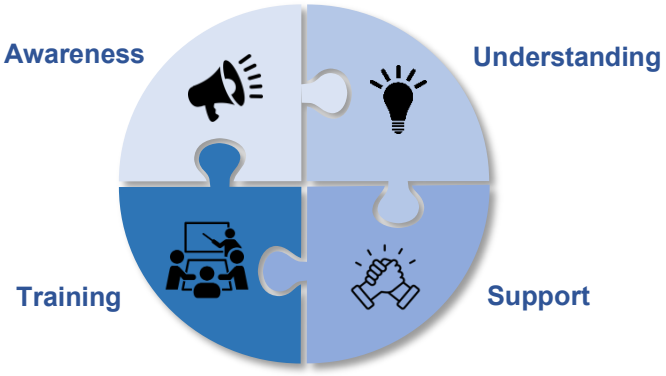

Figure 4.9 The essential components for best practices implementation in forensic radiography.

From the findings of this research, an interdependency of factors has been established, as seen in Figure 4.9. In this scenario, if only one piece of the puzzle is missing, the picture will remain incomplete and the effective implementation and application of best practices in forensic radiography can only be partial at best.

It is widely recognised that the application of protocols premised on evidence-based practice can aid in ensuring standardised practice in both forensic and general radiography practices (Patel, Swinson, & Johnson, 2017; Hulson, van Rijn & Offiah, 2014). However, as this research and other studies have determined, these can only be effective if staff are aware of them, know how, and where they can be accessed, and are trained in them and their application within their specific settings (MacGregor, Breckons & Swainston, 2024; Camilleri, Swainston & MacGregor, 2023).

The lack of guideline and protocol awareness, training, and application, was particularly evident among the international participants, where it was acknowledged that national and international guidelines are generally either limited or lacking in both the scope of practice and responsibilities (Doyle *et al.*, 2023). This issue has been specifically highlighted in certain nations such as Nigeria (Sangonuga, Kekana & Eze, 2022), and Australia (Smith *et al*., 2022), and geographic regions such as Scandinavia (Primeau, Marttinen & Pederson, 2022), reflecting the findings of this research and the nations this considered.

Whilst there are evident issues internationally regarding guideline implementation, the ad hoc situation within the UK is not without concern as was demonstrated within this research. Doyle *et al*., (2023: p.4) in their research described a similar “ad hoc approach” and training requirements, despite well-established guidelines in situ. One reason given for this is that in most instances this work is carried out by diagnostic radiographers on an infrequent basis (Doyle *et al*., 2023), in which forensic imaging could almost be described as a sideline to their day-to-day work.

Organisational awareness and understanding of the role of forensic radiography, together with the educational requirements encompassed within the provision of this, were found to be a key factor in both facilitating or inhibiting best practices

implementation. Where organisational support was present, be this through their manager's understanding of the need to provision their forensic imaging service effectively, best practices were reportedly implemented effectively. This was particularly reflected in the comments from some UK participants who had been proactively supported to undertake the required education, training, and CPD. As established in this research, this was only described in a minority of instances.

To be able to consider the issue of organisational awareness and understanding meaningfully, it is essential to recognise the lack of standardisation within forensic radiography practices across nations. As acknowledged by Doyle *et al.*, (2023), except for the UK, there are no mandated requirements for radiographers to undertake any post-graduate education or training in forensic radiographic practice. The only stipulation in these nations is that practitioners follow the clinical guidelines applicable to their generic radiography roles. However, as established within this research, many international radiographers engaged in forensic imaging have undertaken post-graduate education and other forms of relevant training or CPD, albeit instigated at a local employer-led level.

This questionnaire revealed an excellent level of post-graduate engagement, in which almost three-quarters of the participants held either a post-graduate certificate, diploma or full degree at the master's level. This is a positive finding; however, some qualification of this is necessitated. These participants were recruited through the IAFR, which is an international organisation which seeks to proactively promote best practices within forensic radiography and enhance training opportunities (Primeau, Marttinen & Pederson, 2020). Given this, there would be an expectation that its membership would have a greater knowledge of the relevant legislation, guidelines, and protocols in their scope of forensic radiography, than non-members of this and other similar organisations such as the International Society of Forensic Radiology and Imaging (ISFRI) and International Society of Radiographers and Radiological Technologists (ISRRT). Thus, caution is advised in applying this finding to the wider population of radiographers involved in forensic radiography either in the UK or internationally.

As evidenced in this research the levels of training, education and CPD were high however, this on its own is not sufficient to ensure that best practices are implemented effectively or maintained. If on completion of this training or education, the radiographers return to unsupportive departments or challenges due to the prevailing work-based culture, then effective implementation and changes are unlikely to occur (Primeau, Marttinen & Pederson, 2020). An integral facet of this lies in the lack of awareness and understanding of the role of forensic radiography, its remits, and its impacts on the wider radiography department at an organisational level. As was demonstrated by many participants in this research, these issues manifested as personal and professional conflicts, exacerbated by the impact of their forensic activities on the day-to-day workflow of busy departments. These findings were reflected in MacGregor, Breckons and Swainston's (2023) scoping review undertaken as phase one of this researcher's overarching research. Such challenges have resulted in a two-horned dilemma for those radiographers affected; a lack of investment in staff training by the organisation, and resistance from colleagues to embrace change (Camilleri, Swainston & MacGregor, 2023) and the wider MDTs.

Funding for training, education, and CPD activities if not provided by supportive and understanding employers was found in this research to be a strongly prohibitive factor for many radiographers. However, as was also established, some participants were motivated to overcome this adversity through self-funding rather than simply accepting that further education could not be done. The primary driver for this was the opportunity to enhance their career development. This issue of financial support has been partially addressed in the UK in recent times through the allocation of CPD funding, made available through their employers to eligible staff members undertaking relevant learning. However, for this to be effective, it comes back full circle to the need for departmental managers and employers to have an awareness and understanding of the importance and value of the training requested to grant approval.

A further significant barrier to the engagement in training, irrespective of how it was funded, was the provision of time in which to undertake these essential and, if in the UK, required learning activities. CPD, be this through formal post-graduate education, study days or informal activities such as journal clubs, is mandated by the

HCPC (2016), to maintain professional registration. In other research, it was found that for many radiographers, time, and a reluctance to work in their own time, rather than funding, was the primary barrier to engagement with CPD (Stevens & Wade, 2017), although this was not evidenced in this research. That said, time was highlighted as a cause of resistance and lack of understanding from some colleagues of those undertaking forensic cases, particularly when these occurred during the busy working day. Such cases were found to necessitate the taking of two radiographers from busy departments for potentially one to two hours per case, impacting significantly on understaffed and under-resourced departments, and overly long patient waiting lists. Such pressure points were found to be unavoidable causes of friction among radiography staff and a further departmental dilemma for managers facing potentially significant financial repercussions if patient waiting lists breach.

4.5 Nonresponse bias: the implications

Whilst the methodology for this research phase was considered sound, and based on a strong evidence base, it could be considered that the low response rate for this questionnaire is a potential limitation. As such, it was essential to consider whether a nonresponse bias resulting from low participation has impacted the validity and trustworthiness of the respective elements of this questionnaire's findings. A further consideration was whether these findings could be considered representative of the population of radiographers undertaking forensic imaging roles. This is an important factor when evaluating the meanings that may be drawn (Fincham, 2008). However, as established by Hendra and Hill, (2019) there was perhaps a need to reconsider this concern, due to there being evidence of little correlation between response rates to a questionnaire and nonresponse bias. To continue to keep the questionnaire phase for a further extended period was felt to be impractical for the completion of the overarching research and could potentially impact the value of the data previously collected. Thus, it was decided to cease this phase once 30 responses were received. Although this was a low response, there was good evidence of sample heterogeneity, as demonstrated in Section 4.3.3. Participant demographics.

4.6 A short reflection on this phase of the research

This phase of the research was found to be significantly more challenging and frustrating than had been anticipated. The frustration lay in my inability to gain what would have been considered an acceptable response rate to the questionnaire. This resulted in many hours of soul-searching and consideration of other strategies that could be used to enhance engagement together with numerous discussions with my supervisory team. Whilst perseverance and the promotion of the research through my professional networks saw an increase in participation, the overall uptake was still felt to be disappointing. That said when considering the results, the increased numbers did not lead to any changes in the key findings. Rather it was only the numbers that changed, thereby giving me some small sense of validation, and a basis from which I was able to build the next phase of my research.

4.7 Chapter Summary

This chapter presents the findings of the mixed methods questionnaire undertaken as the second component of this research thesis. This questionnaire was the first primary research that sought to gain an overview and insight from radiographers into the multiple and interrelated factors shaping evidence based best practices implementation in forensic radiography. Through a purposive recruitment strategy resembling that of convenience sampling, only participants involved in forensic radiography were invited to participate. Narrative analysis was applied to the qualitative and quantitative data collected, through which four themes were developed: *guideline and protocol awareness*, *organisational and radiographic community awareness and understanding*, *work-based cultural practices* and *training, education and CPD: impacts and perceptions*. Although aspects of these findings, such as funding, and time constraints were reflected in the findings of the first component of this research and more generic radiography research papers, the insights garnered regarding the difficulties in overcoming the many challenges faced in this area of practice were unique. This also applied to the radiographer's perceptions of the organisation's role in implementing best practices and the working cultures fostered within radiography departments towards forensic radiography and its practitioners. The issues discussed are complex and the implications of these for

forensic radiography best practices and those practitioners involved have been discussed.

Due to the perceived limitations of the questionnaire and the complexities and consequences of its findings, it was considered imperative to delve deeper into these, thereby enabling a greater understanding. Based on this premise, conducting a series of semi-structured interviews with radiographers involved in forensic practice was deemed essential, enabling a greater understanding from their perspective, as detailed in Chapter 5.

Chapter 5 – Semi-Structured Interviews

5.1 Overview

Within the previous chapter, the questionnaire gained an overview and initial insight into the research questionnaire from the perspective of the radiography practitioners themselves and their realities. This was in keeping with the researcher's ontological and epistemological stance underpinning pragmatism. Its other key role was to form the premise on which this next phase of the research would be founded. This was to take the form of primary qualitative research through which an in-depth exploration of participants' experiences and insights could be obtained.

5.2 Methods

To facilitate this, the researcher sought to undertake individual qualitative semi-structured interviews utilising a format proposed by Krueger and Casey, (2015), (Appendix I). The amended question format to be used for these interviews were reviewed and ratified by the researchers' supervisory team. This approach provided a means of exploring and evaluating in depth the findings gathered through the questionnaire phase. It was felt that this would also present opportunities to offer additional meanings to the study's objectives (Galletta, 2013), culminating in the development of a conceptual model capturing the findings from this and the two earlier phases of this research.

The undertaking of qualitative interviews using semi-structured open-ended questions is considered "a conversation with a goal" (Hijmans & Kuper, 2007) enabling insights to be gained into participants' experiences and opinions from their perspectives (Busetto, Wick & Gumbinger, 2020). In the context of the overarching pragmatic paradigm discussed within Chapter 3, qualitative interviews were considered a valuable method in this inductive subjective contextual research (Morgan, 2014). If conducted through rigorous development and objectivity the trustworthiness of this method can be enhanced (Kallio *et al.*, 2016).

Trustworthiness in the context of this research was demonstrated through applying a number of essential steps. These encompassed member checking, whereby

participants were given the opportunity to review the verbatim transcripts of their interviews for accuracy and “resonance” with their experiences. Such a well-established step also served to enhances the credibility of the data collected (McKim, 2023). The data analysis was undertaken in a clear, consistent, thorough and pragmatic approach (Nowell *et al*., 2017), in which each phase was independently verified by a second reviewer, Katherine Swainson (Director of Studies). Had there been any disparity in consensus a third reviewer Matthew Breckons (PhD Supervisor) would have been used. Essential to these steps was the need to demonstrate credibility, transferability, dependability and confirmability as espoused by Lincoln and Guba (1985).

Whilst perceived by some as a relatively easy method of data collection, careful consideration was required for the structuring of the questions used, to avoid the risks of over-simplification whereby only superficial responses were gained and ‘idealisation’ of the interview setting occurred (Qu & Dumay, 2011). Such idealisation could take the form of assuming that all interview participants are acting in the best interests of the research, providing data that will reveal their experiences and those of the organisations of which they are a part (Alvesson, 2003).

Semi-structured rather than structured questions were selected as this offered versatility within their formatting, in terms of theoretically based questions through to and including fully open questions. As proposed by Galletta (2013) this approach enabled the researcher to address the complexities of the research topic more effectively, through enabling the researcher to interact with participants (Busetto, Wick & Gumbinger, 2020). To this end, the final topic guide (Appendix I) contained questions exploring the multi-disciplinary teamwork element of the role of a forensic radiographer, the challenges encompassed within the role and the wider organisational factors.

5.2.1 Ethics and governance for interview data collection

As with the data collection for the questionnaire, ethical consideration was also essential for this phase. The full strategy taken for this phase has been evaluated in full in Chapter 3, Section 3.6: pp. 56-57.

As established previously in Section 3.5 it was essential throughout the conduction of the interviews that the researcher remained mindful of the potential for a power differential given their insider knowledge both as a practitioner and academic in this research field. As suggested by Merriam *et al*, (2001: p. 411) there are strengths that come with being an insider, such as having a real understanding of the 'culture' of practice researched. This can enable the asking of more probing questions examined, however, this must be weighed against the potential advantages were the researcher an outsider. Such advantages could include having sufficient curiosity to ask more probing questions. As proposed by Strudwick (2024) in their paper exploring an ethnographic researchers' navigation of an insiders/outsider status when researching their own area of practice, they should seek to undertake this through the eyes of an outsider enabling clarity to be established in the participants behaviours. Although this current research was not an ethnographic study, a similar stance was required. In recognition of the potential power differential between the researcher and the participant the researcher sought to establish an empowering and interactive relationship with each participant through openness and positive encouragement. This necessitated self-awareness and an open-minded approach (Aburn, Gott & Hoare, 2021), particularly given the scope for potential disclosures relating to bad practices that may even go beyond a lack of best practices. This consideration was addressed in Section 3.2.2 Researcher positionality, Chapter 3 and Section 5.6. Reflection, within this chapter.

Ten Have, (2004: p.58) highlighted the need for extreme care to prevent the interviews from becoming "deeply moral events" with professional and personal implications and possible consequences for the participants, emotionally or professionally. It was therefore important to maintain neutrality and a non-judgemental stance as the interviewer, particularly given my insider role (see Section 3.2.5: p.47), minimising the potential for the interview to become more akin to that of an interrogation (ten Have, 2004). Likewise, it was essential within this process not to overly compensate against the risk of becoming too involved in the interview, whereby the researcher becomes both the interviewer and therapist (Bourne & Robson, 2015; Allmark *et al.*, 2009). Although, for the interviews to be meaningful, a balancing act was required through which, a "relational focus", built through respect,

tact, and sensitivity was necessitated (DeJonckheere & Vaughan, 2019: p. 1). To mitigate against these risks, all potential participants were provided with a Participant Information Sheet (PIS) (Appendix H) setting out information regarding the research, its purpose, how this was to be conducted and the requirement for consent to be obtained before commencement (Appendix G), Cresswell, 2013).

5.2.1.1 Consideration of Potential Psychological Distress

An essential ethical consideration for this phase of the research was to ensure that safeguarding measures were in place to support participants were they to become distressed through the course of the interviews, due to their potential sensitivity (Elmir, Schmied, Jackson & Wilkes, 2011). One such measure was the PIS (Appendix H) which included sources of psychological and well-being support should the participants feel the need for this, following interview completion. However, there was also a need for the researcher to be cognisant of possible signs of distress during the course of the interviews themselves. Were this to have occurred the interview would be immediately suspended with the recording also paused or halted as required. To minimise the risk of this occurring, significant preparation and planning was required prior to commencing the interviews (Dempsey et al., 2016). As part of this, guidance was sought from the researchers' Director of Studies (DoS) (Dr. Katherine Swainston) in their capacity as a Chartered Health Psychologist. Should the researcher have been concerned for a participants' psychological wellbeing during the interview, their DoS was available as a source of support.

5.2.2 Sampling Strategy

Criterion sampling as a form of purposive sampling has been widely adopted as a means of enabling the identification and selection of data-rich participants in the field of implementation science (Palinkas *et al*., 2015). Based on its established validity, this approach was utilised in this phase of the research. Participants were initially recruited through a poster promoted through the International Society of Radiographers and Radiological Technologists (ISRRT) Conference, 2021. This was amended from face-to-face to online interviews, with the option of returning to face-to-face should the COVID-19 pandemic regulations allow at a later point. As with

recruitment for the questionnaire, a further change in recruitment strategy for the interviews was necessitated whereby participants were actively recruited through the researcher's professional social media sites LinkedIn and Twitter and word of mouth. This change in strategy from that initially stated within the ethical approval granted, required the obtaining of a minor amendment (Appendix K) to the original application before commencing this new approach.

5.2.3 Data Collection

The original timeframe anticipated for this interview phase of data collection was six months. However, due to Covid-19 and the extreme impacts of this on practicing radiographers workload due to the increase in patient numbers and reallocation of radiographer roles (Akudjedu *et al*., 2021) this had to be extended by a further nine months to facilitate the recruitment of a sufficient number of participants.

All participant interviews were audio-visually recorded via MS Teams if online, with later interviews audio-recorded if undertaken face-to-face following the end of COVID-19 restrictions. This latter option of online or face-to-face was offered to all participants with their selection based upon their convenience and location, following the end of social restrictions post-pandemic.

It is acknowledged by the researcher that there could have been potential differences in the quality of the online interviews from those of the face-to face. Factors included possible issues with Wi-Fi and connectivity, and conversation via screens impacting the development of a meaningful rapport (Irvine, Drew & Sainsbury, 2013) and the reading of body language (Hanna & Mwale, 2017). This had the potential to impair the sharing of details particularly the psychological context as observed by Hammersley *et al*., (2019). However, Hammersley *et al's* research focused on the efficacy of different media for GP consultation rather than from a research perspective, thereby preventing a direct comparison to be made. Wakelin, McAra-Couper & Fleming (2024: p.1) would dispute Hammersley et al (2019) findings stating that online interviews should be considered a "valuable option", based on the premise that participants would be more likely to share rather than in a face-to-face scenario due to the space and distance between themselves and the

interviewer as established by Jenner & Myers, (2018). Whilst cognisant of the potential impacts of these highlighted possible disadvantages of an online data collection strategy, and conversely the potential advantages, it was felt that the "relational focus" of the interviews as discussed in Section 3.5 (p.54) compensated for any potential artificial barriers created by interviewing online via screens. This approach enabled the researcher to embrace this online method of interviewing participants as a valid aspect of data collection, including the psychological context as advocated by Wakelin, McAra-Couper & Fleming (2024) and Keen, Lomeli-Rodriguez & Joffe (2022).

All recordings (MS Teams or face-to-face) were allocated a unique participant number and transcribed verbatim by a transcription service, after which the audio-visual recordings were securely destroyed thereby maintaining participant confidentiality.

5.2.4 Data Analysis

Inductive thematic analysis was undertaken using the systematic process outlined by Naeem *et al*., (2023). Within this phase of the research, this analysis was taken through to the fourth step as demonstrated in Figure 5.1. The final two steps outlined in this process were used in conjunction with the findings of phases one and two to enable the conceptualisation and development of an overarching conceptual model as can be seen in Chapter 6. This approach was considered a valuable research output, essential to garnering an understanding of the findings of this research thesis. This also facilitated the demonstration of rigour and transparency throughout the research minimising any potential scepticism of the qualitative analysis undertaken (Grodal, Anteby & Holm, 2021).

Integral to the adoption of this systematic approach was the ability to ultimately generate a conceptual model encapsulating the findings from all three research phases which is grounded in the research findings, thereby enabling the addressing of the research questions posed. The application of this model reflected the researcher's application of the first four of the six steps (Figure 5.1) for this research phase, through which the key concepts and variables came together, thereby

providing a 'lens' through which the identified issues could be seen (Imenda, 2014). The analysis was conducted by the researcher in the first instance and subsequently reviewed by the research supervisors as a means of minimising the potential of insider bias and loss of objectivity from the primary researcher (Saidin & Yaacob, 2016).

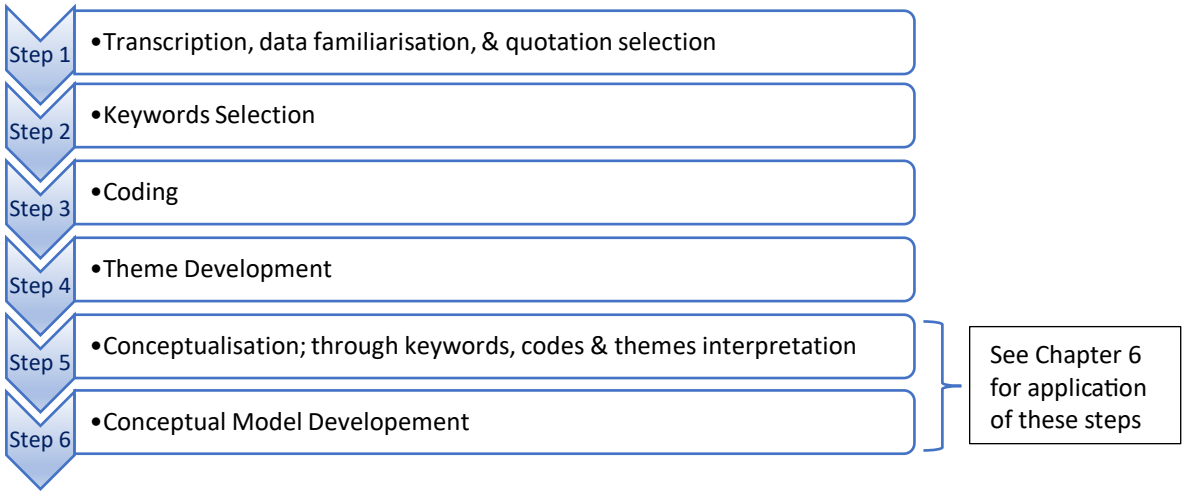

Figure 5.1: Inductive thematic analysis: First four steps to the generation of the conceptual model (Naeem et al., 2023).

5.3 Results

5.3.1 Participants and Demographics

Twelve participants were recruited for this phase of the research, comprising two males and ten females. This could be considered reflective of the wider diagnostic radiography demographics of 1:6 male-to-female ratio (HCPC, 2019). The participants' professional roles at the time of interview conduction are identified in Table 5.1.

This demonstrates an extensive range of experiences and forensic radiography remits, including senior, educational and research roles. Of the twelve participants, three were based outside of the UK, these being from South Africa, Malta, and Ireland. The latter participant's clinical forensic practice was however based within the UK.

Professional Characteristics	n =
Diagnostic radiographer undertaking paediatric forensic imaging for SPA (living and deceased)*	6
Radiographer specialised in Post-mortem Micro-CT*	1
Radiographer specialised in Post-mortem imaging of adults	2
Reporting radiographer undertaking forensic imaging (adults and paediatrics) *	2
University lecturer in medical imaging	1
Additional Professional Roles*	
University (Education)	2
Legal officer	1
Research	1

*Denotes additional duties held by some participants in addition to their primary clinical roles

Table 5.1: Professional characteristics of participants

5.3.2 Interview Format

The time allocated for each interview was unconstrained to enable the participants to discuss and expand upon the questions posed in as much depth as they felt comfortable whilst maintaining a focus on the research question (Ruslin *et al.,* 2022). The interviews lasted from 30 minutes to 1.25 hours with a mean time of 44 minutes. All recordings were transcribed verbatim, and upon proof-checking by the researcher and the opportunity for member checking by the participants if they wished, the recordings were confidentially destroyed. Although member checking was offered to all participants, none chose to do this.

5.4 Thematic Analysis Findings

The resultant semi-structured interview verbatim transcripts (141 pages) were analysed following the first three steps in the process as can be seen in Appendix D. This was facilitated through the researchers' full immersion into the transcripts where, using the approach of Naeem *et al*., (2023) key statements and keywords, were extracted from which the subsequent codes would be generated. By organising these codes into meaningful groups or themes, the identification of relationships and patterns within them was made possible. This enabled the "embodying of pattered meanings" (Naeem *et al.*, 2023: p.4) establishing the relationship between the research questions and the collated data.

Quotes taken from the participant transcripts have been utilised to bring the thematic content to life (White *et al*., 2014) thereby enhancing the interpretation of the thematic findings. The finalised thematic map in Figure 5.2 demonstrates the inductive thematic analysis process in developing the codes and themes.

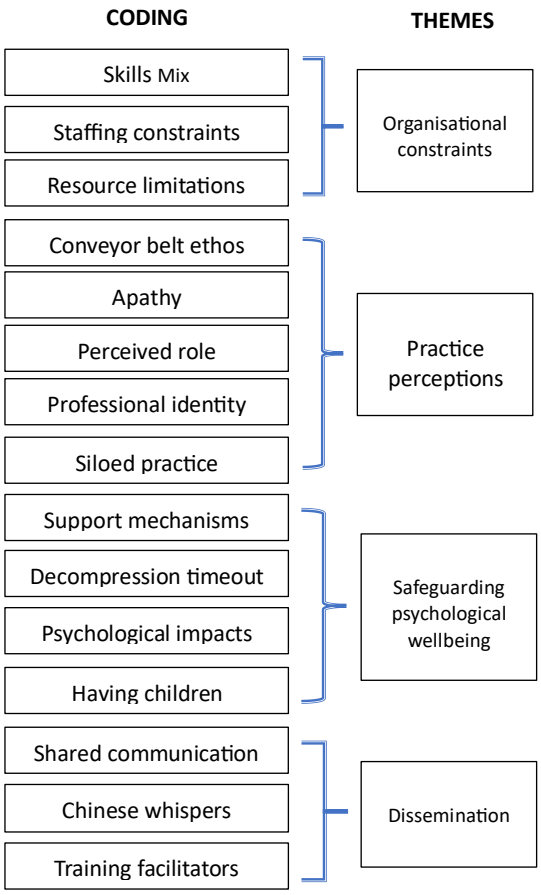

Figure 5.2: Inductive thematic analysis process to the development of Codes – Themes (Template: Naeem et al., 2023)

The thematic map in Figure 5.3 illustrates the relationship between the four themes that were developed: organisational constraints, practice perceptions, safeguarding psychological well-being, and dissemination.

The links between these are such that no one factor can be addressed as a single stand-alone entity. Recognition of this is important when considering the development of the final conceptual model. This will be explored further in Section 5.5. Discussion and Chapter 6 Discussion.

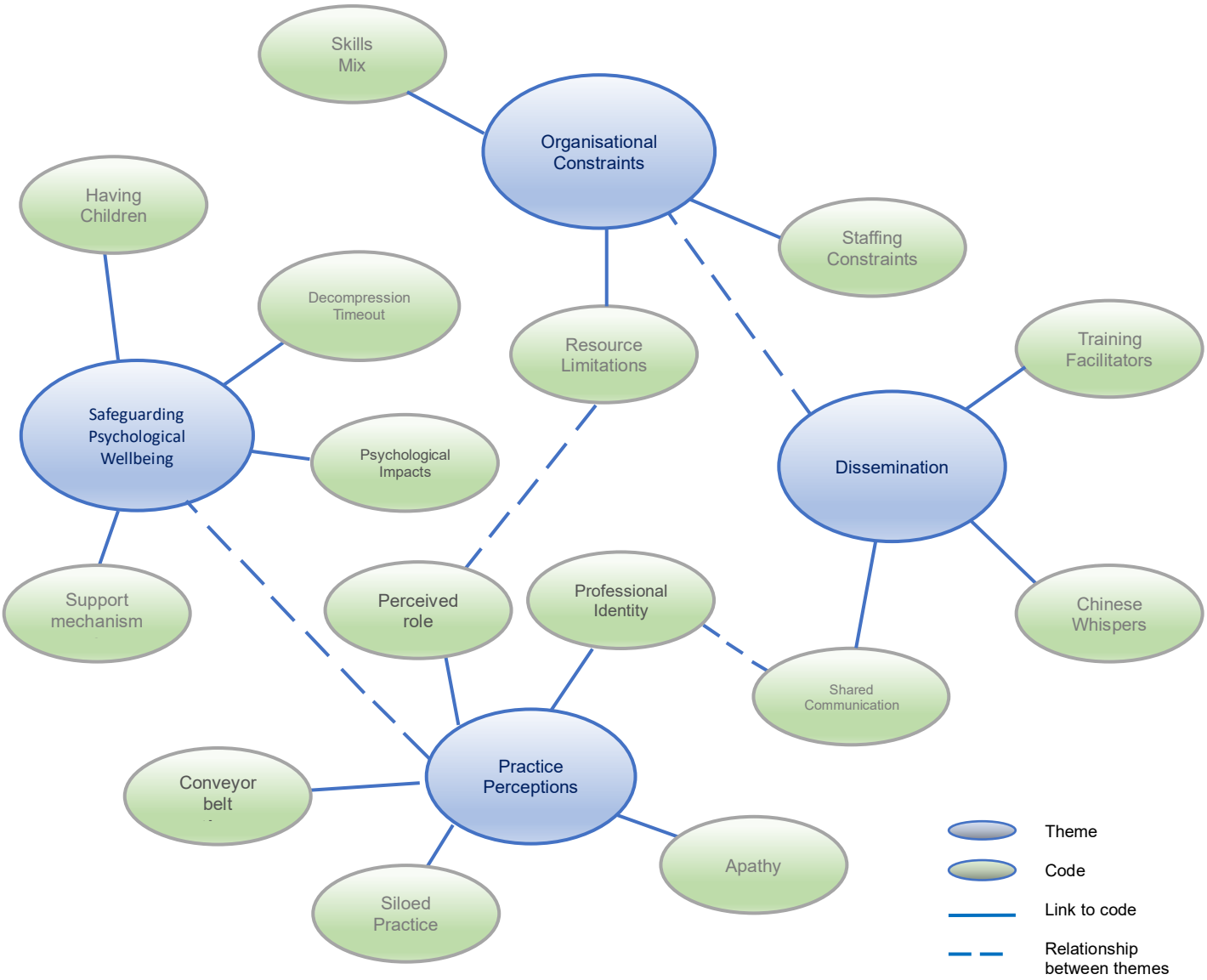

Figure 5.3 Finalised thematic map demonstrating the relationship between the four themes.

5.4.1 Theme 1 - Organisational Constraints

There were many issues identified by all participants encompassed within this theme. These were encapsulated within three codes comprising: *skills mix, staffing constraints*, and *resource limitations*.

5.4.1.1 Skills mix

The skills mix within departments was identified as a key prohibitor to best practice implementation. The crux of the issue lies in two domains: lack of radiologists' support, and lack of diagnostic radiographers with sufficient experience. The lack of radiologist support was particularly evident within the imaging of paediatrics for suspected physical abuse (SPA), and the reporting of adult and child post-mortem (PM) forensic cases. As stipulated in the recently updated SOR/IAFR (2024) and RCR revised (2018) guidelines those practitioners (radiologists), of which there should be two, reporting on forensic and or post-mortem images must have undergone specialist training and be competent within this remit.

> *"… we have a terrible time finding a radiologist to supervise them [SPA cases] because of the specialist paediatric element. We don't have any." (P12)*

The lack of qualified diagnostic radiographers with appropriate training and skills appeared to stem from two main causes. The first is the impact of the loss of experienced radiographers on the 'shop floor', due to retirement and rapid progression into other specialities such as CT, MRI, Mammography, and Ultrasound.

> *"… not having somebody too inexperienced, … we're running out of those experienced radiographers; they're retiring or they're going into other specialities." (P6)*

These points highlight the challenges faced in meeting the RCR (2018:15) revised guidance for the imaging SPA which stipulates that two radiographers, one of which must have documented evidence of post-graduate level education and training in the imaging of SPA and forensic radiography techniques, should perform the forensic examination.

5.4.1.2 Staffing constraints

The staffing constraints are a factor that further compounds the skill mix issue and is identified as a significant barrier to the full implementation of the best practices. This

was evident in the struggles departments had in fulfilling the need for two appropriately trained radiographers as highlighted by several participants.

> *"… there is [sic] priorities, and I don't think forensic radiography is necessarily a priority at the moment, … there is a shortage of diagnostic radiographers." (P2)*

This issue was seen to be further exacerbated by the staffing levels preventing engagement in the training required as stated within the IAFR (Doyle *et al.*, 2020), SOR (2024) and RCR (2018) guidelines.

> *"It's not just staffing levels in the forensics team it's staffing levels in the department to allow people to get trained." (P4)*

From the perspectives of the participants, this was not solely an issue within the radiography department but was reflected within the paediatric team, particularly the paediatricians.

> *"There are going to be different paediatricians each time, and sometimes those paediatricians have changed, so if you get a good slick machine, it's changed again." (P12)*

These comments highlight the link between this and the theme below and was considered particularly relevant within the backdrop of compliance with the RCR, 2018) guidelines and will be reflected further by the results presented around communication challenges.

5.4.1.3 Resource limitations

Resource limitations were seen as a further compounding factor whereby the ability to be able to effectively implement the guidelines was impeded by information technology (IT). An essential aspect of medico-legal practice is the collection, maintenance, and storage of the evidence obtained. In the context of forensic radiography, all images obtained from a forensic case must be stored on a secure database such as the Picture Archiving and Communication System (PACS). This is

a system that is used across the UK and in many other nations for the purpose of forming a centralised 'repository' for the acquisition and sharing of radiographic images and associated reports (Faggioni *et al*., 2011). This system also facilitates more effective communication between the radiologist and referring clinician, thereby enhancing the efficiency of all departments involved (Alhajeri, Aldosari & Aldosari, (2017). This ease of sharing can be problematic however if not managed effectively with certain settings. For forensic, and all other medico-legal cases an essential requirement of this system is the need for all images obtained to be partitioned off within PACS, thus ensuring that these cannot be accessed by anyone other than those directly involved in that case (Doyle *et al*., 2020). It would appear, though, that in practice, as reported by many participants, their PACS system is unable to meet these levels of mandated medico-legal security.

> *"The only issue is our backing up of master and working copies [of forensic images obtained], that doesn't happen … our current PACS system doesn't allow us." (P11)*

A further limitation highlighted was the physical constraints due to imaging room availability and the impact of this on a busy working department. Many participants spoke of rooms being out of use due to equipment issues, adding resource pressures to already pressurised environments. This was further compounded by the requirement to undertake forensic cases such as an SPA examination that could take a room out of commission for general radiography for 1-2 hours at a time, as illustrated below.

> *"… we have got a lack of rooms. We do take out an entire room for a couple of hours sometimes, and if you get a toddler, it could be longer." (P12)*

In some instances, such limitations reportedly resulted in radiographers undertaking forensic cases, outside of normal working hours. Unless required to do so in an emergency, such as a suspected homicide, sudden unexplained death in infancy, or religious and legal instances, where out-of-hours practice is necessitated, forensic imaging should be carried out during routine working hours. Where such an out-of-hours service is required, local written protocols must be in situ (SoR, 2024; Doyle *et*

al., 2020). A point worthy of note is the stipulation from the SoR (2024: p. 30) that instances such as those identified above, requiring imaging as soon as possible, should not "impact on clinical work". As indicated by some participants, there was no option but to do these out of hours.

> *"…it's working around a working department, so we can only do the out-of-hours." (P12)*

Being able to access specific imaging technologies such as MRI was identified by participants as a prohibitive factor.

> *"There's big pressure on all these [MRI] scanners." (P10)*

Whilst not routinely used in all cases of forensic imaging, it does have a role in the imaging of neonates and children under 6 months old for neurological pathologies and trauma. This modality, however, has significant waiting lists for routine examinations with a median waiting time of 3.1 months in England (NHS England, 2023). Those forensic cases requiring MRI have a limited time frame (typically 2-5 days) in which imaging must be undertaken and are thus seen as adding pressure to an already overburdened resource.

5.4.2 Theme 2 - Practice Perceptions

This theme has features that resonated with all twelve participants with five codes generated from their transcripts. These are *conveyor belt ethos*, *apathy, perceived role, professional identity*, and *siloed practice*.

5.4.2.1 Conveyor Belt Ethos

This was demonstrated in two ways by participants, with one directly referring to a conveyor belt culture.

> *"We have a very short interaction time with patients … it's almost like a conveyor belt."* (P1)

This ethos was also reflected in the reference to ‘reductionist practice’, in which patients are referred to by the region of anatomy to be imaged rather than by their name. Thus, patients become objects on the conveyor belt rather than people or individuals with specific needs.

> *“One of the issues is the time for conducting an examination, … we reduce it to the reductionist, ‘this is just an arm.” (P1)*

Other participants referred to this same sense of practice through reference to the length of time spent on forensic cases and the impacts of this on other staff and departmental pressures.

> *“…the whole time we’re taking up this room doing these skeletal surveys or something, we’ve got a queue of patients outside in the corridor waiting.” (P11)*

5.4.2.2 Apathy

A sense of apathy towards change and the adoption of best practices through the implementation of recent or new guidelines was evidenced by several of the participants. For some, this was seen as apathy from colleagues.

> *“It’s difficult to get staff that have been here a long time to change their ways of thinking because they haven’t necessarily undertaken a formal qualification, they’ve just been doing it …” (P1)*

For others, this apathy was deemed to be coming from their management. This was reflected in the reported lack of care and awareness of the issues faced by participants from their departmental managers. There was a generally held belief that issues were only addressed when they became problematic to the department, rather than because it was a best practice recommendation.

> *“… there's a lot of inertia, as I've been saying, resistance to change unless something bad happens. It's a bad mentality.” (P9)*

5.4.2.3 Perceived Role

This theme demonstrates participants' perceptions of how the role of radiographers is perceived by themselves and others, and what this means in terms of the pressure put on them. This was demonstrated in two ways, the first of these being, how they felt they should respond when asked to undertake a forensic case. This should be read in the context of the guidance in which it is emphasised that no radiographer should feel coerced or forced to undertake forensic imaging (SoR, 2024; Doyle *et al.*, 2020; RCR, 2018).

> *"You don't want to stand out and say, "Actually, I couldn't deal with that for whatever reason." (P7)*

> *"It's really challenging to stand up if you're a junior member of staff and say actually "I just don't wanna be involved in this" and there is a certain amount of pressure that we just have to do what's in front of us." (P10)*

A reticence to express their feelings about taking on certain cases was evident in the perceived expectation that they could handle emotional and or traumatic cases.

> *"Radiographers are definitely stiff-upper-lip kind of people, we get on with it and that's it, there's not a lot of emotion from radiographers. … Yes, you're part of that profession and that's what's expected." (P8)*

These challenges are manifested in the expectations in most NHS radiography practices in the UK, where on finishing a forensic case, radiographers are unable to take time out to decompress or debrief. Rather, they are expected to immediately recommence their general radiography work to aid in alleviating the workflow pressures in the department. This is explored in further depth in Sections 5.4.3, 5.5 and Chapter 6.

5.4.2.4 Professional identity

This was a code that some participants felt strongly about, expressing their concerns regarding this as a barrier to the successful implementation of best practices. This

was particularly felt in terms of the reported lack of professionally recognised role forensic radiographers have in the wider multidisciplinary teams, despite it being a specialist area of practice for which additional post-graduate training is required (Doyle *et al*., 2020).

> *"We talk about multidisciplinary teams and sometimes we are in them and sometimes we are not, …. I think it's a bit strange but like forensics there's key stakeholders in there and the radiographer is one of those." (P1)*

For others, this was seen as an issue impacting the credibility of the role of the forensic radiographer, and ultimately their professional and career satisfaction. An issue not only seen in forensic imaging but in the radiography profession, where there is a perceived need to fight for professional recognition in the healthcare setting (Chevalier *et al*., 2022), Currently, forensic radiography is seen as a role extension in the same way that paediatric radiographers are viewed, rather than an advanced role such as a reporting radiographer which is reflected in the radiographer's pay banding.

> *"There's no real definition [of forensic radiography] so people with an interest can suddenly take on this mantle" (P1)*

5.4.2.5 Siloed practice

Whilst discussed in this research as a separate sub-theme this could be seen as stemming from the radiographers' perceived roles and professional identity. Participants reflected on their frustration of not being informed of any outcomes of the forensic imaging they did. This was particularly evident in the suspected physical abuse (SPA) cases.

> *"[We] work in a little bit of a silo … want to get to know the outcome." (P1)*

> *"We always wonder what happens to the babies afterwards because even though you're only with them for like an hour or half an hour, you do sort of*

form a little bit of an attachment to them and especially the more harrowing cases." (P6)

This sense of not knowing the outcome of these cases, in terms of whether the case was established as physical abuse and taken to court or whether the pathologies identified were a result of a differential diagnosis, was seen by one participant to harm staff's perceptions of their role in these cases.

"… we don't know what happens after that [the SPA imaging] we don't know what's happened to that child, so … staff don't want to do the examination, some of them, because they think it's just negative." (P1)

5.4.3 Theme 3 - Safeguarding Psychological Wellbeing

Essential to working in any healthcare setting, particularly those working on the frontline such as diagnostic and forensic radiographers, is the need to safeguard their psychological wellbeing (SoR, 2024; Doyle *et al*., 2020; RCR 2018). Diagnostic radiographers in their day-to-day roles can be exposed to many distressing situations, placing radiographers at high risk of psychological distress (MacGregor, Boyes & Swainston, 2024; Eaton *et al*., 2023; Hulls *et al*., 2018). These can include working with patients of all ages with extreme physical injuries, distress, fear, anxiety, and those facing imminent death. For these radiographers also undertaking forensic imaging, this exposure becomes compounded by the requirement to image children and vulnerable adults who may have been physically harmed and or are deceased, where the cause of death must be established, or where a victim(s) must be identified Glaysher, Vallis & Reeves, (2016). This theme demonstrated strong resonance among participants and comprises of four sub-themes: s*upport mechanisms, decompression timeout, psychological impacts*, and *having children*.

5.4.3.1 Support mechanisms

This code was premised on participants' awareness of the support that is available to them when they feel it is needed. This could be in terms of a physical place to go, the efficacy attached to these or the support from managers and colleagues.

"There certainly wasn't, no, I would absolutely say definitely there was not [mental health support]." (P7)

Some participants questioned the role of the support mechanisms currently available as something that would apply to their role as forensic radiographers. The perception was held that such support was for extreme scenarios and more generic issues that the therapist or counsellor would understand.

"…I can't imagine going to occupational health and talking to a random person who doesn't really understand what we've done would be extremely helpful …" (P11)

This latter comment is reflected in other healthcare practitioners who express reluctance in seeking help even after they have experienced traumatic events resulting in psychological symptoms of emotional distress (Hu *et al*., 2012).

The role of managers in supporting radiographers undertaking forensic cases was generally positive.

"There's a counselling service there and the manager is very understanding." (P4)

However, it was acknowledged by one participant that managers must ensure that there are no stigmas attached to a radiographer raising concerns regarding their ability to cope, or their mental health generally.

"… local line managers to [need to] make sure that there isn't that stigma attached with "ohh they're not coping, they shouldn't do this." (P10)

The potential impact of a lack of appropriate support was exemplified by one participant.

"[Colleagues] who had to do this SPA imaging and were quite traumatised by it, they don't want to have anything to do with it. Had they had that support at that point … I think it would've been a very different story." (P7)

As stated by one participant, there is a need for support to be an ever-present feature rather than one that is only available when there is a problem.

> *" .. the encouragement and support has to be ongoing and has to be out there, if you like, rather than… once you've got a problem, you can just be posted to a website." (P8)*

5.4.3.2 Decompression Timeout

This code resonated with several participants as a means whereby they felt they would be better able to process the experiences of working with forensic cases. Typically, as identified in section 5.4.2.3, Perceived Role, participants spoke of the departmental need for them to pick up their normal radiography role immediately on completing a forensic case. The need to be able to take time out (decompress), to be able to process their experience of the forensic case and talk to others involved was seen as desirable if not essential, but also reportedly lacking in most locations.

> *"… do need to go and sit down for a bit and just process what they've seen… Like you need that time to decompress of what's happened." (P12)*

A prohibitor to acting on this need for time out was identified by two participants, a factor linking back to resource limitations and the conveyor belt ethos of the need for speed.

> *"You know that no-one is rushing us but, in your head, you know you've got that corridor full … [would] be nice just to sit for twenty minutes afterwards and just process maybe." (P12)*

> *"… you never have time to do any of these [go to welfare room] things anyway." (P11)*

5.4.3.3 Psychological Impacts

The impacts of radiographers' perceptions of their role, whereby they just need to get on with their job, were found to have psychological impacts on some participants, including impaired sleep, sleep deprivation, increased anxiety and stress, burnout, compassion fatigue (Robertson *et al*., 2022) and ultimately post-traumatic stress disorder (Glaysher, Vallis & Reeves, 2016) if the earlier precursor symptoms are not addressed. Symptoms such as impaired sleep and distress appeared exemplified by some participants.

> *"[A colleague had an] awful time, couldn't sleep properly … had a terrible experience, … he was kind of thrown into it a bit." (P12)*

> *"[Colleague] can get really affected by some of the stuff we do and before she has gone home and cried about some of our skeletal surveys that we've had." (P11)*

Some participants identified their methods of coping with the psychological impacts of their forensic work.

> *… I had to go behind the screen and just take a moment to compose myself, … don't know of any support mechanisms." (P6)*

5.4.3.4 Having Children

This resonated with many participants (male and female) in terms of how having their children had impacted their engagement with certain forensic imaging activities, particularly the imaging of children for suspected physical abuse generally, and deceased children specifically. This latter area of practice was seen by radiographers who were also parents to be the most emotionally challenging aspect of forensic radiography practice, due to the difficulty in separating the child that is being imaged from their own children (Camilleri, Swainston & MacGregor, 2023).

"…since I've had kids, I don't know if I'd be as interested in deceased postmortem imaging [of paediatrics]." (P2)

"Because I didn't have any children and I was working with a lot of people that did have children I was the one that was normally … you know sort of volunteered." (P1)

For some participants, the fact that they did not have children enabled them to 'detach' from the emotions related to the forensic imaging of children, particularly the post-mortem work.

"… I was upset, but I didn't have any kids or anything, so I wasn't able to relate it to myself …" (P12)

However, one participant felt that having their children made them want to undertake this paediatric forensic role.

"I'm a mum. So, I just want the best for the kids." (P6)

5.4.4 Theme 4 - Dissemination

For many participants communication and the efficacy of this was seen to be a significant factor in the implementation of best practices including guidelines and protocols. This theme comprised three codes: shared communication, Chinese whispers, and training facilitators.

5.4.4.1 Shared Communication

The dissemination of guidelines and protocols together with the rationale for the guidance stipulated within these appeared to be an area of difficulty for some participants.

"With the implementation of the new guidelines … that was obviously a big change for us from radiology side, … so getting the paediatric teams to

understand those changes and why we're asking for certain things was quite difficult…" (P5)

"I think it's an issue with the doctor's not knowing really what's involved from our end… (P12)

This was not, however, an experience shared by all participants, with some sharing their positive experiences of shared communication with other departments, achieved through close collaboration.

"I've been working quite closely with the Paeds to get this implemented correctly within the trust." (P5)

Challenges were identified in the facilitating of the sharing of communication effectively. This was evidenced by the lack of knowledge regarding the processes required from those other departments involved in the forensic imaging process, particularly the paediatric team. In some instances, they did not appear aware of or understand the forensic imaging protocols for SPA. This was evidenced by some paediatric departments challenging the imaging required under the RCR (2018) guidelines, as demonstrated by the following participant.

"[Paediatricians are] still, very cautious about sending them for CTs for the younger ones because they think it's unnecessary but that's obviously their opinion." (P5)

"…lack of understanding of the reasons behind doing the extra images for the follow-ups is a big part of it." (P5)

The imaging protocols were not the only communication challenge identified by participants. The obtaining of consent for the imaging for SPA, and whose role it is to gain this was an area of difficulty. The RCR (2018) guidelines state that written consent for a skeletal survey for SPA must be obtained from the legal guardians by the senior paediatrician (consultant). This must then be verbally verified by the lead radiographer undertaking the scan on the child's arrival at the department.

"we still have problems with the pathway of not being followed properly." (P6)

One of the key issues with this is that the referrer (paediatrician) may not have full knowledge of the radiography component of the investigation.

"… a lot of the times I've got issues with doctors not getting full consent … the parents don't understand that they're going to have 20-odd x-rays. They don't know what the actual procedure is." (P12)

5.4.4.2 Chinese whispers

Many participants felt that a key challenge in effectively implementing best practices within forensic radiography was the efficacy of the dissemination strategies for informing radiographers of any changes in guidelines and protocols. As stated by one participant, this process seemed to be akin to Chinese whispers.

"[They] take a lead radiographer trained … and then they train others, disseminating the information down, hopefully correctly to the staff that work under them. … It also gives them their own interpretation of it I guess … and that system, that Chinese whispers gets different every time." (P2)

The risks associated with this approach to information dissemination were reflected by another participant.

"It's all very well bringing up the guidelines, … people looking at the guidelines, but people can interpret them in different ways." (P1)

This presents an additional challenge to the effective implementation of guidelines, due to the training methods adopted by some Trusts and private practices, where in-house training or experience is relied on alone.

"I've had in-house training, but I haven't had formal training." (P12)

"So we have the knowledge, no formal training as such other than working there for a number of years. So, we were the people in charge of paediatrics." (P12)

Although the current SOR (2024) and IAFR (Doyle *et al*., 2020) guidelines acknowledge that not all radiographers involved in forensic radiography will have undertaken post-graduate training, it is a requirement that those radiographers leading each case must have this level of training. It is also stipulated that they must evidence maintenance of their knowledge in this area through continued professional development. The reliance on such experiential learning without a theoretical underpinning contravenes all guidelines. Such practice risks the undertaking of outdated and potentially damaging practices such as the taking of babygrams as discussed in Chapter 1, whilst also prohibiting the acquisition of new evidence-based practices and guideline implementation.

"It's difficult to get staff that have been here a long time to change their ways of thinking because they haven't necessarily undertaken a formal qualification, they've just been doing it …" (P5)

"My colleagues tend to rely on me for update[s]. I don't really know how you would make it more accessible to people who don't even know about it to start with." (P11)

As identified by several participants the way knowledge is imparted by guideline authors would help address some of the concerns raised above.

"… just to know where to look for them [guidelines] because at the moment, if you said to me, go and find out what the national guidelines are for SPA, I wouldn't know where to look. I wouldn't have a clue." (P6)

"if there was something coming centrally from the society saying, "This has been updated." … that would be really useful… otherwise, where do you find out about this? (P7)

5.4.4.3 Training facilitation

A key component to successful dissemination is training, which if it is to be effective the training must be undertaken appropriately. As indicated within the most recent guidance from the SoR (2024, p.36), all radiographers undertaking forensic and post-mortem imaging should have or be undertaking master's level (Level 7) education and training applicable to their area of forensic practice. Although as demonstrated through earlier participant quotes, this is not always happening. For some participants, this primarily came down to funding, and the time available for studying and CPD activities.

> *"… the time factor and the money factor. It's the usual thing, being released to do the courses and then paying at the moment, is just I don't think Trusts are paying for much training at the moment." (P3)*

> *"it would be nice to get some study time, I suppose. It's not something that we particularly are well known for." (P5)*

The availability of funding was not prohibitive to all participants and some advised that this was available to them.

> *"Funding was available, … that helped (P8)*

There were however examples noted where funding support was available although the time for study was not provided, although all Trusts are expected to support CPD activities.

> *"work paid for it … but they wouldn't give me the time for it."*

For some participants, it was the support from their managers that influenced the levels of forensic radiography training undertaken within their departments. For some, this was a positive experience.

> “My direct superior is very willing to help … They're much more well versed in how these procedures work.” (P9)

As identified by other participants, this support was not always forthcoming as demonstrated below.

> [The manager] “I’m not interested…all I need you to do is go and stand in that room and x-ray people.” (P1)

This lack of support from managers did not always appear to be due to a lack of funding but rather a lack of knowledge and awareness of the need for this training provision.

> “At management level, they don’t understand that, until something goes wrong.” (P2)

> “They don't pay for the full MSc because it doesn't … give them anything that the trust can use.” (P12)

As one participant indicated, this lack of training support is impacting their radiography team, department, and organisation.

> “… the opportunity to do a postgraduate course … is the thing that I feel is holding us back as an organisation. I think it holds my team back.” (P8)

Despite the many challenges identified in accessing and undertaking appropriate post-graduate training, some participants demonstrated their motivation to overcome these barriers.

> *“…If I don't keep up with it [best practice], I'll fall off.” (P9)*

> *“I'll probably self-fund, … it's preservation a little bit for myself.” (P12)*

Many participants spoke of the need for ongoing training, studying, and CPD activities, particularly the practical aspects of the role, as a means of ensuring the currency of their best practices and the accuracy of dissemination.

> *"CPD and training, … its' more of a practical component. It's the practical component that is needed." (P2)*

> *"Well, having CPD relating to forensics would be a very, very useful." (P9)*

5.5 Discussion

This qualitative semi-structured interview component of the research aimed to gain an in-depth understanding of the factors that either facilitate or act as barriers to the effective implantation of best practices within forensic radiography. Stemming from the paucity of literature on this subject area (Chapter 2) and the findings of the questionnaire component (Chapter 4), this was the first research that explored the issues surrounding effective best practice implementation from the forensic radiographer's perspective. Using semi-structured interviews, a range of factors were identified that could be seen as both facilitators and barriers thereby providing invaluable insights into the complexity of the issues at hand.

Typically, when exploring issues within the healthcare sector from any perspective, organisational issues such as staffing, and lack of funding are at the forefront as exemplified in the recently published KingsFund and Nuffield Trust public satisfaction survey (2024). However, whilst these have been factored in, this research sought to get beneath the headlines to better understand what these mean from the practitioners' viewpoints.

The radiography workforce is a critical element in the effective running of any healthcare provision, however, as with many other professions, there is a chronic nationwide shortage of radiographers with an average vacancy rate of 11%. This issue is further compounded by the growing demand for imaging services (NHS England, 2020), rising at rates higher than those for NHS services generally (NHS England, 2022). Although identified as an issue within the research, it was the impact

of this on the skills mix and constraints this necessitated within departments, that was of greater concern.

Such challenges within the skills mix and experience levels within the radiographer workforce, together with the impacts these have on enabling effective implementation of best practices are further compounded by the shortfall in the radiologist and consultant radiologist workforce. This latter aspect currently sits at a vacancy rate of 10% (RCR, 2021). It is an issue that featured strongly with the participants due to the stipulated requirement that those radiologists involved with paediatric forensic imaging and the post-mortem imaging of adults and children must have the required specialist training and experience (SOR, 2024; IAFR, (Doyle *et al.*, 2020); RCR, 2018). As identified in the results, several participants stated that it was not feasible to implement this, resulting in modifications to the guidelines implemented at a local level. This has led to high levels of outsourcing of forensic imaging reporting work to other institutions, with associated workload implications for the receiving centres.

The increased demands placed on the radiography workforce have also impacted the physical resources available, particularly imaging rooms. Perhaps due to this and the pressure placed on radiology departments to reduce the number of patients waiting for more than 6 weeks for their imaging tests (NHS, England, 2024), radiography has developed a conveyor belt ethos where speed and time are of the essence. This has resulted in a reductionist practice where patients are often referred to by the region of anatomy to be imaged rather than as a person. Such practices could be at the expense of patient care and would certainly appear to the detriment of some radiographers' psychological well-being. This was evidenced by participants highlighting the pressure felt due to the time taken to undertake a forensic examination, the time this takes the imaging room out of use for diagnostic imaging, the impacts this has on their colleagues and the pressure they felt to return to their normal duties as soon as possible. This latter requirement appeared to be an expectation, irrespective of the challenging and emotional nature of the work carried out.

As highlighted in all the key guidelines applicable to diagnostic radiographers generally (HCPC, 2023) and those undertaking forensic radiography specifically, radiographers have a duty of care to safeguard their psychological well-being (SOR, 2024; Doyle *et al*., 2020; RCR, 2018). Whilst an admirable and essential aim, the strategies through which this can be fulfilled have not been identified, thereby impacting the viability of this guidance. This was an issue that was strongly demonstrated by participants in this research, through the coping mechanisms demonstrated, the lack of sources of support that they felt appropriate to their needs and in some cases the lack of awareness of support resources that could be accessed.

A fundamental factor that underpinned radiographers' psychological well-being, was the perception that as radiographers they should *just keep going*, *it's the job*, and *they just get on with it*. This perception of their role and expectations was not unique to this study but also identified in other research undertaken in the UK and other nations (Jacquet *et al.*, 2024; Camilleri, Swainston & MacGregor, 2023; Hulls *et al*., 2018). Key within these papers and this research is the description of ineffectual strategies for managing emotionally stressful situations which stemmed from poor guideline implementation, being reflected in poor mental well-being and lack of training to aid them in safeguarding against this.

An essential factor in enhancing mental well-being is the need for recognition of the role that radiographers have in patient care and the workplace together with the need for recognition of their professional role (Chevalier *et al*., 2022). The lack of an established professional identity as demonstrated by their lack of inclusion in MDT settings, together with the sense of working in professional silos and lack of recognition as having a patient-facing role was evidenced within this research. Where this is lacking, job satisfaction will decline whilst emotional exhaustion, leading ultimately to compassion fatigue will only rise (Bakker & Demerouti, 2024). These issues were further compounded by the stated inability of radiographers to be able to take the desired and needed timeout after working on forensic cases, where the need to decompress was identified. The reasons given for this link back to the ever-present pressure of patients waiting for their examinations, and the lack of staff available to cover the department whilst the forensic case was undertaken, whereby

in some instances this necessitated carrying out forensic cases, contravening recommended best practices (RCR, 2018). Such pressures and practices only serve to further exacerbate the work-related stresses radiographers are practising under.

Training to aid staff in managing the impacts of working in such emotionally challenging pressure situations has been identified by Bakker and Demerouti, (2024) as essential if the mental well-being of the radiography workforce is to be safeguarded. A lack of this training has been seen to impact radiographers' mental well-being and significantly impacted their ability to undertake the training that is mandated within the relevant forensic radiography guidelines (SOR, 2024; Doyle *et al*., 2020; RCR, 2018). As identified in this research, time for training, study, and CPD activities was not provided by their employers, despite this being a mandatory requirement for the maintenance of professional registration with the HCPC (2016) for all Allied Health professionals, including diagnostic radiographers.

Wareing *et al*., (2017) proposed that for employers to be supportive of training, studies, and CPD activities, they should align with the organisation's goals. However, as demonstrated within this research, this was an issue for some participants whereby departmental managers did not recognise the need for additional post-graduate training in forensic radiography and were thus unsupportive. This appeared to stem from a lack of knowledge and understanding of the guidelines and requirements stipulated within these for the safe and effective medico-legal provision of forensic radiography services. Whilst managerial knowledge and awareness, or lack thereof are undoubtedly factors in this issue, the ever-present pressure of workload, staff shortages and increasing patient demand, has left employers struggling to free staff to be able to undertake such activities (Al Balushi, Watts & Akudjedu, 2024), even when funding was available.

The challenges in the provision and undertaking of training and CPD is a two-way process. In addition to management and departmental support, this requires a willingness to engage in such activities from the radiographers themselves. As highlighted in this research, there was apathy noted within participants' colleagues towards the embracing of evidence-based practices, particularly if this required a change from what has always been done. This was found by some to have an

impact on how effectively best practices could be implemented. This finding is not unique to this research, having been commented on in other research (Vils Pedersen, 2023; Ramazan, Aarts & Widdowfield, 2022).

Whilst other researchers observed that radiographers were willing to embrace evidence-based practice and research activities, there was low engagement with this in the practice setting (Vils Pedersen, 2023; Ramazan, Aarts & Widdowfield, 2022). This was due in part to those factors previously identified, such as time and motivation (Watts & Snaith, 2023; Abrantes *et al*., 2020). Although, as identified in this research thesis, the availability of funding and resources also had significant impacts, a finding reflected by Ramazan, Aarts & Widdowfield, (2022). Where this was available, participants readily engaged in the study required to facilitate their appropriate engagement in forensic imaging. For many though, this funding was not available therefore prohibiting their enrolment in appropriate training courses. In apparent contradiction to previous research, this research identified that self-motivation and desire were strong enough in a limited number of radiographers for them to self-fund their studies to maintain currency of practice or to safeguard their perceived need for job security.

Due to a lack of funding, time, and resources, this research found that in many instances, evidence-based best practice knowledge was primarily imparted among colleagues through in-house training. This was premised on one radiographer undertaking the required post-graduate forensic training and then sharing their acquired knowledge formally with colleagues. An option seen as the least bad option and a means of effective dissemination, although this is not considered satisfactory for those radiographers leading a forensic radiography examination (SOR, 2024). However, as also identified in this research thesis, there are inherent risks associated with this approach, particularly the potential variations in interpretation of the information given and the risk of “Chinese whispers” with information passed down from colleague to colleague. Once such knowledge has been misinterpreted resulting in the misinforming of others, it is very difficult if not impossible to rectify. This finding was reflected in the work of Addis, (2002) on clinical psychology practice, who stated that this unidirectional approach to the dissemination of best practices within clinical practice is both self-limiting and open to issues.

A significant issue, reflecting the findings of MacGregor, Breckons and Swainston, (2024), Camilleri, Swainston and MacGregor, (2023) and Addis (2002) and further impacting upon effective mechanisms of dissemination, was the lack of knowledge of where to find current guidelines and how they would hear of when new guidelines have been introduced. This was reflected in several participants stating that they simply did not know where to start looking. This issue of dissemination strategies from guideline authors was exemplified in the recent release of the new SOR (2024) Society of Radiographers Forensic and Post-Mortem Radiography Guidance. This was a joint production by the Society of Radiographers and the International Association of Forensic Radiographers (IAFR), with announcements posted on their respective websites together with an invite to attend a release webinar outlining its key elements. However, this webinar was only available to members of these two organisations, neither of which is required to practice as a diagnostic radiographer or forensic radiographer. Through such an implementation strategy many non-member radiographers may continue to be unaware of the changes, particularly since these are not disseminated via the only mandatory regulatory body for this profession, the HCPC.

In discussing the themes demonstrated in this chapter, it was necessary to consider the communities and cultures in which diagnostic radiographers undertaking forensic radiographers practice work. These maybe within the radiology department itself, and/or as part of wider multi-disciplinary teams. As stated by Strudwick and Day (2014), in their research exploring interprofessional working in diagnostic radiography, an environment where many professions with differing backgrounds are involved in an activity, such as in a forensic case, ‘tribalism’ is likely to develop. To facilitate a greater understanding of such a development, it was essential to consider the culture within radiography and how this may be perpetuated by factors such as a poor sense of role perception and professional identity by themselves and other professions. This was facilitated through the modified application of Douglas’ Grid/Group Theory (1970) as demonstrated in Chapter 6, section 6.3.2 (p. 126).

5.6 Reflection

As indicated within the methods and ethical considerations for undertaking this phase of the research it was essential to consider and minimise potential bias when undertaking this research. This was particularly important in this phase whereby I was seeking to build an effective relationship with the participants. Thus, I needed to reflect on my positionality as an insider who, to quote Green, (2014: p.1) is “on the inside looking in,” on my own organisation and professional culture of which I am a member. This membership was in the form of being a diagnostic radiographer who undertook forensic radiographic examinations and a senior lecturer specialising in paediatric forensic radiography. This could be perceived as a “double-edged sword” (Mercer, 2007) whereby it was essential for me to acknowledge the potential pitfalls including power differentials, assumed understanding from participants and over-disclosure due to our shared background and experiences (Byrne *et al*., 2015) There were however some advantages to this, primary among these was the ability of participants to be open and frank in their discussion due to their ease in being able to build a rapport with me (Aburn, Gott & Hoare, 2021).

5.7 Chapter Summary

This chapter has presented the findings of the qualitative semi-structured interviews undertaken as the third component of this research thesis. This was undertaken to enable an in-depth exploration of the barriers and facilitators to the implementation of best practices in forensic radiography from the radiographers’ perspective. Twelve participants were recruited for this phase, demonstrating an extensive range of roles within forensic radiography practice, including research, education, and specialities in paediatric or post-mortem work with both adults and children. Through the application of thematic analysis, four themes were developed: *organisational constraints, practice perceptions, safeguarding psychological well-being* and *dissemination*. Whilst aspects of these thematic findings were not unique to this study, such as time, staffing, and physical resources, the manifestation of these factors within this context and the insights gained from those radiographers undertaking forensic practice are unique. These encompassed the significant multifactorial factors required for the effective implementation of best practices, and

how when organisational support and understanding are present, such barriers have been overcome. The implications for the forensic radiography profession, its practitioners, and patients have been detailed and discussed when effective organisational has been ineffective together with what the radiographers believe is needed.

Chapter 6 – Discussion

6.1 Chapter Introduction

This thesis has used a multi-methods approach comprising of three components underpinned by the pragmatism paradigm which enabled the recognition of the differences in the participants realities based on their individual contexts. This approach facilitated the researcher in addressing the aim and objectives of the research question posed. These being a scoping review and inductive content analysis; a questionnaire using narrative thematic analysis, and qualitative interviews with inductive thematic analysis. Through these, the factors impacting the implementation of best practices within forensic radiography were explored. For the scoping review, an overview of the current literature within this setting was collected, followed by gathering the views of diagnostic radiographers involved in forensic radiography through two primary research methods.

This chapter synthesises these collective findings, enabling a comprehensive discussion of concepts identified, together with the application of relevant theories. These included the Douglas Grid/Group Theory (Spickard, 1989) through which factors impacting on the interactions within the radiographic community could be evaluated. This was in addition to the Socio-ecological model (SEM) which facilitated an overview of the multifaceted, interrelated spheres of influence impacting radiographer's behaviours at the individual, intrapersonal level. These theories were explored together with the wider pertinent literature. There is a reflection on these findings in the context of the wider research, together with consideration of the strengths and limitations of this research. The final component of this chapter comprises the conclusions drawn from these accumulated findings, how they impact practice through consideration of the relevant aspects of these theories and potentially inform future implementation of best practices within forensic radiography, and wider healthcare services through the provision of key recommendations.

6.2 Summary and Interpretation of Key Findings

To frame the key findings from this thesis, this chapter will use the final two steps of Naeem *et al's*., (2023) inductive thematic analysis conceptual framework (Figure 6.1)

first presented in Chapter 5. These final two steps, demonstrate the overarching themes developed through synthesising those conceptual categories and themes gathered from the three research phases previously outlined, supported by aspects of the Douglas Grid/Group Theory and SEM.

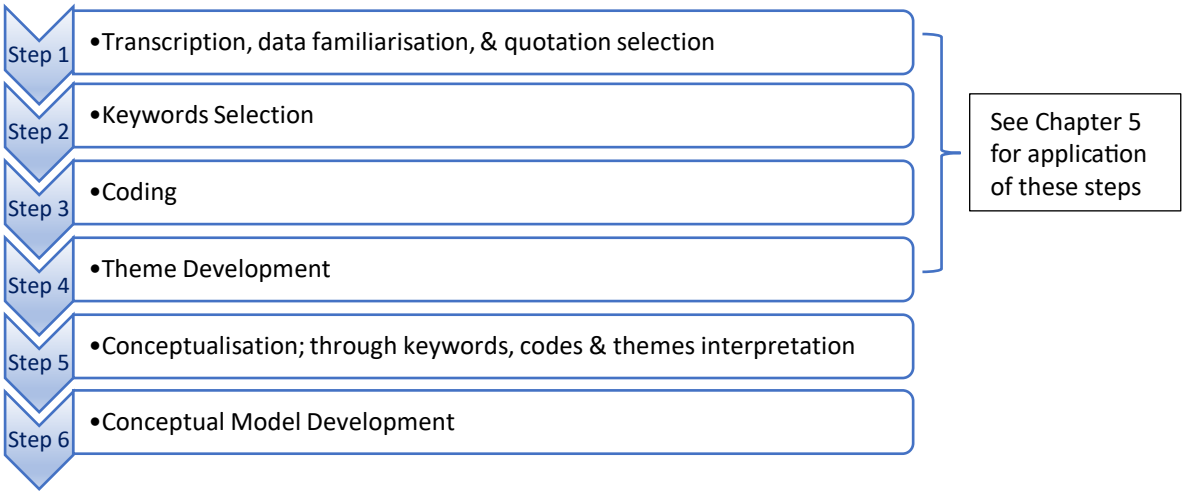

Figure 6.1: Inductive thematic analysis: the six steps used to generate the final conceptual model, (Naeem et al., 2023).

Through utilising Naeem *et al's*., (2023) approach this supported the conceptualisation of two concepts; 'intractable organisation factors', and 'normalising negative conformity', through the interpretation of the three synthesised themes premised on social patterns (Glaser, 2002), or occurrences (Oliver, 2021). Applying this approach enabled the encapsulation of this research thesis findings, culminating in the development of a unique conceptual model of 'The acceptance of adversity', as demonstrated in Figure 6.2 (p.122). Through using this systematically structured approach a clear connection between the data, their interpretation and the final conclusions is evidenced, ensuring thoroughness and minimising the potential for researcher bias. The concluding conceptual model, the two concepts and the three synthesised themes have formed the focal point of the discussion within this chapter.

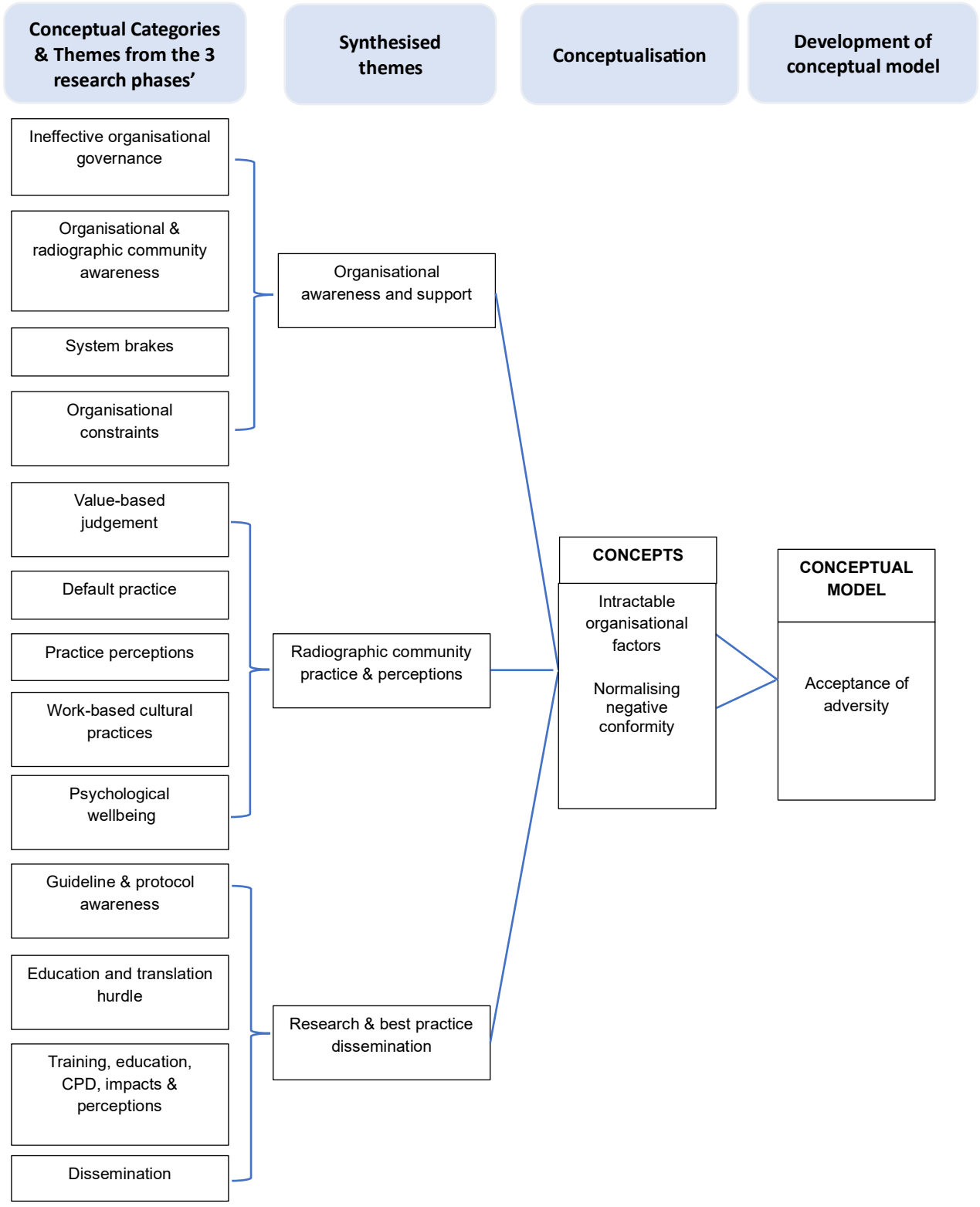

Figure 6.2: Inductive thematic analysis process to the development of conceptual framework: Themes – Conceptual Model

6.3 Synthesised Themes

6.3.1 Theme 1 - Organisational awareness and support

Through this research, awareness and support at departmental and organisational levels were established as fundamental to the efficacy of best practice implementation within forensic radiography. Where this was evidenced, a range of strategies had been employed across all staffing levels, ensuring that a lack of awareness or potential for misinterpretation of the current guidelines was minimised. Such strategies included the reported enablement of appropriate education, training, and continuing professional development (CPD), having named individuals for specific roles and responsibilities, with these clearly signposted, and suitable support mechanisms in situ.

The efficacy of this latter strategy of identifying specific roles and named individuals is one that was borne out by the work of Michie and Johnson (2004), and Michie and Lester (2005) in GP practices and mental health services respectively. They found that one of the most substantial issues in effectively implementing new guidelines was their wording and subsequent lack of clarity. This would result in the key issues of who, what, when, where, and how these were to be implemented were left largely unanswered or unclear. Their work determined that the initial steps for guideline implementation were enhanced and clarified by having identified roles, with person and behaviour specifications written into the protocols, thereby addressing the ‘who, questions that inevitably arise in the first instance.

As highlighted in this research thesis, radiographers undertaking forensic imaging do not work in a silo but rather are part of a wider multi-disciplinary team (MDT). As such, the implementation of specific guidelines such as the SoR (2024) and RCR (2018) whilst aimed primarily at radiographers and radiologists are also relevant to the referrers and practitioners within the MDTs. This therefore necessitates, as identified above, a clear pathway of identified people to facilitate the effective implementation in both radiology and the MDT departments. Without this, communication breaks down and evidence-based recommendations are not followed, as shown in this research. Thus, implementation was stated to be most

effective in this research when disseminated and supported by named experts in their respective fields who shared their knowledge, experience and guidance. These strategies align with the new workforce planning strategy, outlined in the recently published SoR (2024) Radiography Manifesto in which accountability and responsibility are proactively promoted. However, as established within this research, such examples are currently in the minority, due in part to an evident lack of organisational answerability, awareness and support.

Where such organisational awareness and support were lacking, this was manifested in many ways, primarily the lack of standardised practices, and a lack of knowledge of where and how to access guidelines even when available. These factors are further compounded by insufficient training opportunities, primarily due to poor managerial, and departmental understanding of what is required, together with the lack of available time and funding for this and CPD opportunities.

Compounding factors such as those identified above may also have significant legal ramifications regarding both forensic imaging procedures and outcomes. As identified by Viner (2020) in their doctoral thesis examining the development of standards, protocols and standard operating procedures in forensic radiography, there are many instances where radiographers may image patients unaware that they are forensic cases or could become part of one. There may also be an unfamiliarity with what is required where imaging of forensic cases is undertaken infrequently (Camilleri, Swainston & MacGregor, 2023; Primeau, Marttinen & Pedersen, 2022; Smith *et al*, 2022). In such cases, appropriate guidelines and protocols may not have been followed leading to the incorrect collection and storage of images (evidence). Such actions could result in breaches of patient confidentiality, where images can be viewed and discussed by others not involved in the case, potentially resulting in departmental and institutional reputational damage. Additional legal consequences of such actions include the potential contamination of evidence and a break in the chain of evidence collation. This may be through the form of images being altered subsequent to them being obtained, with no documentary evidence of what was done, when and by who. Such breaks in the chain of evidence may lead to its integrity being challenged in court (Viner, 2020). This is further explored in 6.7.3 (p.141).

It was established in Chapters 4 and 5, that many issues lie outside the direct control or influence of individual healthcare organisations and departments, such as the nationwide radiology staff recruitment crises, and lack of physical resources, including rooms, and imaging equipment. Such issues have inevitably impacted the degree of support organisations can provide, primarily the provision and protection of time and funding for ongoing professional development as advocated within the SoR (2024) Radiography Manifesto. Although acknowledged by participants in this research, these were not the most significant factors identified as impairing effectual guideline implementation within forensic radiography practice. Rather it was the organisations and departments' lack of recognition and understanding of the role of forensic radiography that was the uppermost concern, and the impacts of this on facilitating guideline implementation, and staff morale. This was evidenced through the highlighted insufficient provisioning of resources to deliver these services effectively, and managers' unwillingness to support radiographers in undertaking this role through education, remuneration, professional recognition, or psychologically.

One factor contributing to this lack of organisational and managerial support could lie in the change in healthcare organisations in the UK since 2008. This changed from an administrative style of healthcare provisioning in which managers "oiled the wheels" in consultation with other healthcare professionals (Gabe, 2022: p.343), to one of an industrialised approach with an emphasis on better leadership (O'Reilly & Reed, 2011). This approach has meant managers must prioritise the control of budgets, performance targets and workloads, resulting in an adversarial relationship with doctors and other health professionals who previously held autonomous roles within this sector, leading to a prevailing loss of confidence in management (Bresnen *et al*., 2015). This loss of confidence was reflected in the findings of this research, particularly in those instances where departmental managers were felt to know nothing about and have no interest in forensic radiography and its specific requirements. As such, radiographers were left believing that managers saw no need to prioritise the mandatory training of radiographers undertaking this role, or their well-being, despite the SoR, (2024) and IAFR (Doyle *et al*., 2020) guideline recommendations. A point worthy of note raised by Bresnen *et al.,* (2015) is that one essential role for managers in healthcare is the exact adherence to and maintenance of policies and procedures. As demonstrated within this current research, this is not

the experience of many radiographers working within forensic imaging practices and was a source of frustration to many.

These feelings of frustration have been further exacerbated by the recent publication of the SoR, guidelines published in February 2024. This research has highlighted many areas within these guidelines where departments and radiographers involved in the delivery of forensic radiography services are currently unable to implement them effectively, despite their best efforts, knowledge and awareness, for the reasons previously given. Examples of such issues include the reporting of images by specially trained radiologists with specialist experience in paediatrics or the reporting of post-mortem images, and the secure storage of radiographic images and records on an IT system that prevents unauthorised access. Further issues comprise the provision of the training levels mandated for radiographers undertaking forensic and post-mortem imaging, and the safeguarding of radiographers' psychological well-being (MacGregor, Boyes & Swainston, 2024).

6.3.2 Theme 2 - Radiographic community, practice and perceptions

In evaluating the changes in organisational, departmental and managerial roles, and the provision of support, it was useful to consider Mary Douglas' (1970), work on culture, the impacts of cultural bias, and their impacts on social and occupational relations (Spickard, 1989) in settings such as healthcare. Whilst her work on sociological theory and cultural bias was premised on religions, faiths and worldviews, parallels may be drawn from her work on grid/group theory regarding the 'institutions' people construct for themselves and the control placed on these individuals by society, or in this instance, organisations. An example of this theory application can be seen in Goopy's (2005) research, in which she applied Douglas' grid/group theory to explore the cultural or day-to-day practice constructs built by nurses in their respective clinical settings and the challenges created by the hierarchical relations within these. Through applying this theory, an enhanced understanding was gained into the impacts of, in this instance, national culture in determining aspects of daily life and work, the workplace culture and social interactions. Integral to this was that the nurses were found to be 'encultured' into the

institutions' working practices, together with a strong understanding of their own cultural identity (Goopy, 2005).

The application of this same theory in this current research thesis, highlighting the factors and their interactions within the radiography community impacting the effective dissemination of best practices in forensic radiography is demonstrated in Figure 6.3. Within this figure, the 'Group' denotes the outside boundary erected by practitioners between themselves and the extrinsic or external world, whilst the 'Grid', refers to the other social distinctions and authority delegations that are used to restrict their behavioural interactions with each other (Douglas, 2003; Fardon, 1999).

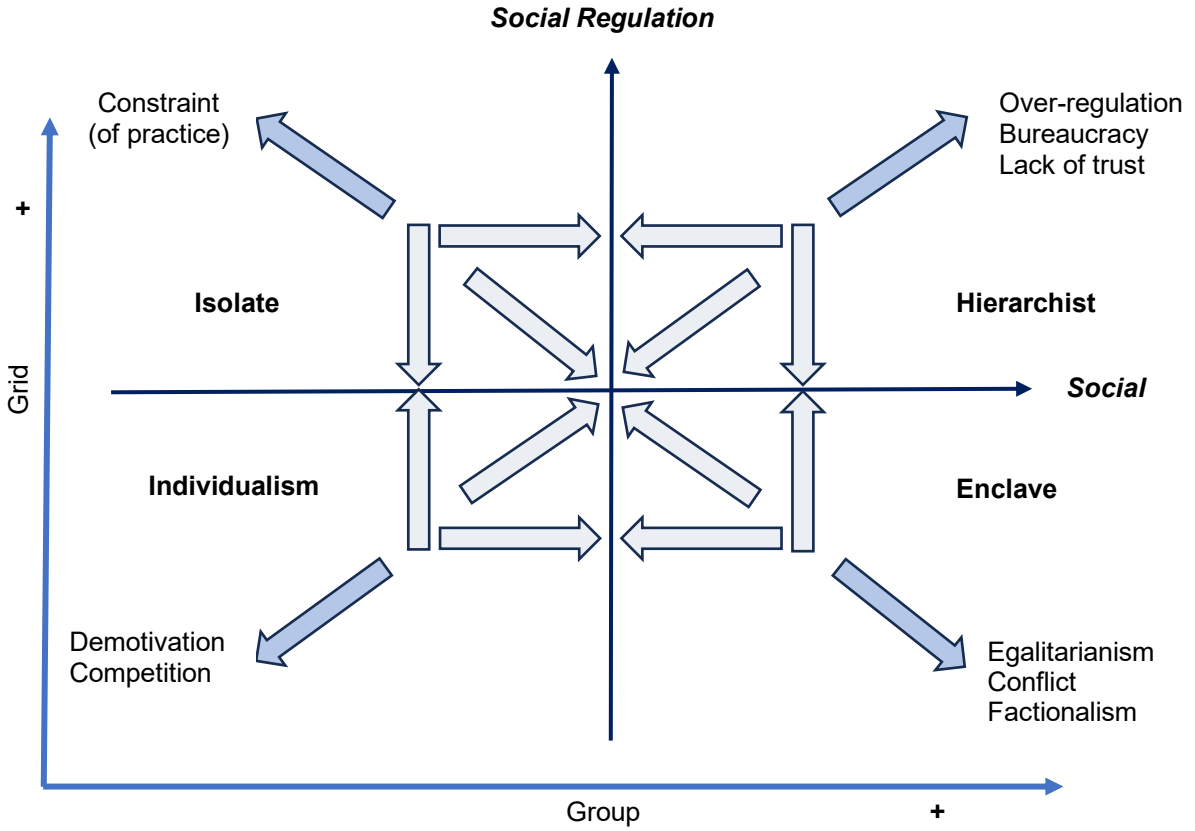

Figure 6.3 Diagrammatic illustration of the organisational influences impacting best practice implementation (Adapted from 6, Richards, 2017).

In the context of this research thesis, this figure demonstrates the detachment, and other barriers existing between radiographers in forensic imaging, their management and organisations.

6.3.2.1 Social regulation

As was found within this research thesis, such barriers can lead to collective solidarity against the perceived autocratic hierarchy through which nothing is changed, or conversely to individual isolation in which they do not feel able to speak out against what is being asked of them, such as to undertake a paediatric forensic examination. Meaningful relationships between radiographers involved in forensic imaging, their radiography colleagues, departmental managers and those involved from the wider MDTs can be difficult to establish and maintain. This can be due to the cultures and hierarchies prevailing within the respective teams and departments and the widely dispersed imaging facilities within departments and organisations, as evidenced by this research, and that of Cowlings' (2018) research exploring the concept of being a radiographer from a socio-cultural perspective.

Diagnostic radiographers are registered independent practitioners under the HCPC (2023; 2016) and can practice autonomously as the practitioner and operator under the Ionising Radiation (Medical Exposure) Regulations (IR(ME)R, 2017). However, within forensic radiography, their work must always be first guided and approved by a radiologist in consultation with a referring clinician or coroner. In the case of children imaged for suspected physical abuse, the subsequent images must be reviewed by a radiologist before the child can leave the radiography department (RCR, 2018). As established within this and other research, the lack of radiologists and the need to often outsource to other Trusts when combined with the fluidity of personnel changes can significantly impact cultural practices and relations. This is also reflected by Goopy (2005: p.147) whose work with nurses determined that working relationships are established by two elements, the autonomy associated with 'professional behaviour' and the enforced realities created through the structure of departmental management.

6.3.2.2 Hierarchy

The need for a 'negotiated order' within the competitive and collaborative powers existing in interprofessional and MDTs, (Nugus *et al.*, 2010) is mirrored within radiography where there is the desire to maintain autonomy and self-determination

premised on knowing what works for them. However, this can bring radiographers into direct conflict with the need for standardised practice or “controlled regulation” (Ryan & Deci, 2000: p.1557). The required subordination to radiologists was a perception reinforced by the Royal College of Radiologists report (RCR, 2010) in which they determined the level of autonomy radiographers can have regarding image interpretation and reporting. This perception of the relationship between radiographers and radiologists was hotly refuted by the Society of Radiographers (2010) describing the RCR (2010) report as unsubstantiated, stating that this relationship is a partnership on equal terms, in which radiographers are primarily accountable to their patients through the HCPC (2024; 2016), with whom they are registered and not radiologists. Whilst long since resolved, this dispute demonstrates the scope for misunderstanding of roles and positionality between two closely intertwined professions, where radiographers still perceive a hierarchical rather than collegiate structure remains in situ (Vom & Williams, 2017). This perception remains and has been upheld within this current research and that of Cowling (2018). Such disputes, together with the departmental structures and management, are exacerbated within forensic radiography by the continued mandated requirement to defer to often, unfamiliar colleagues, such as radiologists from external settings, and staff changes within MDT personnel. Such challenging working cultures and settings can thus significantly impact the radiography communities of practice and perceptions within this.

This lack of role clarity is reflected in the poor understanding held by many healthcare professionals of radiographers. A situation which continues to be compounded by the lack of profile radiographers have in healthcare generally (Britton, Pieterse & Lawrence, 2017; Sim & Radloff, 2009). This is particularly evident in MDT meetings and debriefs specifically, where radiographers are often left out, as highlighted within this current research, and the wider healthcare research literature (Al Balushi, Watts & Akudjedu, 2024; Hogg *et al*., 2020; Nightingale 2016; Probst & Gallagher, 2013).

6.3.2.3 Individualism

The intent to maintain practice autonomy in forensic radiography is demonstrated within this research through radiographers (and MDT colleagues') deferral to practice based on experience, and value-based judgements. rather than evidence-based practice and guidelines. This is a practice that radiographers in this research reportedly found challenging to overcome in others, a finding supported by other research, including Stravas *et al*., (2020), and Berger and Lindberg, (2019). Yielder and Davis (2009) propose that one reason could be the work-based culture in which the application and adherence to protocols have become synonymous with acquiescence, obedience and convention. It was essential in this research thesis to understand this work-based culture and the other possible reasons why many radiographers defer to experience and value-based judgements rather than guidelines in this setting. This required the garnering of an insight into the radiographers' perceptions of their role and positioning within the organisation, department and MDTs, particularly if such factors are to be addressed effectively.

One approach used by radiographers to maintain their autonomy and professional identity is to develop and sustain an occupational or 'tribal' (Strudwick, 2021) culture through which their identity, sphere of influence, and shared characteristics, are distinguished from other healthcare professionals (Strudwick & Day, 2014; Loxley, 1996). However, this has proven particularly difficult for radiographers, especially forensic radiographers working in an environment of flexible and permeable boundaries essential for an interprofessional collaborative environment, as demonstrated within this research. This finding is not unique to radiographers but also evidenced in other healthcare professions such as nursing (Salhani & Coulter, 2009).

As a profession, radiographers in this research thesis and additional research have highlighted their need to feel recognised (Chevalier *et al*., 2022), and valued (Nightingale *et al*., 2022; Nightingale *et al*., 2021; Bakker & Demerouti, 2017). However, radiographers themselves are commonly at risk of self-defeating behaviour in establishing and safeguarding their professional status, positioning, value and autonomy, simply through the language used in their daily practices. Typically, when

referring to projection imaging (X-ray in layman's terms), radiographers will refer to this in this research, the literature and to health professionals and patients as 'plain' or 'basic'. Using such terminology only serves to perpetuate the misconceptions of the profession, and undermine their professional identity, by denigrating the complexity of their role, skills, and training required for such an undertaking (Mussmann, Hardy & Jensen, 2021).

6.3.2.4 Individualism leading to demotivation

Such continued undermining of their professional identity by practitioners within their profession and other health professionals can have detrimental knock-on effects on radiographers' self-esteem (Strudwick, 2011), leading to apathy in their roles and reduced motivation to change practice habits (Ryan & Deci, 2006). This serves to enhance an individualistic culture of practice as demonstrated in Douglas' grid/group theory (Figure 6.3: p.125) and found within this research. This culture is further compounded by external pressures such as high workload, inadequate staffing and physical resource constraints, lengthy waiting lists, and the knock-on impacts of the four-hour target for treatment in A&E (McCartney, 2016; Weber *et al.,* 2012). The latter of these alone, resulted in increased imaging requests and time pressures on the imaging departments to prevent A&E from breaching their target times (Tse *et al*., 2016). Such pressures were frequently reported in this research whereby radiographers felt compelled to return to general practice immediately on completion of a forensic case, potentially to the detriment of their psychological well-being. This and the other pressures highlighted in this research were manifested in the radiographers' perception of their role as facilitators and providers of a conveyor belt ethos, where speed is paramount, leading to reductionist practice where patients have become objectified, i.e., the arm, the ankle. These findings were mirrored in the work of Cowling (2018) in which they explored being a radiographer in diverse settings and the socio-cultural factors impacting on them and their practice.

Such practice holds two significant implications for radiographers: their accountability to their patients, and detrimental effects on the psychological well-being of some radiographers. The recognition of radiographers' role in providing meaningful patient care, their professional role and their role within the workplace are considered

essential for the maintenance and enhancement of radiographers' mental well-being (Chevalier *et al*., 2022). Without this, job satisfaction will decline (Bakker & Demerouti, 2017) and thus their motivation to embrace new learning, evidence-based best practice, research and reflection will also fall away.

6.3.3 Theme 3 - Research and Best Practice Dissemination

In diagnostic radiographic practice and forensic radiography specifically, research knowledge transfer remains in its infancy, as evidenced by the variable levels of evidence-based practices established through rigorous research, implemented in practice settings (Di Michele *et al*., 2020). This is despite the UK adopting an evidence-based practice (EBP) approach to healthcare delivery over thirty years ago (Munn *et al*., 2020), and the publicised aspiration of NHS England (2013) that research is everybody's business and should be integrated into everyday practice.

Radiography as a profession has not historically demonstrated its willingness to embrace or engage with research (Al Balushi, Watts & Akudjedu, 2024; Hogg *et al*., 2024; Nightingale, 2016). Many reasons have been given for this, including a lack of physical resources, time, funding (Rodrigues *et al*., 2022) and support from their organisations and managers as established within this current research. Additional reasons not so widely spoken of, provided by Healthcare Improvement Studies (Marjanovic *et al*., 2019) include radiographers' lack of knowledge, skills and confidence in interpreting, applying and implementing research. Essentially though, as a factor contributing to engagement in research, the personal motivation of radiographers must also be considered, as demonstrated in sections 6.3.1 and 6.3.2 of this current research. This can be significantly impacted by the many external factors highlighted. As observed within the wider literature, such findings are not unique to radiography but are also seen in other healthcare sectors such as pharmacy (Lowrie *et al*., 2015).

The College of Radiographers (CoR, 2021) have acknowledged this ongoing gap between research and practice, seeking to address this by embedding research at all levels, from pre-registration education to post-registration practice. This is despite

the skills for reading, analysing, interpreting, and undertaking research being built into all pre-registration diagnostic radiography degree courses for many years. A key challenge in addressing this issue is to establish within all pre-and post-registration radiography students that research is not simply an academic exercise that must be survived, but rather one that is fundamental to their continued practice, career development, and that of the professions' development. Essential to this, is the role of Higher Education Institution lecturers and clinical academics (Rosser, 2007).

As established within this current research and the wider literature (Berger & Lindberg, 2019; Hatch, 2015), some radiographers see their role as clinical and experienced-led, rather than research-led. Such a lack of critical enquiry and reflection in their practices can lead to "false expertise" (Yielder & Davis, 2009: p. 346), inappropriate diagnostic practices (Bairstow *et al*., 2010), and potentially serious implications for patient care. In forensic radiography this can have additional consequences, resulting in the potential contamination of, or disruption to the continuity of evidence and medico-legal outcomes, which are integral to this specific role. Essential to addressing such behaviours and risks, is the need to build up motivation and desire to continue learning within radiographers individually and collectively. An integral facet of this is the psychological well-being of each radiographer, which can be significantly enhanced or impacted by their relationships with colleagues, managers and organisation (Chevalier *et al*., 2022), evidenced through their sense of belonging, recognition and willingness to engage (Jacquet *et al*., 2024).

Whilst some of the wider literature has indicated that radiographers appear receptive to research (Watts & Snaith, 2023), this was not reflected within the current findings, where it seemed that not all radiographers involved in forensic imaging were aware that engagement with research and EBP is a requirement of forensic radiography, (SoR, 2024; Doyle *et al*., 2020) their job description and professional registration under the HCPC, (2024) and SCoR, (2013), (Watts & Snaith, 2023; Abrantes *et al*., 2020). For some, it was felt that this should be optional and voluntary, rather than mandatory. This may be due to an unwillingness to step outside their comfort zones (Hatch, 2015), a lack of confidence in their research skills, or a desire to maintain autonomy over their practice.

Linked to the need for radiographers in this setting to utilise evidence-based guidelines, is the need to consider the efficacy of the methods used to disseminate them. It is acknowledged that there is no one-size-fits-all regarding how EBP may be most effectively disseminated or implemented, but what is recognised as ineffective is the use of passive methods such as mass email circulation, and simply the publication of the latest guidelines and protocols (Brownson, Colditz & Proctor, (2018). This is reflected in the findings of this research thesis where many radiographers highlighted that they were unaware of the guidelines and did not know where they would find them. This may be due to these being published by associations through their own websites and social media platforms for which no mandatory registration is required, such as the Society of Radiographers and International Association of Forensic Radiographers.

A more proactive approach is required if uptake is to be improved. One which enables radiographers to engage in activities such as being invited to participate in research projects and attend conferences and interactive workshops have been identified as positive motivators, and an effective means of enhancing job satisfaction (Vils Pedersen, 2023). Although, as established within this current research, being able to fund such opportunities, facilitate time away from their departments, and free up dedicated time for research whilst in clinical practice, continues to be challenging for many, and impossible for others. One approach used by many organisations, due to lower costs, and the reduced need for staff to be away from the departments (Pinto *et al*., 2010), is online learning via e-modules, which has grown exponentially in the past decade (Cheng *et al*., (2014) and even more so during the Covid-19 pandemic and its aftermath. However, whilst positively received by some radiographers and other healthcare professionals (Dascalu *et al*., 2023), this has been described in the current research thesis by others as a tick-box exercise from management which on its own is insufficient. Rather this requires substantiation through other means such as interactive workshops for CPD, as proposed by Vils Pedersen, (2023). There may be many reasons for these negative sentiments towards e-learning, including the lack of direct communication and tutor interaction, or this could be due to low motivation. In gauging the reasons for these

negative attitudes towards online learning it is essential to consider the 'human factor' since there can be no one-size-fits-all (Dascalu *et al*., 2023).

6.4 The Concepts

The two concepts of, intractable organisational factors, and normalising negative conformity, have been developed through synthesising the notions and data presented within this research (Naeem *et al*., 2023), as presented within the synthesised themes in section 6.3.

6.4.1 Concept 1 - Intractable organisational factors

The literature and participants' experiences cited in this current research have demonstrated that there are many intractable factors within organisations which have impeded the effective implementation of best practice guidelines within forensic radiography. These factors primarily included a lack of funding, provision of physical resources from the organisations, and a lack of awareness and support from departmental managers and in some instances, colleagues. Essential to the consideration of these is to explore why such factors have not been evident across all settings and all participants. As was established within the two primary phases of this research, whilst far from being the predominant findings there were instances where these seemingly overwhelming factors had been overcome. Consideration is therefore required of how this became achievable in those examples, and to recognise that whilst presenting formidable challenges the impossible can with the right support and direction become possible.

Evident within this research, in those instances where best practices in forensic radiography were fully implemented, innovative approaches requiring only small incremental steps were employed. Underpinning these, was the need for education in forensic radiography and its requirements, for all levels within the organisational structures involved from senior managers down. Where implementation was most effective, this encompassed having a manager with previous experience and or knowledge of forensic radiography. Such 'insider' knowledge at a managerial level, was found to enable radiographers to access the support and funding to undertake

the relevant levels of post-graduate training and CPD in forensic radiography. Although this did not address the mandatory contractual provision of time for education, training, and CPD, those radiographers who undertook this level of education accepted the need to engage these studies in their own time to facilitate learning. This was not, however, recognised as an acceptable or appropriate solution by most participating radiographers in this current research. It is acknowledged that in those instances where support and understanding were received from managers, this was primarily in the UK. This research has highlighted that this remains largely insoluble for those radiographers engaged in forensic activities abroad where the required levels of post-graduate education (Doyle *et al*., 2020) have been primarily self-funded with no time allocated by their organisations to facilitate these studies.

Two factors were firmly established as insurmountable within this research even where guidelines were implemented effectively, the lack of physical resources such as rooms, and staffing, particularly an appropriate skills mix within this. It is recognised that there are no short or medium-term measures that can be readily applied to address the issues with rooms and the reliability of the equipment from an organisational perspective, due to the financial and physical logistics involved. However, as this research evidenced, aspects of this could be managed by working more closely with radiography and MDT colleagues, and management, thereby increasing awareness, and in some instances collegiate support.

This thesis, together with the wider literature illustrates how many radiography departments have addressed the lack of available and appropriately trained and experienced radiologists to support their forensic work, by outsourcing their images to other Trusts and facilities. From the perspective of this research, the issue presented by an inadequate skills mix among radiographers has proven impossible to overcome. This has been compounded by many factors, some of which lie outside the control of the organisations. The primary one is the shortfall of radiographers entering the profession which cannot replenish the numbers that have left, due to retirement or other reasons, or to meet the increased demands placed on radiographic imaging services (Woznitza *et al*., 2014). This situation is not unique to radiography but is also evidenced in other health professions such as nursing (Burmeister *et al*., 2018). In their multinational nursing review, the loss of

experienced staff had increasingly resulted in junior inexperienced staff being expected to run and lead shifts and departments, impacting job satisfaction. These findings are also highlighted in the findings of this thesis. Although recruitment to the profession is one unavoidable aspect of this issue, it is also essential to consider the retention of those staff currently within the profession (Nightingale *et al*., 2021). This is a facet organisations and managers can and should have some input on, as evidenced within the wider literature discussed in section 6.3.2. Essential to this, is the provision of a work environment conducive to enhancing the physical and psychological well-being of the staff (Jacquet *et al*., 2024; Burmeister *et al*., 2023).

6.4.2 Concept 2 - Normalising Negative Conformity

In those instances where radiographic staff experience a poor or negative working environment, the engagement with evidence-based practices and research is reduced, as highlighted within these current research findings. An essential consideration within this, in addition to those factors previously highlighted, is the impact of peer pressure on conformity and non-engagement. Conforming, defined as changing behaviour to align with the group consensus (Beran *et al*., 2014), can enable employees to feel part of the team and gain a sense of belonging. Whilst such behaviours can be positive for workers in emotionally and physically challenging settings such as those experienced in forensic radiography, they can also be a cause of distress. This is due to the perceived loss of autonomy and choice, linking back to those social and cultural factors of isolation and individuality identified within Figure 6.3: p. 127.

The consequences of the perceived necessity or want to conform is an important consideration due to the need to consistently challenge the cultural norms and behaviours in healthcare and radiography. When not checked or challenged, these can result in the situations identified within this current research and wider literature, whereby practice defers from the guideline implementation to experience and comfort-based decision-making. Although it is acknowledged that such factors do not necessarily lead to non-conformity with best practice implementation, it can be difficult for inexperienced and junior staff members to stand out from the crowd and challenge the practice of those remaining seniors who prefer to rely on their

experience and what they have always done (Werkhoven, Kodden & Burghout, 2023; Barach, Satish & Streufert, 2001). However, as established by the inquiries into the actions within the now re-structured and re-named Mid-Staffordshire Trust (Francis, 2013) and Alder Hey Hospital (The Royal Liverpool Children's Inquiry, 2001) among others, there can be catastrophic consequences when individuals cannot stand up and feel safe to voice their concerns.

Research has established that effective management and leadership can address the negative impacts of conformity that result in default practice (Werkhoven, Kodden & Burghout, 2023; Frooman, Mendelson & Murphy, 2012). As evidenced in this thesis a change towards a transactional and transformational style of leadership, where departmental managers have amended their communication skills, encouraging departmental openness, and collaboration, has resulted in positive changes within the departments (Toussaint & Barnas, 2021) and support received by radiographers doing forensic work. This has also enabled staff to grow in confidence and develop individuality and autonomy in their practice thereby enhancing their engagement, knowledge dissemination (Kodden & Groenveld, 2019) and best practice application. However, as has also been established in this current research, there remains a passive avoidant style of management and leadership in many departments as experienced by practicing radiographers, whereby management has failed to implement protocols and consider or address the basic requirements for supporting an effective forensic imaging provision. The consequences of this leadership style have become accepted and remain commonplace as evidenced by Elshout, Scherp & van der Feltz-Cornelis, (2013: p. 823). Their research into the "stressful environment" of mental health practice in the Netherlands identified links between this form of leadership and employee dissatisfaction and sickness.

6.5 The Conceptual Model – Acceptance of Adversity

The development of this conceptual model represents the final step of the thematic analysis of this research outlined in Figure 6.1. This comprised the construction of a conceptual framework premised on the researchers' interpretation of the themes and concepts discussed. This also encompassed consideration and application of the Socio-ecological Model (SEM) (Figure 6.4: p. 141).

This research has highlighted many noteworthy issues impacting the implementation of best practices within forensic radiography. These have been evaluated and discussed individually and collectively throughout this research, through a multi-methods approach, and lens of the pragmatist paradigm, enabling the knowledge gained to be actioned, as detailed in Chapter 3. What has become clear through this approach is that the actions, intentions and preferences of the radiographers and departmental managers within organisations are not sufficient on their own to explain the actions of the wider organisations, a finding reflected by May and Finch (2009). Given this, it is necessary to consider those factors that have led to this research's conceptual framework, the *acceptance of adversity*.

When faced with the many challenges highlighted and justifications given in this research, it can be understood why many radiographers have come to accept the adversities of their current circumstances rather than continue to battle them, particularly when considering their interlinked spheres of influence (Figure 6.4). It has been seen in this research that many radiographers engaged in forensic imaging have sought to access the mandated training and had their requests dismissed or not heard by their managers. As became apparent, most have had to accept this decision due to the associated financial and time commitments required that are not viable without organisational support. This has had significant detrimental impacts on many departments providing forensic radiography services, whereby outdated protocols continue to be used in some departments, with others failing to adopt any protocols or guidelines. Integral to such failures is the organisations' lack of commitment to adopt the guidelines, facilitate the time required for these to become routine practice (Linton, 2002), and ineffective mechanisms for dissemination in the radiography departments and MDTs.

As established within this research, where there was reported awareness and knowledge among some radiographers of best practice guidelines facilitated by engaging with the required levels of education and training. This was achieved through being supported by managers with an understanding of forensic radiography, to access the appropriate resources and training. However, even in these instances, most radiographers found full implementation remained significantly

inhibited by the physical resources and staffing available. For those, this meant accepting their current circumstances by working with what they had available, such as using inexperienced radiographers with inadequate training, and IT storage systems that do not provide the levels of data security mandated in direct contravention of guidelines recommendations (SoR, 2024; Doyle *et al.,*2020; RCR, 2018). This research established that this situation was a considerable frustration to many, due to their concerns regarding the efficacy and validity of the service provision needs not being listened to.

Such frustration was exacerbated by the radiographer's general working conditions, and their role expectations, as discussed in section 6.3.2, which has impacted job satisfaction and overall motivation. As highlighted, this has led to a prevailing sense of apathy, exhaustion and acceptance towards tackling an unending battle with adversity.

6.6 The Conceptual Model through the Context of the Socio-ecological Model

The Socio-ecological Model (SEM) has been utilised in this component of the research, with the rationale for this discussed in Section 3.7 (pp. 57-59). Essential to this was consideration of the relationships between the concepts within the themes depicted in Figure 6.2 (p. 122).

The presentation of this as a model as opposed to a further theme was taken, premised on a theme being defined as an important feature about the data in relation to the research question posed (Braun & Clarke, 2006). However, through applying a conceptual model the researcher is able to convey a systematic demonstration of the relationships evident among a set of concepts (Morgan, 2018). This is illustrated through application of a modified version of the SEM employed by Ma *et al*., (2017), (Figure 6.4: p.141) in their work on the factors impacting sex workers attending health services.

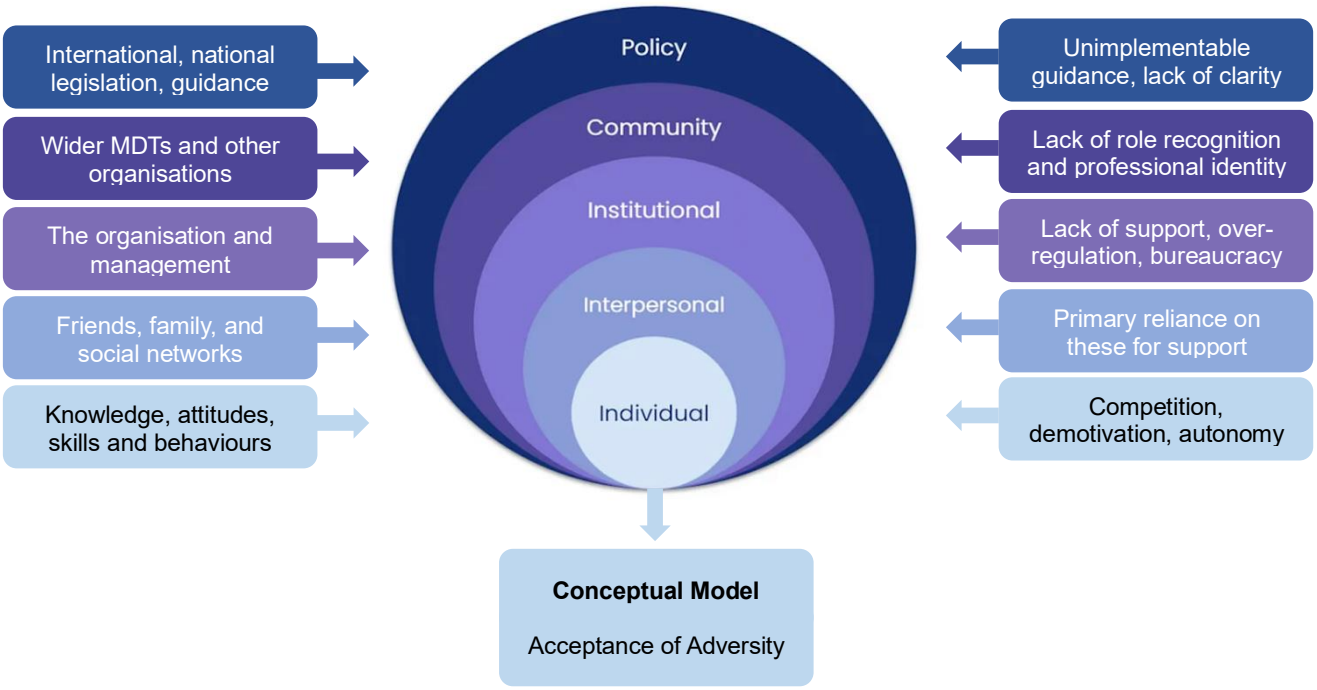

Figure 6.4: Setting the context of the conceptual model through The Social-ecological Model (Modified from CDC, (2015) and Ma et al., (2017).

This approach reflected the pragmatist stance of this research through the interlinking of the radiographers' experiences, knowledge and actions (Kelly & Cordeiro, 2020) within a rapidly changing and constantly renegotiated forensic imaging environment (Patel, 2015). This was established through the application of the context of a set of 'nesting circles' depicting the radiographer's systems, levels of influence and relationships; institutional, community, and policy (Bronfenbrenner, 1989). This facilitated an enhanced understanding of the complex, interrelated factors impacting these radiographers' behaviours and attitudes in respect of their interaction and engagement with evidence-based practice when undertaking forensic imaging.

6.7 Implications for Practice and Guideline Implementation

This thesis has considered the factors that have impacted the effective implementation of best practice guidelines in forensic radiography. This has established that there are many multifaceted and complex factors within those organisations providing forensic radiography services. These findings have

significant implications for organisations, the efficacy and validity of the practice delivered, the medico-legal cases, and the radiographers involved.

6.7.1 Implications for Organisations

The primary implications for organisations failing to support and facilitate the implementation of forensic radiography guidelines are reputational damage, increased staff absenteeism, and loss of radiographers to the profession. Damage to an organisation's reputation may occur when practice is challenged in court and justification must be given for why recommended guidelines have not been implemented effectively and followed.

6.7.2 Implications for the validity of forensic radiography practice

As established in Chapter 1, forensic radiography has an extensive scope of practice and an indispensable role in forensic science. Maintenance of the gathered evidence's integrity is fundamental to each of these because this imaging is for medico-legal purposes, if this is not to be challenged in a court of law (Brown & Henwood, 1997). Integral to this is the effective implementation and application of all guidelines applicable to the relevant scope of practice. However, as this research thesis has demonstrated this is not evident in clinical settings, thereby potentially jeopardising the validity and integrity of the forensic radiography work undertaken.

6.7.3 Medico-legal implications

This also presents a risk to those cases presented in court where the continuity and integrity of evidence cannot be assured. In worst-case scenarios of suspected physical abuse of a child or vulnerable adult the case may be dismissed due to an inability to guarantee and demonstrate the required continuity of evidence. In the case of person identification, where guidelines are not followed, this risks misidentification, with long-standing legal ramifications for that individual, the families involved, and the organisation providing the forensic imaging service.

6.7.4 The Implications for radiographers undertaking forensic radiography

The continued failure of many organisations to effectively implement best practice guidelines and protocols has left many radiographers involved in forensic radiography potentially exposed and vulnerable on many levels. Although it is usually the role of expert witnesses such as a radiologist to present and defend the forensic radiological imaging undertaken in any case in court, a radiographer may still be required to attend court to corroborate their role. This could present immense pressure if asked to defend actions that lie out with the recommendations of international, and national guidelines and local protocols.

The failures of organisations and leadership within these to effectively fulfil their duties and obligations in the provisioning of these guidelines and protocols have also been found within this research thesis to have significant impacts on the mental and physical well-being and motivation of radiographers involved in forensic and general radiography, as discussed in sections 6.3.2 and 6.4.2. Such impacts continue to be intensified by radiographers' current working culture and conditions, particularly in the NHS.

6.7.5 Implications for guideline implementation

On a positive note, there have been significant enhancements in the development of guidelines nationally and internationally through which practice standards have become more standardised across the scopes of forensic radiography practice since the scant guidance of the 1980's (Viner, 2020). This was considered essential due to the variations in practice both within the UK as evidenced in this research and across other nations, with many still in their infancy (Acquah, *et al*., 2024; Patyal & Pandey, 2023; Primeau, Martinnen & Pedersen, 2022; Viner 2020). However, despite the aspirations of organisations such as the International Association of Forensic Radiographers (IAFR), International Society of Forensic Radiology & Imaging (ISFRI), the International Society of Radiographers and Radiological Technologists (ISRRT) and the Royal College of Radiologists (RCR), these guidelines are not effectively implemented across most clinical settings.

Having established the many scopes of forensic radiography, and its medico legal role in which continuity and integrity of the evidence collected is fundamental to this field of practice, this research thesis has established that there is no room for complacency. This is particularly applicable in those countries where forensic imaging is considered well-established, such as the UK and Netherlands. Should the current situation where only in a minority of locations can best practice guidelines be considered fully implemented, this brings into question the role and integrity of forensic radiography.

6.8 Recommendations for Practice

Many recommendations forensic radiography best practices implementation have been developed through the conduction of this multi-method research as considered below.

An essential first step is to recognise that there are many issues with the current provision of forensic radiography services in the UK and internationally and that they do not stand up to the scrutiny of current guidelines and expectations. It is recognised that factors such as workforce shortages and the provision of adequate physical resources such as rooms, facilities and equipment are long-term goals for which policies and manifestos have been provided at governmental and professional body levels.

As evidenced throughout this research such long-term measures are insufficient on their own to address the multi-faceted issues raised. As such, recognition must be given to those smaller and achievable steps that can be instigated in the interim. These can be premised on those examples highlighted within this thesis (Chapter 4, Section 4.4) where full implementation has been successfully achieved. The recommendations listed below are premised on this.

- The creation of meaningful two-way communication channels, rather than the current top-down method from managers to radiography practitioners. This is essential if radiographers are to be heard and respected for the role that they

have in forensic science, associated medico-legal processes, and the wider multi-disciplinary departments.

- Diagnostic radiographers undertaking forensic imaging must be included in all appropriate multi-disciplinary team meetings and debriefings where applicable. Currently inclusion within these is sporadic at best.

- Greater understanding and appropriate psychological well-being support must be offered to radiographers undertaking forensic imaging. This must be provisioned in a way that is recognised as meaningful to these radiographers, together with enabling the facilitation of decompression time after undertaking forensic cases, rather the current expectation of immediately recommencing day-to-day practice. Such provisions are considered essential due to the risks of professional burnout resulting from emotional and physical exhaustion (Singh *et al*., 2017). Without management and organisational recognition and support of the need to protect and safeguard the radiographer's mental well-being, those radiographers' involved in forensic imaging risk being unable to meet the professional registration requirements of HCPC (2023) standards. To facilitate this recommendation, further research is required to determine what formats this should take as there is no-one-size-fits-all (See section 6.12 for further details).

- A re-evaluation of the perception of the role of radiographers involved in forensic radiography held by the radiography profession and organisational managers is essential if the current mind set of "we just have to get on with it, it's what radiographers do" is to be addressed. Without this, the risks of emotional and physical exhaustion as discussed above will only increase.

- As indicated within this research many radiographers in forensic radiography have defaulted their practice to one premised on experience and comfort rather best practices, resulting in the stagnation of practice (Sim & Radloff, 2009). Motivation or the lack thereof to engage in learning and research was found to underpin these actions. It is recommended that programmes such as mindfulness, through which radiographers' well-being and motivation can be

enhanced (Lomas *et al*., 2017), and thus their receptivity to learning and innovations in their practice be implemented in pre- and post-registration education and practice.

- The implementation of communities of practice (CoPs) as proposed by Ramazan, Graham, & Hayes (2024) within forensic radiography could be a means through which awareness, knowledge and understanding of best practices can be disseminated with greater efficacy. It is considered that the use of such an approach, based in Social Learning Theory, could also enhance individual radiographers' performance and thus that of their organisations.

6.9 The Strengths of this Research

A key strength of this research was the use of the pragmatism paradigm. Integral to this application was the three core principles that underpinned this approach that facilitated the study of multiple and interrelated factors impacting best practice implementation in forensic radiography. These three principles comprised a focus on actionable knowledge, recognition of the interlinking between experience, knowledge and action, and inquiry as an actionable process (Kelly & Cordeiro, 2020). This enabled an effective identification and addressing of the complex issues and recognition of the multifactorial approaches that are needed to address the issues identified through this research (Allemang, Sitter & Dimitropoulos, 2022).

The use of a multiple methods of data collection, through the literature review, questionnaire, and semi-structured interviews enabled the broadest scope of data to be collected to answer the questions posed. This was essential to enable an understanding of the international perspective and wider issues, together with the invaluable insights of the experiences of those radiographers involved in forensic radiography.

Utilising the six steps of thematic analysis as proposed by Naeem *et al*., (2023) whereby a conceptual model was explicitly constructed has enhanced the overall

validity of this research by establishing a well-structured interpretation of the research findings.

6.10 Limitations of this research

Recognition of the limitations of this research is important to determine the efficacy and objectivity of this research.

6.10.1 Research methodology

An ethnographic methodology whereby detailed, descriptive accounts of a ‘culture’, or in this instance clinical practice and setting gathered through observation and interaction (Dikomitis & Wenning, 2024; Strudwick 2024; 2021) with the forensic radiographic community and wider multidisciplinary teams would have been advantageous in this research. This is due to its enablement of gaining a familiarity of the participants’ lived experiences, thereby providing an insight that is not possible through other research methods. However, the need for this was in essence negated by the researcher having insider knowledge of this specialist setting through their clinical and academic experience. Whilst perhaps desirable, due to the medico-legal requirements, guideline stipulations regarding witnesses and unpredictability of when the imaging of forensic cases is required, this was not a feasible methodology for this research.

6.10.2 Primary data collection

As indicated within Chapter 4 the relatively low response to the questionnaire phase of data collection could be considered a limitation. However, it is important to recognise that an integral factor impacting on this was that many radiographers whilst undertaking forensic imaging cases during their day-to-day practice do not see themselves as forensic radiographers, and thus did not see themselves as meeting the participant criteria for this research. Whilst this was not an anticipated issue, this lack of role recognition and understanding proved to be an important finding as reflected in the discussions within this thesis.

6.10.3 International data

Although this research sought to gain an international as well as a national understanding of the factors implementing best practice implementation, the majority of the data collected through the primary data collection phases comprised participants from the United Kingdom. This is an important consideration, as there are many differences across nations, particularly in respect of healthcare practices and radiography practice. The international guidelines such as those written by the IAFR (Doyle *et al*., 2020) have been written to standardise practice across international borders, whilst also acknowledging the national variations in legislature and practice. This research thesis has highlighted the many impacts of the perception of the role of radiographers held by themselves and other professions do appear to correlate across nations. However, the impact of working within the culture and pressures of the NHS could be considered unique to the UK and thus not transferable to other nations.

6.10.4 Applicability of findings

One such limitation when considering the findings of the literature review (Chapter 2) is that the included sources only addressed factors within paediatric forensic radiography. Whilst a limitation of this research, this reflected and highlighted the lack of literature addressing the issue of best practice implementation in other areas of forensic radiography, including narcotics body packing, person identification, mass fatalities and age-estimation. The lack of wider forensic radiography coverage in this review does impact on the ability to generalise these findings to those other scopes of practice.

A similar issue was observed among the participants in both phases of primary data collection where most were radiographers undertaking paediatric forensic cases. Again, this is reflective of the fact that the largest remit of forensic radiography practice lies in the suspected physical abuse of children. However, in these phases, this encompassed the post-mortem imaging together with live cases, thus providing a broader perspective within this remit.

6.11 A reflection on the positionality of this research thesis and future research strategies.

This section has been written in the first person to enable an insight into my positionality regarding the stance taken and scope of this current thesis together with its anticipated future development.

Whilst being aware of implementation science theory, and the proliferation of theories, models and frameworks developed within this (Wang *et al*, 2023) and its role in facilitating best practice implementation, I remain resolute in my decision not to include this within the remit of this thesis. Rather, this research sought to utilise the pragmatism paradigm and position itself as a form of scope setting root cause analysis. I considered this essential in fulfilling my research aim; to create actionable knowledge through the pragmatism paradigm, encapsulating my epistemological, ontological and methodological approaches (Guba, 1990). This actionable knowledge comprised of the many and interrelated factors impacting on the adoption of best practices, culminating in the overarching conceptual model of the *Acceptance of Adversity*.

This finding will I believe, serve as the precursor or foundation for the next phases of research, in which implementation science theory, a theoretical basis premised on psychological, sociological or organisational theories, such as the COM-B model, the Behaviour Change Wheel and Normalisation Process Theory (NPT) can be utilised. By using such theoretical frameworks, I can seek to explain how behaviours can change and why this needs to happen in the forensic radiography setting. Through this, strategies for more effective implementation can be adopted (Nilsen, 2020).

6.12 Further research

Through the undertaking of this research topic, it was quickly established that this is a complex and multifaceted issue, which simply cannot be addressed in full through this single research activity. As such, given the widely acknowledged role and importance of patient and public involvement and engagement (PPIE) in the development of outcome measures (Carlton *et al*., 2022) it is felt that an important

next step would be the facilitation of a PPIE group. This would enable the gathering of their insights in the recognition and development of possible measures that could be designed to address or manage at least some of the key barriers to effective best practice implementation identified within this thesis.

As this research has highlighted in Chapter 2, there is a significant lack of research literature exploring the factors impacting the efficacy of best practices and guideline implementation across the diverse scopes of forensic radiography. Although there is more research in respect of suspected physical abuse in children and the consistency of imaging standards in this, there remains a lack of evaluation of the factors impacting the efficacy of best practice implementation. As such, further primary qualitative and quantitative research is essential if a comprehensive understanding is to be gathered of best practice implementation in forensic radiography in its entirety, and within each aspect of this practice individually. The need to evaluate each scope of practice is essential for the full meaning to drawn due to the very different organisational issues, constraints, and pressures that may exist within and between these.

The different stages and levels of forensic radiography practice development and application across the international community must also be considered when assessing the efficacy of best practices implementation. Based on this, primary research formatted in the same way as that proposed above is essential if direct comparisons are to be made. This would enable more meaningful methods of addressing those factors identified to be developed. This consideration of these international factors is essential given the drive of the international forensic radiography organisations to develop and implement internationally standardised best practice guidelines.

One of the key findings of this research thesis was the impact of diagnostic radiographers' role perception and expectations of daily practice on their motivation to learn and enhance their practice through evidence-based practices, and on their psychological well-being. This was found to have a significant impact on those radiographers also involved in forensic imaging. In consideration of this and the new HCPC (2023) Standards of Practice requirement that radiographers must take

responsibility for safeguarding their mental well-being, the lead researcher and their Director of Studies, have initiated a year-long funded research study exploring the psychological effects of clinical radiographic practice on radiographers in the UK. A greater understanding of these effects together with identification of strategies that can enhance mental well-being and resilience that are meaningful to radiographers, will serve to increase motivation and thus receptivity to the adoption of evidence-based practice.

6.13 Conclusion

This research is the first to evaluate the multiple and interrelated factors shaping evidence-based practice implementation in forensic radiographic practice. To date the focus has been on the need for, and development of standardised guidelines for each scope of forensic radiography and the technological innovations that are enhancing practice within these. Whilst these developments are essential for the continued growth of forensic imaging practice, without meaningful strategies for implementation, their efficacy in clinical settings will only remain partial at best. As established in this thesis, without a fundamental shift in healthcare organisations and their leaders' approach to the role of evidence-based practices through which guidelines are developed and disseminated, their implementation will continue to face difficulties. Although this is an issue across many healthcare settings as established within the wider literature, this research has identified this to be of particular concern in the field of forensic radiography. There has been considerable research regarding implementation strategies with many trialled and subsequently implemented across healthcare settings. However, these cannot be fully effective without the support of organisations management whereby those radiographers undertaking forensic radiography are not only heard but listened to. This requires support and recognition of their profession, their forensic role and the unique challenges that come with this.

Through application of the pragmatist paradigm utilising a constructivist ontological and epistemological approach as evidenced through the sequential multi-method data collection strategies employed within this thesis it was possible to fulfill the principle aim of the research. This enabled the identification of the many complex

and multifactorial factors impacting the efficacy of evidence-based best practices implementation across forensic radiography settings. It is essential that these be recognised, acknowledged, addressed at organisational, community, cultural and personal levels. For as established within this thesis these are very much intertwined and must be addressed collectively if evidence-based practices (EBP) across the scopes of forensic radiography are to be effectively adopted. The revelation within this research of the integral role of organisation managers in the facilitation of EBP implementation is important and must not be underestimated. Unfortunately, to date, as demonstrated within this research, many departmental managers have misunderstood or have simply not been aware that this is a requirement of their role.

This research found that it is not possible to disassociate the daily pressures, constraints, and experiences of diagnostic radiographers from those of radiographers engaged in forensic imaging practices. Fundamental to this are the levels of motivation among radiographers, their perceptions of their role and their knowledge and understanding of research within radiography. Regarding this research, this is an important finding and one that will require further evaluation of strategies taken to enhance EBP implementation.

For the efficacy of evidence-based practice to be enhanced and implemented effectively at all levels within forensic radiography those factors identified within this research must be addressed. This requires managerial and departmental investment and interest in their personnel, together with specific role identification of forensic radiography by radiography professional bodies. Essential within this is the need to raise the diagnostic radiographer's professional profile within healthcare.

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Appendices – Contents

Appendix A: Scoping Review Modified PRISMA-P Checklist (Based on Moher, *et al.,* 2015)

Section and Topic	Item No.	Checklist Item	Yes/No/ NA
Administrative information			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Y
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of registry and registration number	Y
Authors: MacGregor, F. Swainston, K.			
Contact	3a	Provide name, institution affiliation, email address of all protocol authors, and corresponding author	Y
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Y
Amendments	4	If represents an amendment of previous completed/published protocol	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Y
Sponsor	5b	Provide name of the review funder/sponsor	N/A
Role of Sponsor or funder	5c	Describe roles of funder, sponsor, and/or institution, if any, in developing the protocol	N/A
Introduction			
Rationale	6	Discuss the rationale for the review in the context of what is already known	Y
Objectives	7	Provide explicit statement of the question(s) the review will address with reference to Participants, Concept and context PICO)	Y
Methods			
Eligibility criteria	8	Specify the study characteristics (PICO), study design, time frame, and report characteristics to be used as criteria for eligibility for the review	Y
Information sources	9	Describe all intended information sources (such as electronic databases, grey literature sources with planned dates of coverage	Y
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits	Y
Study records:			
Data management	11a	Describe the mechanism that will be used to manage records and data throughout the review	Y
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Y
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Y

Data items	12	List and define all variables for which data will be sought (such as PICO items), any pre-planned data assumptions and simplifications	Y
Outcomes and prioritisation	13	List and define all outcomes for which data will be sought, including prioritisation of main and additional outcomes, with rationale	Y
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Y
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/A
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies	N/A
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/A
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	N/A
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	Y
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

Appendix B: JBI Systematic Review Title Registration Form

JBI Systematic Review Title Registration Form

Title: Efficacy of the implementation of evidence-based practice within forensic radiography: a scoping review

Centre: Teesside University

Primary Reviewer

Name: Fiona MacGregor **Email:** f.macgregor@tees.ac.uk

Question: What are the factors that positively or negatively impact on the ability to implement best practice (clinical guidelines) within forensic imaging practice from organisational perspectives?

PICO

Population: Healthcare professionals involved in the forensic radiography, radiologists; diagnostic forensic radiographers, consultants, pathologists, coroners. No exclusion based on age and gender, only that they are involved in the management, delivery and facilitation of forensic radiographic practice. In addition those involved in the delivery of forensic radiography education, university lecturers, clinical facilitators, CPD forensic trainers.

Intervention: Phenomena of interest (qualitative)

Guidelines, protocols; Knowledge and awareness; Workplace culture; Multi-disciplinary team working Evaluation of forensic radiography practice encompassing pedagogical delivery; organisational training and education; efficacy and availability of CPD; staff skill mix; protocols and guidelines; and communication

Comparator: No comparator (qualitative review)

Not applicable

Outcome: Context (qualitative)

All geographical settings rural and urban, hospital, airport, mortuary, makeshift sites on location (for mass fatality incidents)
Facilities

This review will be set within a broad ranging context in which no specific geographical setting or location be that rural or urban will be stipulated. This is essential in reflecting the extensive remit in which forensic imaging may occur globally and in terms of setting i.e. a hospital, airport, makeshift facility following a mass fatality incident, or mortuary. Contextual consideration of available facilities and staffing composition in conjunction with the timing (day or night) of when forensic imaging is undertaken will be encompassed within this review.

Please **download, fill in, save** and **email** this form to: jbisynthesis@adelaide.edu.au

Appendix C: Data Extraction Form Template

ID Number		**Date reviewed**		**Reviewer name**	
Details of how the data was retrieved *(including search details and access information)*					
Type of publication *(tick box)*					
Journal article		Authored book		Policy document	
Edited book chapter		Research report		Other *(give details below)*	
				Journal Editorial	

Bibliographic details

First Author *(Surname, initials)*	Co-Authors *(Surnames, initials)*	Year of publication
Title	**Publication** *(name of journal/book)*	**Publisher and place of publication**

Details about the study

Date study conducted	Country (place the study was undertaken)
Aim(s) of study	
Research methods employed	
Study setting	
Participant sample details/characteristics or profile *(details of category of people participant in the research – and numbers, e.g., foster children, social workers etc)*	
Main findings	
Recommendations *(if given)*	
What clearly is not covered by this study	
Theme – original	
Research Questions	
Keywords	
How is this useful to my project?	
Other notes (misc)	

Appendix D: Key article findings and ICA conceptualisation categorisation process

Subcategories	Categories	Conceptual categories
Lack of standardised approach	Non-standardised practice	Ineffective Organisational Governance
Lack of standardised guidelines		
Variations in populations imaged		
Discrepancies in undertaking and reporting		
Lack of concerted approach - neuroimaging		
Inconsistencies with CT head imaging		
Variations in documentation completion.		
Variation in practice		
Guidelines clear but lacking completeness	Inconsistency	
Wide variations on key factors		
Inconsistent application		
Lack of standardised access to clinical pathways		
Evaluation variable		
Variation in number of images obtained		
Use of babygrams despite guidance		
Clinician overconfidence	Overconfidence	
Radiologists lack adequate training and education in SPA reporting	Education	Education and the 'Translation Hurdle'
Need to involve paediatric radiologists to ensure image quality		
Minimal injury may be a sentinel injury		
Poor quality imaging		
Inadequate knowledge, inconsistencies with case management		
Discrepancies in knowledge base of trainees and consultants in medico-legal aspects of child abuse		
Gaps in recognition, treatment, and follow-ups		
Underuse of existing guidelines		
Insufficient initial and on-going training		
Physician concern of not over-using imaging resources		
Reliance on clinician intuition, anecdotal experience	"Translation hurdle"	
Lack of Funding	Resources	System 'Brakes'
Lack of access		
Poor access to paediatric radiologists.		
Online availability of guidelines, not widely applied by radiologists		
Lack of protocols (published)	Lack of protocols	
Lack of best practice standards		

Appendix D (Continued)**:** Key article findings and ICA categorisation

Lack of guidelines		
Many death investigation processes lack evidence base		
Lack of guidance 'Service creep'	"Service Creep"/ Habits	Default practice
Variety of imaging techniques		
Current habits difficult to change		
Reliance on local habits/jurisdictions		
Clinician overconfidence		
Practitioners staying in comfort zone	Comfort zone	
Infrequency of practice	Infrequency of practice	
Seen as judgement on family /caregiver	Judgement	Value-based judgement
Gestault (person centred focus on present rather than past).		
Biased application		
Socio-economic status influences		
Less SS for patients with Private insurance than with public insurance for same injury presentations		
Clinician overconfidence	Clinical judgement	
FUSS dependent on concerns on initial survey		
Based upon clinical judgement		
Social intuition still used	Intuition	
Social intuition and social information influences		

Appendix E: Questionnaire - Participant Information Sheet

"Organisational Barriers and Facilitators to the Implementation of Best Practice within Forensic Radiographic Practice"

Student: **Fiona MacGregor**
Chief Investigator: **Dr Katherine Swainston**

Hello, my name is Fiona MacGregor**.** I am a PhD student studying through the School of Social Sciences, Humanities and Law, Teesside University. This PhD entails undertaking a research project in which I would like to invite you to take part. Before deciding if you want to participate, please read the following information and discuss it with others if you wish, since it is important that you understand why this research is being conducted. Please contact me, or my supervisor, if you have any questions - Fiona MacGregor, f.macgregor@tees.ac.uk; Katherine Swainston, K.swainston@tees.ac.uk, Tel: (+44)1642 848013.

What is the purpose of the study?

Forensic imaging (radiography) is an extended role of the diagnostic radiographer who as stated within the Society and College of Radiographers/International Association of Forensic Radiographers guidelines (2014) must undertake post graduate level education and training in forensic radiography and practice and be in receipt of regular updates. In addition, such training should be demonstrated through maintenance of continuing professional development (CPD), which must be documented.

It is recognised that Forensic radiographers do not work alone but rather as an essential component of wider multi-disciplinary teams (MDTs) who's personnel will vary dependent upon the case presented. Cohesion and implementation of best practice within the multidisciplinary working relationships is essential in order to ensure that the chain of evidence collection and evaluation is undertaken with professional integrity and remains clear and unbroken.

This research seeks to explore the implementation of best practice across the full spectrum of forensic radiography settings in order to gain an insight into the organisational barriers and facilitators within these environments. It is also designed to explore education, training and CPD opportunities relating to forensic radiography within your scope of practice.

This will entail the completion of an anonymised electronic questionnaire. The questionnaire with ask for basic demographic information about yourself; age, sex, and profession (i.e. radiographer, radiologist, pathologist etc). This is collected to aid in understanding the spectrum of professionals involved in the forensic imaging pathway.

Why am I being invited to take part?

You have been invited because I believe you may be a practitioner involved in the process of forensic imaging through the scope of your practice/work. This may be in terms of the referral process, the imaging itself, the reporting of images obtained, or in any of the additional roles surrounding this area of practice.

To be able to take part you must be a practitioner involved in forensic cases in which radiography forms a part. ***Please note participation in this research is not specific to diagnostic/forensic radiographers.***

Do I have to take part?

No, your participation in this research project is entirely voluntary. By completing and submitting this online questionnaire, it is deemed that you are giving your implied consent to participate in this study.

What would I be asked to do if I chose to take part?

Your participation in this project will involve the completion of an on-line questionnaire. This will involve you answering a series of questions which will explore your awareness of best practice (guidelines) within your practice setting;

training; education and Continued Professional Development (CPD) opportunities. The questions will also explore what you have found has enabled you to implement or follow best practice and conversely what may have made this implementation challenging, in addition to an exploration of training, education and CPD that is available to you as a practitioner in the forensic radiography pathway.

This questionnaire will include a range of tick boxes and free-text boxes, in which you can expand upon answers given in the tick boxes. Please do not write anything that will enable you, your colleagues or employer to be identified, as the text boxes will be visible as presented to you. This will take approximately 20-25 minutes to complete.

Any personal data including special category data obtained for the purposes of this research is processed lawfully in the necessary performance of scientific or historical research or for statistical purposes carried out in the public interest. The processing of personal data including special category data is proportionate to the aims pursued, respects the essence of data protection and provides suitable and specific measures to safeguard the rights and interests of the data subject in full compliance with the General Data Protection Regulation and the Data Protection Act, (2018).

What are the possible disadvantages, or risks, of taking part?

There is minimal risk to participants, however it is recognised that recollection of incidents/events may cause some distress. If this were to happen, support can be obtained through your Occupational Health department (where applicable) and also through the 24-hour on-line Counsellor service (https://onlinecounsellingservice.co.uk) which offers both counselling and emotional support. Please note that there may be a fee for this service. Alternative sources of support include MIND (www.mind.org.uk) and the Samaritans (https://www.samaritans.org).

What are the possible benefits to taking part?

Whilst this research project may not be of direct benefit to you, it is hoped that the findings will directly have an influence on the development of future forensic radiography (and other healthcare) curriculum development and have an impact

upon clinical preparedness and ability to apply best practice within the clinical environments.

What would happen to the information collected about me?

The non-identifiable research data will be stored indefinitely on a secure password protected server at Teesside University. This is in case other scientists wish to raise questions about the results that need checking against the dataset. In the event that the study is published in a scientific journal, the non-person identifiable research dataset may be made publicly available (for example, as a supplement to the journal article, or stored on an on-line scientific data repository).

Personal data including special category data obtained for the purposes of this research project is processed lawfully in the necessary performance of scientific or historical research or for statistical purposes carried out in the public interest. Processing of personal data including special category data is proportionate to the aims pursued, respects the essence of data protection and provides suitable and specific measures to safeguard the rights and interests of the data subject in full compliance with the General Data Protection Regulation and the Data Protection Act 2018.

Direct quotes may be used from those given within the free-text boxes, but please be advised that whilst you may recognise them, these will not be identifiable to anyone else.

What would happen if I started, but, changed my mind?

Prior to submitting your completed questionnaire, you may withdraw at any time, without the need to provide a reason. However, once you have submitted your completed survey, it will not be possible to withdraw your submission due to this being anonymised.

What happens if there are any problems?

If you are unhappy, or there is a problem, please talk to either me or my supervisor. If you remain unhappy, or there is an issue which you do not wish to talk to me or my supervisor about please contact:

Mr Alasdair MacSween
School of Health and Life Sciences
Teesside University
Middlesbrough
TS1 3BX
Email: A.macsween@tees.ac.uk

Who has approved this study?

This study has been approved by the School of Social Sciences, Humanities and Law, Research Ethics Subcommittee.

Thank you for reading this information sheet and for considering whether or not to take part in my study. If you would like to take part then please click the 'Proceed to Survey' button.

Appendix F: Questionnaire Template

Thank you for reading this information sheet and for considering whether or not to take part in my study. If you would like to take part then please click the 'Yes I understand the above, and consent to participate' option.

1. I confirm that I have read and understood the above information. I understand that by submitting my responses to this questionnaire, I consent to participate in this study and that my answers cannot be withdrawn due to these being submitted anonymously. * *Required*

2. I confirm that I am a practitioner involved in the process of forensic radiography (imaging) through the scope of your practice. This includes occupations such as (but not exclusively): diagnostic and/or forensic radiographer, radiologist, paediatritrician, social worker, consultant, anatomical pathology technician, pathologist, anthropologist, and coroner). Please only complete if you have a role within the forensic imaging pathway, (i.e. referall, patient care, imaging, reporting, management of evidence etc) * *Required*

Page 2: General Information

This to enable the researcher to gain an overview of the scope of practitioners involved within the forensic radiography imaging pathway

3. Please tick the age range applicable to you from the list below * *Required*

- 21-30 years
- 31-40 years
- 41-50 years
- 51-60 years
- Over 60 years

4. Please select * *Required*

- Male
- Female
- Prefer not to say

5. Please state your profession * *Required*

Page 3: Best Practice within the forensic imaging pathway

This section is designed to gain an understanding of your awareness of best practice within forensic imaging pathway from the referal process, obtaining of consent, care of the patient, through to the imaging, reporting and management of evidence acquired.

6. Within your scope of practice, are you aware of best practice guidelines specific to forensic imaging and the management of forensic cases within this pathway? * *Required*

- ○ Yes
- ○ No

6.a. You have indicated that you are aware of best practice within your setting relating to forensic radiography. Please identify those that you are aware of that apply to this area?

7. Based upon your awareness of best practice for forensic imaging, to what extent are these implemented or followed within your speciality * *Required*

7.a. What factors do you feel has enabled this to happen? These may include organisational and/or personal factors.

More info

7.b. You have stated that best practice is implemented/followed 'in part', within your practice setting. From the list below please tick as many reasons that explain why this is the case

- ☐ Staffing pressures/workload constraints
- ☐ Funding issues/financial constraints
- ☐ Resources - equipment
- ☐ Insufficient appropriately qualified staff, i.e. paediatric radiologist
- ☐ Time constraints
- ☐ Insufficient training, education, CPD updates
- ☐ Conflicting agendas within the multi-disciplinary team(s)
- ☐ Lack of awareness/understanding of individuals professional roles
- ☐ Professional/personal conflicts
- ☐ Other - please state

7.b.i. If you selected Other, please specify:

7.c. From the reasons you ticked above please rank these in order of most challenging barrier to least challenging (1 being most challenging - 11 being the least)

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	1	2	3	4	5	6	7	8	9	10	11
Staffing pressures / workload constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Funding issues / financial constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Resources - equipment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insufficient appropriately qualified staff, i.e. paediatric radiologist on site	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Time constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insufficient training, CPD, education	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Conflicting agendas within the multidisciplinary team(s)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lack of understanding/awareness of individuals' professional roles	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Professional/personal conflicts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Resistance within team/department	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other - please specify	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

7.d. You have stated that best practice is 'Not implemented or followed' within your practice setting. From the list below please tick as many reasons that explain why this is the case

Please select between 1 and 11 answers.

- ☐ Staffing pressures/workload constraints
- ☐ Funding issues/financial constraints
- ☐ Resources - equipment
- ☐ Insufficient appropriately qualified staff, i.e. paediatric radiologist
- ☐ Time constraints
- ☐ Insufficient training, education, CPD updates
- ☐ Conflicting agendas within the multi-disciplinary team(s)
- ☐ Lack of awareness/understanding of individuals professional roles
- ☐ Professional/personal conflicts
- ☐ Resistance within the team/department
- ☐ Other - Please specify below
- ☐ Other

7.d.i. If you selected Other, please specify:

7.d.ii. From the reasons you ticked above please rank these in order of most challenging barrier to least challenging (1 being most challenging - 11 being the least) *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

Please don't select more than 1 answer(s) in any single column.

	1	2	3	4	5	6	7	8	9	10	11
Staffing Pressures/workload constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Funding Issues/Financial constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Resources - equipment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insufficient appropriately qualified staff, i.e. paediatric radiologist	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Time constraints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insufficient training, education, CPD updates	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Conflicting agendas within Multi-disciplinary team(s)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lack of awareness/understanding of individual's professional roles	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Professional/personal conflicts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Resistance within the team/department	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Page 4: Education, Training and Continuing Professional Development

The Society of Radiographers and International Association of Forensic Radiographers joint guidance paper - Guidance for Radiographers providing Forensic Radiography Services (2014) states that Radiographers undertaking imaging for forensic purposes must have appropriate training and education in the field of forensic practice and a good working knowledge of legislation and guidelines; and that these radiographers must maintain clinical competence and currency of knowledge as evidenced within their CPD record.

This Section seeks to explore where this has been achieved and if not what the barriers may have been to facilitating this.

8. Within your scope of practice, are you currently or have you had the opportunity to undertake any post graduate education, training or continuing professional development (CPD) training, since September 2018. ✱ *Required*

Please select exactly 1 answer(s).

- ☐ Yes - Including Post Graduate Education
- ☐ Yes - but NOT Post Graduate Education
- ☐ No

8.a. Please state the name and level of Post Graduate Education you are currently engaged with or have successfully completed since September 2018

8.b. You have indicated that you were able to undertake training and or CPD activities but not formal post graduate educaction. From the list below, please select the **ONE** reason that best applies to you for this.

Please select exactly 1 answer(s).

- ☐ Unable to fund/to expensive
- ☐ Lack of time to undertake formal study
- ☐ Unsupported by employer/department
- ☐ Personal choice
- ☐ Not required/already attained
- ☐ Other - please specify below

8.b.i. If you selected Other, please specify:

8.c. You have indicated that you have been unable to undertake any Post Graduate Education, training or CPD relating to the forensic radiography pathway within your scope of practice. Please select ALL factors applicable to your situation from the list below

- ☐ Is not considered within your scope or practice
- ☐ Lack of staff to enable attendance/engagement
- ☐ Insufficient funding
- ☐ Unsupported by employer
- ☐ Unaware of education, training or CPD opportunities
- ☐ Please use this free-text box to expand upon any of the responses selected above
- ☐ Other

8.c.i. If you selected Other, please specify:

8.d. What factors do you believe have enabled you to be able to undertake these activities? Please select ALL those that apply form the list below

- ☐ Job role - requirement
- ☐ Career progression
- ☐ Managerial / organisation encouragement
- ☐ Change of career pathway
- ☐ Personal circumstances
- ☐ Financial support, i.e. grant, bursary, employer funded
- ☐ Personal motivation
- ☐ Other

8.d.i. If you selected Other, please specify:

8.e. What do you feel would encourage or enable you to engage in formal education, training and or CPD around forensic radiography going forward? *Required

Page 5: Thank you

Thank you for participating in this project.

Remember that your participation in this questionnaire is entirely optional and you have the ability to withdraw your consent by not submitting your responses. Submission of this completed questionnaire demonstrates your consent to participate in this study. Once you have submitted your answers, your consent cannot be withdrawn because it will not be possible to remove your anonymised answers from the data. As such please do not submit your answers if you do not consent.

If you have any further questions or would like to discuss anything in respect of this survey, please contact Fiona MacGregor (f.macgregor@tees.ac.uk), or Katherine Swainston, email (k.swainston@tees.ac.uk)

Appendix G: Consent Form Template – Interviews

Research Title: "**Organisational Barriers and Facilitators to the Implementation of Best Practice within Forensic Radiographic Practice"**

Student: **Fiona MacGregor**
Chief Investigator: **Dr Katherine Swainston**

Please **initial** the boxes to indicate your agreement with the corresponding statements.

- I confirm that I have read and understood the Participant Information Sheet for this study ***(insert date).*** I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
- I confirm that I meet the inclusion criteria for participation in this study. ☐
- I understand that data collected during the study may be looked at by individuals from Teesside University where it is relevant to my taking part in this research. I give permission for these individuals to have access to that data. ☐
- I understand that my participation is voluntary, that I do not need to answer any question I am uncomfortable with, that I am free to withdraw at any time (or where appropriate, up to commencement of data analysis ***(insert date)*** without giving any reason. ☐
- I understand that participation in this research is confidential, and all information collected as part of this research will be stored in accordance with the Data Protection Act and the General Data Protection Regulations 2018. ☐
- I agree to have the interview audio recorded, and for this to be transcribed. I am aware that I have the right to edit the transcript of this interview group upon completion. ☐
- I understand that my data will be anonymised but linked to me through a Unique Reference Number (URN) which will be stored separately from the data. ☐

I agree to take part in this study

Name of Participant ..... Signature.....

Date .....

Name of Researcher ..... Signature.....

Date .....

Appendix H: Interviews - Participant Information Sheet

Unique Reference Number (URN): ……

"**Organisational Barriers and Facilitators to the Implementation of Best Practice within Forensic Radiographic Practice"**

Student: **Fiona MacGregor**
Chief Investigator: **Dr Katherine Swainston**

Hello, my name is Fiona MacGregor**.** I am a PhD student studying through the Population Health Sciences Institute, Newcastle University. This PhD entails undertaking a research project in which I would like to invite you to take part. Before deciding if you want to participate, please read the following information and discuss it with others if you wish, since it is important that you understand why this research is being conducted. Please contact me, or my supervisor, if you have any questions - Fiona MacGregor, f.macgregor2@newcastle.ac.uk; Katherine Swainston, kate.swainston@newcastle.ac.uk, Tel: (+44)191 2080571

What is the purpose of the study?

Forensic imaging (radiography) is an extended role of the diagnostic radiographer who as stated within the Society and College of Radiographers/International Association of Forensic Radiographers guidelines (2014) must undertake post graduate level education and training in forensic radiography and practice and be in receipt of regular updates. In addition, such training should be demonstrated through maintenance of continuing professional development (CPD), which must be documented.

It is recognised that Forensic radiographers do not work alone but rather as an essential component of wider multi-disciplinary teams (MDTs) who's personnel will vary dependent upon the case presented. Cohesion and implementation of best practice within the multidisciplinary working relationships is essential in order to

ensure that the chain of evidence collection and evaluation is undertaken with professional integrity and remains clear and unbroken.

This research seeks to explore the implementation of best practice across the full spectrum of forensic radiography settings in order to gain an insight into the organisational barriers and facilitators within these environments. It is also designed to explore education, training and CPD opportunities relating to forensic radiography within your scope of practice.

Why am I being invited to take part?

You have been invited because I believe you may be a practitioner involved in the process of forensic imaging through the scope of your practice/work. This may be in terms of the referral process, the imaging itself, the reporting of images obtained, or in any of the additional roles surrounding this area of practice.

To be able to take part you must be a practitioner/worker involved in forensic cases in which radiography forms a part. ***Please note participation in this research is not specific to diagnostic/forensic radiographers.***

Do I have to take part?

No, your participation in this research project is entirely voluntary. If you do decide to participate, please note that you may withdraw your involvement at any time during the interview without giving a reason. Your contributions made prior to your withdrawal will not be included within the data collection.

What would I be asked to do if I chose to take part?

A mutually convenient interview date, time and location will be confirmed with you. Your interview is expected to last for approximately 45 mins to 1 hour. During this time, you will be asked questions by Fiona MacGregor (facilitator) in which you will be expected to share your experiences and opinions around best practice within forensic imaging. There are no right, or wrong responses and your opinions will be

respected and valued. There are no questions within this session that will cause embarrassment or put your employment at risk.

The interview will be audio visually recorded and field notes will be taken by the facilitator during the session. The recording will be used to enable a verbatim transcription into print, for review by the researcher. You will receive a copy of the transcription which you may check for accuracy and provide written comments on. It is advised that whatever is said within the interview must remain confidential, with no aspect divulged outside of the session.

Any personal data including special category data obtained for the purposes of this research is processed lawfully in the necessary performance of scientific or historical research or for statistical purposes carried out in the public interest. The processing of personal data including special category data is proportionate to the aims pursued, respects the essence of data protection and provides suitable and specific measures to safeguard the rights and interests of the data subject in full compliance with the General Data Protection Regulation and the Data Protection Act, (2018).

The maintenance of your confidentiality is a priority however where unsafe or unprofessional practice is disclosed, your confidentiality may have to be breached. Such concerns would be raised with the Chief Investigator who would follow this up in accordance with the applicable guidelines.

What are the possible disadvantages, or risks, of taking part?

There is minimal risk to participants, however, it is recognised that recollection of incidents/events may cause some distress. If this were to happen, support can be obtained through your Occupational Health department (where applicable) and also through the 24-hour online Counsellor service (https://onlinecounsellingservice.co.uk) which offers both counselling and emotional support. Please note that there may be a fee for this service. Alternative sources of support include MIND (www.mind.org.uk) and the Samaritans (https://www.samaritans.org).

What are the possible benefits to taking part?

Whilst this research project may not be of direct benefit to you, it is hoped that the findings will directly have an influence on the development of future forensic radiography (and other healthcare) curriculum development and have an impact upon clinical preparedness and ability to apply best practice within the clinical environments.

What would happen to the information collected about me?

All information collected will be stored indefinitely on a secure password protected server at Teesside University. This is in case other scientists wish to raise questions about the results that need checking against the dataset. In the event that the study is published in a scientific journal, the non-person identifiable research dataset may be made publicly available (for example, as a supplement to the journal article, or stored on an on-line scientific data repository).

You will not be personally identifiable within the typed transcription, or in subsequent written or verbal accounts, as you will be allocated a pseudonym. The recording and transcript will only be accessed by the researcher and research team, and neither your name nor other means of personal identification will appear in the printed copy. A paper(s) and presentations will be printed on conclusion of this research, and while you may recognise comments that you made during the interview, your name and place of practice will not be identified thereby ensuring confidentiality and anonymity.

Personal data including special category data obtained for the purposes of this research project is processed lawfully in the necessary performance of scientific or historical research or for statistical purposes carried out in the public interest. Processing of personal data including special category data is proportionate to the aims pursued, respects the essence of data protection and provides suitable and specific measures to safeguard the rights and interests of the data subject in full compliance with the General Data Protection Regulation and the Data Protection Act (2018).

What would happen if I started, but changed my mind?

If you decide to take part, you can withdraw at any point before or during the interviews, and up to four weeks after the date of your interview, without giving a reason. There will be no negative impact on you, or your care, if you choose not to take part or to withdraw from the study. You can withdraw by contacting Professor Ryan using the contact details at the bottom of this information sheet and quoting your participant ID number (at the top of first page of this information).

Debriefing

At the end of the focus group there will be a debriefing session, which will also be audio visually recorded. This will enable a collective evaluation of the quality of the session and provide an opportunity to check responses and aid in improving the skills of the facilitator.

What happens if there are any problems?

If you are unhappy, or there is a problem, please talk to either me or my supervisor. If you remain unhappy, or there is an issue which you do not wish to talk to me or my supervisor about please contact:

Chair of the Faculty of Medical Sciences Ethics Committee
Email: fmsethics@ncl.ac.uk

Who has approved this study?

This study has been approved by the Newcastle University Faculty of Medical Sciences Ethics Committee.

Thank you for reading this information sheet and for considering whether to take part in this study. If you have any questions the Chief Investigator Dr Katherine Swainston can be contacted via kate.swainston@newcastle.ac.uk.

Appendix I: Interview Topic Guide

Note: This is for the undertaking of semi-structured interviews, therefore these formed the basis for the questions asked but further questions could be asked, based on the responses received.

These questions are based on the initial data from the Phase 1 JISC online questionnaire, using a format suggested by Krueger and Casey, (2015).

Engagement Question

1. What attracted you to become involved in forensic practice?

Transition Questions

1. What areas of forensic practice do you have experience in?

2. What other areas of forensic radiography would you be interested in undertaking?

Exploration Questions

Best practice/guidelines

1. From your own practice in the forensic imaging process can you share your experiences and awareness of best practice implementation.

2. It is noted that some practitioners have found that best practice is only partially followed in practice – from your own practice experiences please identify any reasons you may be aware of for this.

3. From your experiences of being involved in the forensic imaging process what issues have you faced in practice; this may be from colleagues/organisational level etc?

Formal Training/CPD

1. What training opportunities would you like/ feel would be most beneficial to you, moving forward in your practice setting?

2. What factors do you believe would enable you to undertake formal post graduate training?

3. From your own experiences, what do you feel has prevented or supported you in undertaking the training that you would have liked?

Exit Questions

2. Is there anything else you feel that you would like to add about your experiences of best practice implementation in forensic radiography?

3. Is there anything else you would like to add in terms of making best practices and guidelines more accessible?

4. Is there anything else you feel you would like to tell me about your forensic radiography training experiences or future training that you feel would be most useful?

Appendix J: An Exemplar of the Analysis Process Applied Through Each Stage of Data Collection

In Chapter 3 Methodology, Section 3.3. (p. 49) a sequential multi-methods design was applied to the three phases of data collection. This facilitated an analytical process to taken across these phases culminating in the development of the conceptual model of "Acceptance of Adversity" through thematic analysis. Figure 7.1 illustrates the researcher's thought process, through one example.

In Chapter 2 (Literature Review) through application of Inductive Content Analysis, the conceptual category of "*ineffective organisational governance"* was developed, encompassing lack of standardised guidelines, protocols and approaches to forensic imaging.

The questionnaire phase (Chapter 4) saw the topic design premised on the findings of Chapter 2. Through inductive narrative synthesis a theme of '*organisational and radiographic community awareness and understanding*" was developed. This encompassed departmental knowledge and understanding and the need for named individuals in specific roles.

In the interview phase (Chapter 5) using inductive thematic analysis one of the four themes developed was that of "*organisational constraints.*" This theme encapsulated three codes, skills mix, staffing constraints and resource limitations.

These three findings were synthesised, forming a concept and ultimately a component within the conceptual model.

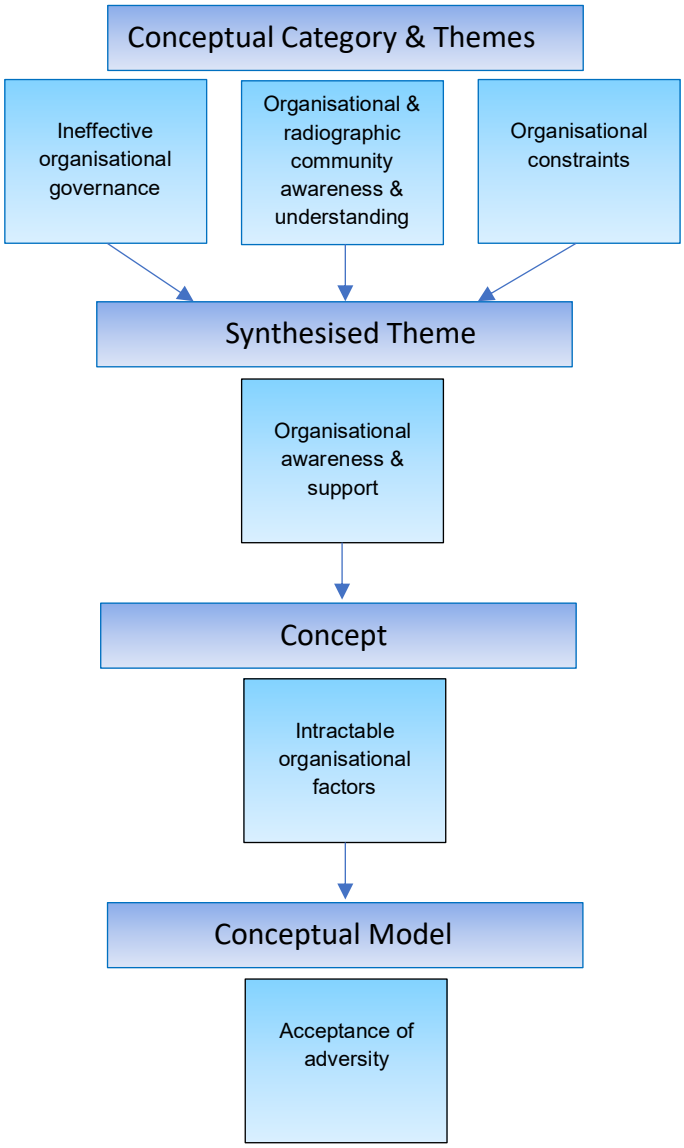

Figure 7.1: *Diagrammatic illustration of thought process showing analysis processes through one theme*

Appendix K: Ethical Approval – Teesside University

Confirmation of research ethics Clearance

Dear Fiona MacGregor

Re: Project Title: Organisational barriers and facilitors to the implementation of best practice within forensic radiography practice **; Review Reference:** 2020 Nov 1669 MacGregor

Your application has been reviewed and I can confirm that **this study has received research ethics Clearance** and can proceed as soon as you receive this confirmation.

This document can be used as evidence of authorisation.

Please note that if you need, in the future, to make any amendments to your study details now that it has been approved, you should contact the Chair Dr Katherine Swainston to notify the Committee and then forward the required amendments as a document to ERMHelp@tees.ac.uk so that the amendments can be added to your approved application.

Yours sincerely,

Dr Lee Copping (SRESC Member)

on behalf of

SSSHL Research Ethics sub-Committee

Appendix L: Ethical Approval – Newcastle University

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval.

Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you.

Please complete the declaration to submit your application.

Declaration

I certify that:

(11314)
Type: (M/multiple-opt)

[X]

the information contained within this application is accurate. (11441)

[X]

the research will be undertaken in line with all appropriate, University, legal and local standards and regulations. (11442)

[X]

I have attempted to identify the risks that may arise in conducting this research and acknowledge my obligation to (and rights of) any participants. (11443)

[X]

no work will begin until all appropriate permissions are in place. (11444)