Development and Evaluation of a Quality Assurance Programme for a Radiology Department

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<tr>
<td>ALARP</td>
<td>As Low As Reasonably Practicable</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CFO</td>
<td>Chief Finance Officer</td>
</tr>
<tr>
<td>CIS</td>
<td>Clinical Information System</td>
</tr>
<tr>
<td>CS</td>
<td>Clinical Specialist</td>
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<tr>
<td>COO</td>
<td>Chief Operations Officer</td>
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<tr>
<td>CPD</td>
<td>Continuous Professional Development</td>
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<td>CS</td>
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<tr>
<td>C&amp;H</td>
<td>Clinical and Healthcare</td>
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<tr>
<td>ED</td>
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<td>EUROSOCAP</td>
<td>European Standards on Confidentiality and Privacy in Healthcare</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>H-QAP</td>
<td>Hospital Quality Assurance Programme</td>
</tr>
<tr>
<td>HIQA</td>
<td>Hospital Information and Quality Authority</td>
</tr>
<tr>
<td>HIPPAA</td>
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<td>HR</td>
<td>Human Resources</td>
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<td>Health Service Executive</td>
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<tr>
<td>ICT</td>
<td>Information Communication Technology</td>
</tr>
<tr>
<td>IPEM</td>
<td>Institute of Physics and Engineering in Medicine</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>Abbreviation</td>
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I would like to dedicate this PhD thesis to my family.
Declaration

The work presented in this thesis is entirely my own work. It has not been submitted previously to this or any other institute for this or any other academic award. Where used has been made of the work of other people, it has been acknowledged and referenced.

Signed: ___________________________  Date: ______________________

Martha Lötter
Abstract

Design and Implementation of a Quality Assurance Programme for a Radiology Department (RAD-QAP).

Abstract—This thesis describes the development, implementation and evaluation of a quality assurance programme for a radiology department. This research project reviewed relevant standards, legislation as well as recent high-profile enquiries into serious incidents in radiology and compared existing health care quality performance measurement systems, exploring their relevance. A method to select a set of appropriate key performance indicators (KPIs) to measure and improve the quality of the service where it most needed has been derived (see section 5.1.5) quality assurance scorecard for radiology (QASC) is the chosen data collection tool and provides a central point for data collection and quality improvement (QI) tracking. This measures the aspects of radiology that enable and support a high-quality radiology service. The set of selected KPIs were mapped to health standards, presenting scorecards specifically for a radiology department initially, and then scorecards for the next level of management were developed.

RAD-QAP presents a structure with seven components to measure, within a predefined framework, process outcomes against set targets by utilising a set of specific key performance indicators. Following an action research methodology, RAD-QAP was implemented and evaluated in a live clinical environment to assess effectiveness for measuring quality to assure continuous quality improvement in radiology. The quality assurance programme commenced at a baseline, followed by quality improvement initiatives for non-compliant KPIs. A justification system for the different levels of quality achieved i.e. level 1 = Emerging Quality, Level 2 = Continuous Quality, level 3 = Sustained Quality and the achievement of Excellence at level 4 is included as part of RAD-QAP. This system was adapted from the QA Tool developed by the HSE. The tool is mapped to themes of the national health care standards [247]. An escalation Model for non-performance is also part of the programmed.

Keywords—hospital quality plan; clinical audit; clinical data quality; data quality; quality processes; software systems, radiology key performance indicators, health care quality measurement systems, radiology quality metrics, radiology software standards, clinical software systems and data.
Chapter 1 Introduction

The institute of medicine states that “because of the high cost of medical imaging and the many opportunities for medical errors in radiology, we are clearly in the crosshairs in the quality and safety debate [2]. It goes on to highlight that “the radiology community must take the lead in developing solutions and do so quickly. Therefore, the development of an effective quality assurance programme for a radiology department is an issue of great and growing importance throughout health care services [1].

Review of the medical literature presents many reports identifying the suboptimal processes of care that can lead to patient harm. Radiology provides a core service to medicine and surgery many examples of suboptimal processes can be found in the literature [1]. According to [1] “communication of errors, the root cause of many sentinel events, can be traced to radiology reports where clinicians were not aware of a serious report finding”.

Medical inquiries establish causes of accidents, injuries, and near misses in the clinical field, and have been influential in changing hospital culture and medical legislation [3]. International inquiries such as the Francis Report [4] into the failings of the standard of patient care and a report from the Institute of Medicine into Health IT and Patient Safety highlighted the need to have checks and balances in place to encourage patient safety in the hospital environment [5]. The Institute of Medicine [2] provided evidence of the sub-standard healthcare in the United States and the high number of medical errors that result in patient death or injury.

Risk management [6] is a very important factor in patient safety. Patient safety, effectiveness, efficiency; timeliness, equity, and patient centeredness are key quality dimensions’ and form part of a holistic quality assurance programme [7]. In Ireland; national inquiries including the radiology review of chest x-rays and computer tomography (CT) scans [7], the Hayes Report [8] and the Portlaoise Report [9] put emphasis on managing risk for delayed diagnosis by prioritising clearing the backlog of unreported images as an immediate action. They also identify workforce planning as an integral part of management which should be given consideration in planning new services and expansion of current services. The importance of maximising existing resources by optimising the efficiency of the workflow practices is listed as a priority in [10]. Other reports identify suboptimal radiology processes of care that cause patient harm for e.g. misidentification of patient images and sub-optimal images that can lead
to misdiagnosis to the wrong patient. In fact, “the lack of useful outcome data in the scientific literature and in the evaluation of specific local practices reveals a staggering lack of actionable information” [1].

The dangers of ionising radiation are well documented and are one of the reasons why a quality assurance programme for a radiology department should be prioritised. Radiation dose to the patient must be justified and the benefits must outweigh the harmful effects of radiation [29]. This is not withstanding clinical justification of each radiology request. There is ample opportunity for error from patient registration to the production of the radiology report [8] [103]. Patient miss-identification, correct procedure to be carried out on correct patient and report returned to the correct referrer in a timely manner. Each collection point is an opportunity for error. Publications by [24] focus on the enormity of the issue of safety in medical health care as many patients die each year from medical errors that were preventable. The radiology department poses distinct risks that can result in unplanned adverse medical outcomes. Radiology departments have developed to include a variety of different modalities to produce diagnostic images which create quite a large and diverse composition of activities that can lead to errors. The pressure to increase efficiency at reduced cost introduces more stress into the equation. Radiology staff are expected to perform a large number of examinations that includes a variety of complex activities such as the administration of intravenous contrast media as well as operating complex scanners and software systems that involves the delivery of high dose ionizing radiation, needles and sophisticated medical equipment and interventional clinical procedures etc. to obtain the required images.

[1] states that “there are probably many ways to consider quality in radiology …the approach for each of these are different and needs different knowledge base”. There is no standardised approach to quality management in radiology identified [1] [24].

The literature points out that the proliferation of computerized networks in healthcare has created enormous amounts of data which makes the selection of key performance indicators (KPIs) difficult as some metrics might be easy to select but might not be meaningful in yielding much needed quality improvement. Ireland's health information quality authority and [20] [21] reiterate that “important KPIs such as interpretation accuracy, patient outcomes, professionalism and communication are difficult to measure”. There is also the possibility of incorrect measurement and the possibility of manipulation the KPIs to maximise personal reward rather that improve the system [1]. As technology is central to any radiology
department, legal requirements for the management of software systems were included in the review. [31] points out the need for one single point of control and review to assure the quality of clinical care in a radiology department.

The goal of this research is to develop a quality assurance programme to manage quality and risk by utilising a set of relevant key performance indicators to measure quality against set targets. The framework focus on utilizing information produced by the different software systems by extracting key performance measurements, in particular, the national image management system (NIMIS), to support quality improvement of patient care in the radiology setting. The solution should “act as the “cockpit” of the radiology department where the metrics are the flight instruments enabling the provision of health care based upon continuous process and structure refinement. This framework must allow for the discovering of existing information and should create new knowledge that will stimulate quality improvement by reusing and reassessment of information [21].”

This programme was developed after an extensive literature review and a study of existing practices and other existing quality programmes described in a clinical environment. Research was undertaken in the live clinical environment of a radiology department as well as a mapping study against healthcare quality standards and the department quality profile. RAD-QAP includes the development of a radiology quality assurance scorecard with a set of radiology specific KPIs to establish a baseline for quality performance in the radiology department. The analyses of the measurements stimulate the development and implementation of quality improvement Plans. The effectiveness of RAD-QAP as a quality assurance programme was evaluated in the action research phase of this project. Using an action research cycle the programme was implemented and analysed at departmental level [24] [25] [26].

In building, RAD-QAP the research:

- Profiles the service delivery and the service received by the patient,
- Develops resource analysis with capacity /demand studies as part of the model,
- Develops a template for selection of appropriate radiology KPIs,
- Develops a holistic radiology quality assurance programme,
- Achieves quality assurance through continuous KPI measurement that stimulate appropriate quality improvement plan development to address any non-compliant KPIs
• Aligns the hospital and radiology departmental governance structure with the radiology quality assurance scorecard and data collection points,
• Aligns selected KPIs with the operational and service plan of radiology that in turn aligns with the priorities of the organisational service plan.

This radiology quality assurance programme (RAD-QAP) is proposed within the context of an Irish Research Council employment-based research funded project in partnership with the hospital. The aim was to enhance the radiology healthcare system driven by research that is applicable to a quality shortfall in the hospital domain and that could produce implementable solutions to improve patient safety as well as the conduct and volume of clinical research in Ireland [22].

1.1 Problem Statement

The absence of baseline quality data with set targets and timeframes to measure against makes it impossible to prove a measurable improvement in quality over time [44] [187]. There are currently no set timeframes in place to govern the production of quality data, let alone standardised statistical methods for analysis and interpretation [1].

“Informatics could improve and streamline quality initiatives in radiology significantly” [197]. NIMIS collects vast amounts of information that is not applied and used for quality improvement [8]. There is no standard approach to quality management in a radiology department to measure the quality of patient care [29] [31] [34] [7] [8] [9] [103]. The goal of this research is to develop a quality assurance programme for a radiology department.

1.2 Overview of Proposed Solution

The development of a radiology quality assurance programme was required to achieve the goal of quality assurance in the radiology environment. The programme consists of seven components, applied in sequence to assure the standard of patient care is controlled by KPI measurement. It includes the dimensions of care as stipulated by national health care standards [193]. The seven components are: authority component, structure component, quality profiling component, quality data component, quality improvement validation component, quality verification component and quality assurance component as demonstrated in Figure 7.1.
This four-phase mixed methods research project has iteratively produced four versions of RAD-QAP. Phase 1-3 were carried out in 3 hospitals that included 2 model 2 sub-acute hospitals and 1 model 4 acute hospital. The action research in Phase 4 was carried out in the model 4 radiology department in an acute hospital. The researcher is a qualified radiographer and radiation therapist having worked in the different departments of radiology including magnetic resonance imaging (MRI), nuclear medicine, computer tomography (CT), accident and emergency (A&E) department and theatre. The absence of a co-ordinated quality assurance programme in radiology was observed across the different modalities. The site visits provided observational case studies that confirmed the same quality shortfall in 2 other radiology departments that were visited as part of the initial research phase.

The analysis of literature into existing quality assurance programmes for radiology, as well as analysis of national standards and legislation, produced research questions. White papers presenting high profile inquiries into failures in radiology and healthcare in Ireland [7][8][9], the United States of America [2][3][5] and England [4] were reviewed and indicated that there were international concerns in relation to the method of selecting the relevant KPIs to manage quality in radiology [20]. An extensive systematic literature review was carried out to identify any existing radiology specific key performance indicators that could be used to construct an initial model of RAD-QAP. The output from the literature review, legislation, standards and inquiries review was RAD-QAP version 1.

The second phase of the research involved an analysis using the site visits, interviews, hospital observational case studies, and service analysis with participant observer Delphi studies. In-house observational case studies were conducted to assess whether the findings from the literature corresponded to the reality of the domain. RAD-QAP requires a measurement system that depends on the selection of appropriate radiology specific key performance indicators (KPIs) to measure the structure, process and outcome for the various activities in a radiology department. It measures the quality performance of the enablers responsible for the delivery of a high-quality health care service i.e. the structure including finance, human resources, equipment, technology infrastructure, staff, and training. It includes the process indicators such as turnaround times and productivity while outcome indicators concentrate on patient/staff satisfaction, clinical accuracy, and risk. The KPIs and metrics are designed to reflect the true context and reality of each quality dimension being measured. Capacity and workforce planning are also included in the quality assurance programme [6]. The Delphi study reduced the number of KPIs to a manageable number. This
process provided a standardised method to select a set of relevant KPIs for a radiology department. This produced RAD-QAP Version 2.

The next step involved the model being mapped to quality standards, health care standards and a hospital quality assurance plan. A gap analysis was performed to compare RAD-QAP with the national health care standards. A quality scorecard was constructed as a result. RAD-QAP version 3 was the output of this phase. In the fourth and final phase the model was implemented and evaluated through action research in a live radiology department in a model 4 acute hospital setting. This phase produced the final version of RAD-QAP.

Technology support provides the necessary KPI measurements to populate the scorecard, which is an integral part of the programme. The programme implies continuous review, with risk assessment, quality improvement plans and appropriate monitored actions according to the results. It also necessitates the development of appropriate governance structures and alignment with core functions and reporting relationships in specific departments across the hospital.

1.3 Contribution

RAD-QAP has been developed, implemented and evaluated in a large acute radiology department. The development of RAD-QAP contributed to research in establishing a working model with a template to guide implementation (chapter7) consisting of the following:

- A radiology quality assurance programme, consisting of 7 components and requirements with a step by step template to guide implementation
- A method to select a set of appropriate radiology specific KPIs,
- An example of a quality assurance scorecard as a central data collection tool,
- An illustration of how the resultant programme can be assessed.

1.4 Scope of the Work

The research described in this thesis mainly focuses on the development of a quality assurance programme consisting of 7 components with specific requirements to manage quality in a radiology department. It includes a quality profiling component that facilitates the selection of a set of relevant KPIs for a radiology department to allow measurement in the
areas where it is needed most. A quality assurance scorecard was included as a central data collection tool. The scorecard measures the quality of radiology as a collective, and not do not focus on individual performance measurements. The KPIs concentrated on issues that represented highest risk to the organisation. [82] [83] [84].

1.5 Research Questions

Building on the review of academic literature, standards, and regulations, national and international inquiries the research questions; for this thesis have been derived as:

Research Question 1: What aspects of radiology need to be measured in a quality assurance programme for continuous quality improvement?

Research Question 2: What are the measures associated with those aspects?

Research Question 3: How should the process of measurement be structured in conjunction with continuous improvement?

Research Question 4: What is the impact of such a programme?

1.6 Thesis Structure

The remainder of the thesis has been structured and presented in the following manner:

Chapter 2: Literature Review.

This chapter begins with an overview of the definition of quality. The published literature on quality assurance programme to the field of radiology is reviewed. The gaps in the literature are identified and discussed. The chapter reviews the literature in relation to quality performance measurement, the different KPIs and metrics that can be selected to measure quality performance and continuous quality improvement in radiology. The chapter finally describes the literature in relation to the role technology plays in quality control and quality assurance and verification in acute hospitals.

Chapter 3: Research Methodology. This chapter discusses a selection of research methodologies. The methodology chosen for this research is discussed in detail. The research questions are presented, and the suitability of the chosen methodology to provide the required
answers is defended. The chapter concludes with a description of how the research questions were answered through application of the chosen research methods.

Chapter 4: Description of the Domain. Chapter 4 describes in detail the domain where the research took place. The changes in management to the domain throughout the course of the research are also described.

Chapter 5: Research Findings from Phases 2&3. Chapter 5 details how the RAD-QAP structure was designed and developed to this stage.

Chapter 6: Implementation and evaluation of RAD-QAP. The chapter described how the programme was implemented and evaluated in the radiology department. Changes were made at various stages of the action research project and are presented with the reasons for and associated impacts of the changes.

Chapter 7: Description of RAD-QAP. This chapter provides a detailed description of RAD-QAP discussing an overview of each component of RAD-QAP and their significance in practice.

Chapter 8: Summary and Conclusions. The final chapter outlines how the research questions of the thesis were answered, the contributions to learning the limitations of the research and the recommendations for future research.
Chapter 2  Literature Review

2.1  Introduction

A literature review on current published material, international and national, relating to quality in radiology and in health care pertaining to the acute and the sub-acute hospital setting was undertaken. The objective of the review was to identify, review and evaluate literature that explores the successful development and implementation of a radiology quality assurance programme. The research also informed on the existing radiology standards, status of recent inquiries and relevant Irish legislation. Radiology standards, Irish legislation, radiation protection and health care software systems legislation were reviewed.

2.2  Review Protocol

Publications ranging from single case studies of individual projects to retrospective reviews of departmental quality programs were researched. National and international literature were included in the review. The articles represented the views of medical consultants as well as professions allied to medicine from mono-disciplinary to multi-disciplinary projects. Key published documents were selected to provide the necessary guidelines for the development of the quality assurance programme [23] [27]. Following the review of published articles, standards and legislation and high-profile inquiries into failings in radiology, it was concluded that there were many different approaches to quality management in radiology. The academic literature review included English language publications from 1992-2016. A comprehensive search was conducted of PUBMED, IEEEXplore, specialist medical informatics databases and relevant international conference proceedings. Keywords were hospital quality plan; clinical audit; clinical data quality; data quality; quality processes; software systems, radiology key performance indicators, health care quality measurement systems, radiology quality metrics, radiology software standards, clinical software systems and data. The objective of the review was to identify, review and evaluate literature that specifically explores the use of quality assurance programmes in a live radiology department of an acute hospital. The necessary building blocks, as well as correct configuration required for an optimum quality assurance programme for a radiology department, in particular, the selection of the relevant KPIs was investigated.
Inclusion/exclusion criteria to reduce the number of studies were applied. Articles on film-based radiology departments were excluded. Peer reviewed journal articles and conference papers that reviewed processes or methods of quality assurance and management of software systems were included. Papers describing how a system affected quality of care or outcome, but not discussing the selection of the KPIs, were excluded. Papers describing the development of a quality assurance programme but not the implementation were excluded.

The reference lists included studies that were reviewed to identify further studies and forward citation tools were applied to achieve a comprehensive literature review.

2.3 Overview of Literature

Literature Review Summary

On reviewing the publications that assess the current management processes around quality in radiology in the acute hospital setting, there appears to be a lack of standardised methods for quality assessment of standards and quality in radiology [29]. There is evidence of risks associated with a modern radiology department that will dictate the outcomes in the clinical domain i.e. risks associated with the staff, the patient, equipment and the associated technology in the hospital environment [1] [23] [29]. Despite being aware of the risks present in a radiology department formal, evaluation of risk was not routine [8] [9] [23]. Review of the literature, however, identified no standard approach to quality assurance in radiology. The review provided an understanding of quality in the various fields that combine to make up the hospital environment.

On reviewing the publications exploring existing quality assurance programmes for a radiology department there appears to be a lack of scientifically sound metrics to measure quality in a radiology department [32]. [1] states that “the lack of actionable data in the scientific literature and in the evaluation of practice reveals a staggering lack of actionable data “.

The concept of proactive risk management such as identification of risk, quantification and evaluation of risk and consideration of measures to eliminate or control risk in a radiology setting is strongly emphasized in the literature [6]. In addition, it was noted that information technology is often under or inefficiently used in quality management [32] [8]. [34] states that “informatics methods should not be regarded as futuristic developments on the horizon;
such applications are already in routine use in other medical areas...quality is not just a goal, it’s our responsibility, and deploying informatics methods will help us achieve our objectives”.

Legislation requires every radiology department to be involved in audit [14] [15] [16] [19]. Radiography imaging protocols must be developed using the European guidelines on quality criteria for diagnostic imaging [33].

This was found to be the case for radiology departments in general. Irish hospitals were found to be inconsistent in adhering to standards and in some instances, they are non-existent. [8][7][2][5] [103].

The remainder of this chapter divides the literature into five parts.

Section 2.4: Quality in Radiology- Provides an overview of quality issues in radiology, where they fit into the hospital domain, how quality can be measured and managed with appropriate actions that contribute to quality and success.

Section 2.5: Quality Assurance and Verification – Describes clinical governance, clinical health care audit and the relevance of quality verification to achieve quality assurance. It also describes the hospital environment, stakeholders, quality and risk management in that environment that allows clinical Governance to be achieved.

Section 2.6: Legislation and Standards in Radiology- Provides an overview of international and national standards and legislation for radiation safety in Radiology, it describes the significance of healthcare standards and how it can be used to improve patient care.

Section 2.7: Risk Management in Radiology- Provides an overview of the integrated quality and risk framework, how quality shortfalls are identified, and how they are addressed.

Section 2.8: Data and Information- discusses information and data and what constitutes quality and success of information. Various types Hospital Information Systems are also described.

Section 2.9: Technology in Radiology- An overview of clinical information systems are described in this section. Factors contributing to the use of data captured by information systems in radiology are discussed.
Section 2.10: I.T Adoption and Infusion and Impact on Quality - Describe the current state of I.T. adoption and infusion in healthcare, in particular Radiology. The human and financial factors and their impact on adoption and infusion are illustrated.

2.4 Quality in Radiology

There are several definitions found in the literature that describe quality in radiology. “It starts when the physician first decides that imaging might contribute to the patient care and only ends when the same physician gets the report” [161]. “Quality is the extent to which the right procedure is done in the right way, at the right time and accurately and quickly communicated to the patient and referring clinician” [31] [33] [34].

The following components are required for quality in radiology once the clinician has referred the patient for imaging [34] [35]:

a) Appropriateness of examination, [34] states it is expressed by the term “the right way” – the appropriateness of the examination requested by the referring clinician and the appropriateness of the imaging protocol. Referring clinicians must “be knowledgeable about which imaging procedure is appropriate for each clinical indication” [34]. The correct type of test must be requested by the referring clinician. Comprehensive clinical details must be provided by the referring clinician to allow the radiologist to justify the study and the radiation involved. “The right way” refers to “the selection of correct protocol for the procedure that needs to be communicated to the radiographers who will perform the study” [34].

b) Process of interpretation, “correct interpretation” means that the radiologist needs to accurately perceive and interpret the image [34].

c) Communication of results is expressed by the term “accurately and quickly” meaning once the radiologists have completed the result (critical vs. non-critical) must be communicated to patient and correct referring clinician in a timely manner [34].

d) Measuring and monitoring performance is expressed in quality, safety and efficiency. The accuracy of the radiology report is ultimately the measure that the radiologist performance is based on as well as unintended complications during interventional studies
[34]. Safety is covered by repeated monitoring and auditing of protocol compliance and patient outcomes.

[1] points out that these aspects should be included in a radiology quality assurance programme as it details the sequence of events for the patient in radiology, “Quality is a never-ending cycle of continuous improvement” [35]. According to the Institute of Medicine “Quality care is patient-centered, timely, efficient, effective, safe and equitable” It is also coordinate, compassionate and innovative”. It is highlighted that the latter aspect of the definition of quality is not measured and at risk of being ignored [3].

“A ‘quality and safety culture’ supports and values learning, particularly learning from situations when things go wrong. Promoting and reinforcing this culture requires effective governance, clear accountability and robust leadership from healthcare professionals and managers at all levels of the organisation. However, a quality and safety culture also recognises that the quality and safety of services is the responsibility of everyone within the service” [19] [35].

There is a distinct difference between service quality and service delivery. “Service quality is part of service delivery, and thus one of the components of service delivery. Service quality can be defined as service that meets and exceeds the needs and expectations of a customer, while customer service can be defined as the ability of the organisation to constantly and consistently exceed the customers/patients’ expectations” [36] [37].

The quality shortfalls identified in the literature points to inadequate resources/capacity to service the demand for diagnostic imaging. Hence access to the service is a main concern [7]. Long waiting lists and a backlog of unreported images are highlighted in the literature [8]. Delayed diagnosis is also a serious failing in the current system [9].

Interpretational errors made by radiologists were also emphasised in the literature. The following points were listed as key priorities.

- Provision of structured reports,
- Communication of critical results,
- Holding peer-view and discrepancy meetings,
- Prioritising of training in areas as is required and recommended by national inquiries [8] [7].
2.4.1 Concepts in Quality Improvement

**Quality assurance means (QA)** assurance of minimum quality standards as set by external regulatory bodies and enforced by accreditation or certification combined with regular inspections [37]. According to [8] [11] [33] quality assurance is achieved by having set procedures based on protocols with regular checking and feedback as well as certification.

**Quality improvement (QI)** initiatives lead to quality improvement that focuses on processes of delivery of care and measured against performance indicators in radiology. The latter is managed as part of the total quality management which aims to continuously improve the quality of the variety of quality activities, as oppose to assuring it.

**Continuous quality improvement (CQI)** is achieved by continuously, collecting and analysing data, implementing and experimenting with different solutions through teamwork to improve quality [37].

**Quality validation (QVA)** “Validation is the confirmation, through objective evidence, that the system will perform its intended functions. The intended functions, and how well the system performs those functions, are determined by the customer.”

**Quality verification (QVE)** “Verification is the confirmation, through objective evidence, that the specified requirements have been fulfilled. Verification tasks point back to the requirements.

**Quality assurance versus continuous quality improvement**

In the literature; quality health care is categorized into the following components; the content (i.e., the care delivered and its resultant medical outcome), the delivery (i.e., “service” and patient satisfaction with the health care experience) and the cost [21]. The literature emphasizes that technically successful procedures does not equate to high quality patient care if the health care professionals delivering the service are rude to the patient [40]. In industry, overall quality includes durability, service-ability, aesthetics, features perceived quality and conformance to standards [38] [39].

**Quality assurance and quality improvement** have mostly been used to achieve high quality health care. Quality assurances dictate that low-quality events are identified if they fall under a certain target. This approach focuses on poor outcomes of poorly performing clinicians and equipment leads to a lack of focus continuous improvement of technique, process, or patient
care [40]. “The concept of a minimal standard of compliance is reinforced and a sense of “good enough” prevails” [41].

In contrast “continuous quality improvement (CQI) attempts to anticipate problems and improve processes” [42]. This concept was first described by Schewart, who was a physicist and engineer of profession. Edwards and Deming of Toyota was influenced by this approach and six sigma and lean principles were developed as a result [42] [43]. Six sigma is aimed at optimising process by standardisation to eliminate variation and lean seeks to eliminate unnecessary steps in the process which is not contributing to the overall quality and constitutes “waste”. This approach is based on the Toyota production system [44].

In the literature, it is stated that when resources are limited, waste and variation in work practices can do harm. For example, having more than two radiographers per computer tomography scanner can cause confusion and slow the process down. Another good example is when radiologists’ reporting workload is not equally distributed and certain types of films might not be reported while others are prioritised [37]. Clinical accuracy is measured by KPIs such as voice recognition error rate and complication rate for invasive procedures.

According to Jacobs et al “clinical care algorithms provide the corner stone of a practical continuous quality improvement programme and facilitate and comparative research” which in turn “enhances the generation of useful, consistent data that are easily collected and analysed” [37].

The Irish Health Service Executive recognises the importance of quality management; recommending that quality and risk are managed through an integrated quality and risk management systems ensuring continuous quality improvement [46]. Ireland ranks 13th on the European Consumer index report [47] and, though there are many areas of good practice, one significant area of weakness is the lack of a provider catalogue with a quality ranking. Healthcare systems performance can be measured in three terms; access, costs and quality. The three are so tightly bound that a positive change in one can only be obtained by a negative change in one of the remaining two [48]. The use of software in the clinical domain has a place in impacting on this iron triangle, by improving quality and access while equally decreasing costs [49].

Seminal work on quality in hospitals outlined that “Good structure increases the likelihood of good process, and good process increases the likelihood of a good outcome” [21]. Thus, the
focus of many quality programmes are now on structure, process and outcomes [51] [52]. Structural measures examine relatively fixed aspects of care delivery such as physical plant and human resources. Process measures, the focus of the largest proportion of quality improvement efforts, assess specific transaction in clinical-patient encounters which are expected to improve outcomes. Outcome measures comprise quality of life endpoints as well as morbidity and mortality [50]. It must be noted however that structure and process are not the only factors influencing patient outcome; but contributing factors, such as lifestyle, will also have a significant effect on outcomes [53]. The structure of quality systems is also important to the processes and outcomes [51]. There are a number of domains of quality care that must be considered in the development of a quality programme.

There are six quality dimensions defined by [2] that must be considered:

1: **Safety**: minimising medical errors and adverse events,

2: **Effectiveness**: maximizing intended health outcomes,

3: **Patient-centeredness**: focusing on patient and family comprehension, preferences, goals, and priorities in making treatment decision,

4: **Timeliness**: minimising delay between onset of illness and initiation of treatment,

5: **Efficiency**: providing maximally cost-effective care,

6: **Equity**: providing care of equal quality regardless of gender, ethnicity, region, socioeconomic status, or insurance coverage.

2.4.2 *Quality Assurance Programmes*

There is general acceptance of the requirement for quality management in radiology. The literature describes different approaches and strategies for the design of a quality assurance programme for hospitals based on compliance with set targets locally and nationally. The institute of medicine defines quality of care as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” The literature review provided insight into the history of the development of quality assurance programmes in the clinical field. Implementation of evidence-based practices and measurement of outcome have been shown to improve outcomes and decrease variations [55].
2.4.3 *Quality Assurance Programmes - A Brief History*

Ms. Florence Nightingale is one of the first health professionals that applied performance measurement in healthcare and in specific to sanitary conditions in hospitals. “This system allowed comparisons from hospital to hospital and from unit to unit within the same hospital over time. Having an explicit, objective measurement system allowed Ms. Nightingale and others to make significant breakthroughs in the understanding of the relationships between sanitary conditions and hospital morbidity and mortality “[56].

Dr Anthony Codman, a Boston surgeon, proposed an idea of public reporting of hospital mortality data around 1914. This system was rejected by his peers who led to Dr Codman implementing the system in his hospital based on end results. Unfortunately, without the support of his peers the system was closed down and public reporting did not resurface until 1986 [76] at which time Dr Paul Ellewood instigated a programme based on outcome management. It was a simple approach where health care providers were accountable for patient outcomes. Dr Ellewood attempted to establish large national data bases based on standardised clinical demographic treatment and outcome variables for major clinical conditions. This approach was not accepted on a larger scale [56] [76].

Performance measures for managed care were developed when a group of national health care providers met to develop a set of performance measures for managed care plans. HEDIS, health plan employer’s data and information set were officially taken on board by the American national committee for quality assurance (NCAQ) as a performance measure set. This set was tested and became part of the accreditation process of NCAQ in 1994. These measures focus mainly on primary care services and are not representative of a multi-hospital performance.

“The Agenda for Change” came next in the early 1990’s and was driven by the joint commission on accreditation of health care organizations (JCAHO) in the United States of America [54]. It included a set of measures for clinical processes and patient outcomes. JCAHO got huge resistance when they attempted to make the measures mandatory to obtain accreditation form JCAHO. Hospital management was complaining about the collection of the data as well as their fear for misleading and inaccurate information. Other hospitals that had already implemented other types of measures objected that they would have to redesign their measurement systems with mayor overhaul for data collection and reporting.
JCAHO had to adopt an approach that would include an approved list of measures rather than a national standard performance reporting system. JCAHO has developed measure sets for health care networks including integrated health care systems, managed care systems, managed care plans, long term care networks, or other types of multi-entity systems.

In the late nineties, quality assurance programmes in health care based on the continuous quality improvement (CQI) approach changed the focus to internal data collection and analysis as a very important tool of performance management. The radiology quality assurance scorecard prioritises the customer’s expectation for the service. No specific system for measurement was produced by the CQI approach.” Some CQI concept would suggest that assurance programmes should be tailored to the priorities of local process owners and local customers” [56].

The last approach in assurance programmes were developed in the use by the consortium for research on indicators of system performance (CRISP). The project included defining standard data collection methods, procedures for organisations of different structures and missions. It was concluded that the integrated healthcare system might be the wrong unit for analysis, it was considered too large, too diverse and cumbersome, and hence a more focused approach was then enlisted [56].

In Ireland the National Radiology Quality Assurance Programme was rolled out in January 2010, led by the faculty of radiologists [58]. The programme was developed as a result of cancer misdiagnoses. The faculty of radiologists recognised that “there were few formal measures in place to reassure the public that error is kept to a minimum and few national benchmarks were in place to measure performance” [58]. This programme provides an information system designed for workflow-integrated collection of quality assurance (QA) data. This data reporting system, the national intelligence quality assurance system (NIQAS) was developed as an information technology (IT) solution around this quality assurance initiative. The data is collected on a central system that interfaces with NIMIS. A report on quality improvement activity for each radiologist is provided on a monthly basis [56] [57] [58]. The faculty of radiologists acknowledges that the selected measures were just “a starting point and that it is impossible to legislate against all error” [58] [253].

This programme includes the following areas for measurement; radiology alerts for communication of critical, urgent and unexpected findings, turnaround time within 24 hours,
no of radiology quality improvement meetings (RQI) meetings attended, no of multi-disciplinary meetings attended, no of focused audits, prospective review, retrospective review, assigned peer review, peer prospective review, peer retrospective review, and combined retrospective peer review. This initiative only focuses on the radiologist’s activities; it does not include the radiographers, nurses or support staff, which represent more than 75% of the multidisciplinary workforce in a radiology department. The programme does not include KPIs measuring the non-clinical components of the radiology service, leaving a significant gap for a more encompassing provision.

2.4.4 Key Performance Indicators

Performance indicators can be used by organizations to achieve set targets to measure performance and the performance gap. KPIs are used as objective tools to reach the set target. As organisations want to reach high standards of patient care, quality management systems in healthcare has become very important worldwide [56]. KPIs to measure performance in healthcare is not a new concept, but rather are being looked at in a different way at this juncture in time [21] [76]. From a radiology perspective “Radiology professionals must persuade administrators and managers that standards of care relate closely to performance metrics like workload, diagnostic precision and patient safety concerns [13] [10]. Thus, it provides for resource allocation and performance metrics to measure this reality and manage risks [10] [94] [98].

The benefit of a real KPI provide….” meaningful information to make better decisions…KPIs will not only tell the story of what is going on in the business but will also give the business time to react appropriately” [100]. “One of the central issues in performance management remains the absence of agreement about what should be measured. Management key performance indicators (MPIs) are becoming an integral part of healthcare but further standardisation of data collection is imperative.

According to the literature, there are key questions that need to be asked when [100] [101] an assurance programme is being designed as they underlie all other considerations:

- Who is using the information? Is the information for senior managers for oversight or strategic decisions or is the information to be used by front line staff for quality improvement?
- What core organisational processes or skills are the measures designed to reflect?
Is it about clinical quality of care or management efficiency or a combination? [21],
What are the measures? [101],
Does baseline data exist? [101],
Does comparative data exist? (Internally, externally, nationally) [100],[99]
How many indicators are you selecting? [101],
How often, how much and how long will data be collected? [100] [20],
How accurate are your data sources? [103],
Have you considered overall design of the KPI project and factors that can influence and affect the monitoring project? [101] [100],
How should information be collected, collection methods? [101] [99],
What statistical analysis is undertaken? (Methodology for analysing data) [101] [20],
Do you have targets and goals? [103],
Are you prepared to act on data positive or negative? [101].

"An appropriate set of KPIs should reflect the mission, vision and strategic direction of an organization” [56]. Figure 2.1 shows the different processes that must be measured for a holistic approach in quality measurement.

2.4.5  **Balanced Scorecard**

The balanced scorecard is a strategic planning and management system that is used extensively in business and industry, government, and nonprofit organisations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. It was originally designed by Drs. Robert Kaplan (Harvard Business School) and David Norton as a performance measurement framework that added strategic non-financial performance measures to traditional financial metrics to give managers and executives a more 'balanced' view of organizational performance [106] [190].

There is a worldwide trend to use dash boards in health care based on Norton and Kaplan’s balanced scorecard. According to the Yale New Haven Health System the vision and mission of a radiology department must be stated followed by strategic dimension with critical KPIs as hospital tend to collect large amounts of data without verifying if the measures impact on performance [105]. This research will include KPIs that will measure for the quality delivered by a radiology service.
According to [25] [26] [188] [190] the quality manager’s most valuable tool will be data produced by information systems. Data can be collected using different methods, for example, benchmarking, manually or electronically. The most common way is manually extracting data from different system that does not interface. Data produced by data bases i.e. IPIMS, NIMIS, RIS, CISWEB, NIMS, Q-Pulse, MOCIS, NIQAS and Q-Genda would be used for this data collection.

Stevens (2007) states that there is “Vast arsenal of statistical tools ... statistical dispersion, analysis of variances, correlation and regression, t-distribution, t-test...” can all be applied in measurement and management and of KPI data.

2.4.6 Radiology Specific Scorecards and KPIs

The balanced scorecard can be used to support data requirements. The scorecard is a useful tool for tacking, trending and analysis of data [188]. “Healthcare industry is facing increasing challenges in the days of shrinking budgets, increased government regulations, declining reimbursement and an aging population while maintaining the highest quality patient care” [105]. Balanced scorecards are increasingly being used in radiology and typically include measures related to quality of care, outcomes, and access [1]. The literature identified
different approaches to the grouping of radiology KPIs. The literature review points to a lack of consistency in metrics adopted by radiology departments worldwide and reiterates that uniformity of measurements will facilitate meaningful performance trends analysis over time [56].

Important parameters related to imaging care delivery include measures in the areas of safety, patient access, customer satisfaction, appropriateness of examinations, percentage of standard protocols used, and timeliness of reporting [1] [103]. The medical ionising radiation committee groups radiology key performance indicators according to structure, process and outcome where structure refers to radiology equipment and staffing levels, process refers to the effectiveness of the various policies, procedures, protocols and guidelines in place for the difference modalities in radiology and outcome refers to the success or failure of radiology examinations and processes [12].

[1] [103] define the specific criteria for key performance indicators in radiology as (1) work load, (2) access, (3) turnaround times and (4) obtaining adequate clinical details for justification of radiology requests. [1] used for quality buckets such as safety, process improvement, professional outcome and satisfaction to distinguish between the groups of key performance indicators.

According to the Irish national quality assurance programme KPIs should measure productivity, radiology reporting, access to examinations i.e. MRI, ct, mammography. The focus should be on patient satisfaction followed by referring physician satisfaction and employee satisfaction [56]. They selected the following for KPI measurement, radiology alerts for communication of critical, urgent and unexpected findings, turnaround time within 24 hours, number of meetings radiology quality improvement meetings attended, no of multi-disciplinary meetings attended, no of focused audits, prospective review, retrospective review, assigned peer review, peer prospective review, peer retrospective review, combined retrospective peer review

Clinical accuracy and timeliness of communication of report findings, access and appropriateness, hygiene, and patient/employee satisfaction were also listed as important areas for measurement [24] [1] [27]. Abudujeh et al (2011) and [1] included KPIs for human resources and finance KPIs to measure activity and capacity to reflect radiology as a whole.
According to [103] displaying multiple safety- and quality-related parameters on scorecards, the monitoring and improvement of quality can be greatly enhanced. It also provides documentation of quality improvement initiatives in radiology which is allows identification of trends and assist with learning, forward planning and effective quality and risk management.

[1] [103] found that the transparent display of data can be a strong motivational tool to drive the quality agenda in radiology. According to Pearson’s law “That which is measured improves. That which is measured and reported improves exponentially” [58].

The following were identified in the literature review.

- Quality assurance programmes that were too sophisticated did not work as other hospitals felt they have already invested in other systems and could not justify the financial cost of changing to the new programme and as a result were reluctant to change [56],
- Data captured by software system in radiology are not used to improve quality
- The literature suggests many different approaches to quality management in radiology and hospitals in general, with no standard or preferred method identified [38] [39] [40] [42] [44],
- Inconsistent approach to selecting KPIs was identified in the literature [56],
- No consensus on what should be measured [56]
- There is no consensus on the specific groupings of KPIs is used in radiology [24] [27] [56].
- The literature also shows that the end user satisfaction must be considered for a quality assurance programme to measure quality effectively [56] [103] [29].
- Risk assessments are not carried out in radiology as a regular activity [13]

These point to a gap which is addressed by this research: to configure a scorecard with radiology specific KPIs as part of a complete radiology quality assurance programme.

2.4.7 Conclusion: Quality in Radiology

Quality and safety is an area that is rapidly gaining importance in healthcare provision. Healthcare organisations are increasingly being accredited, regulated and inspected in relation to healthcare quality assurance. Organisations, recognising the importance of quality and safety, and developing systems to support care processes to improve quality should be
more successful in achieving better, safer healthcare [60]. Therefore, the quality assurance and quality validation and verification must be considered and important part of a radiology quality assurance programme.

The literature review identified no standard approach to quality management in radiology. The suggest literature that local measures and specific issues relevant to the location cannot be ignored and indicates that local internal data must be collected and form the basis of a quality assurance programme. The history review points out that quality assurance programmes should not be too elaborate initially as it runs the risk of overwhelming the organisation and fail as a result. A quality assurance programme for radiology should consist of a set of relevant KPIs to allow measurement of quality short falls. Quality assurance programmes should focus on learning and the quality improvements stimulated by detecting errors.

Such a measurement system has the potential to facilitate periodic discussion around performance if the relevant KPIs specific to the department in question were selected appropriately. Thus, this research focuses on the development and use of a quality assurance scorecard as the collection and display tool for data. This research endeavoured to develop a quality assurance system, based on performance measurements and tailored to local priorities and patient needs, becomes an important ingredient to allow the quality assurance programme to reflect and capture the specific quality issues within the context and reality of the radiology department.

This section 2.5 contextualizes the literature relating to quality in radiology departments. The section commences with a general overview of quality in acute hospitals what it is, how it can be achieved and the barriers to achieving quality in the domain. The unique stakeholders who work together in hospitals are described. The clinical governance binding people and process in a common goal is outlined. The processes of clinical and healthcare audit are also described as these are the processes legislated to measure quality in Irish hospitals. Finally risk management in radiology is described.

2.4.8 Stakeholders and Shared Care

Shared care is seen across institutions where different institutions, providing different specialised services, must cooperate to afford holistic care to the patient. This shared care can result in fragmentation and creates challenges on the availability and processing of
information, trust in the information and interpretation of the information [61]. The role of the stakeholder is seen as critical in the Institute of Medicines’ report into health IT and patient safety: building safer systems for better care [5]. This report recognises that products are not used in isolation but are part of a larger system that includes people, organisations, processes and the external environment. It is necessary, therefore, to analyse and categorise the role of stakeholders in quality management.

As discussed previously the stakeholders have a common need for information in clinical practice and the literature indicates that availability of this information would improve work process and patient care [49]. IT is an enabler and for it to be successful requires complementary processes and resources. Organisational change is required to achieve this [61]. Despite the need for information and the evidence that it can improve quality process and management of care, there is evidence of resistance to its use. The development of hospital systems is driven by the stakeholders and [48] state that “decisions are made by consensus, not through authority.” They also note however, that medical staff have more control and that it is difficult to make changes in healthcare delivery without their approval. Jana et al (2011) indicates that although healthcare policy makers value information technology they do not always adopt it into practice. Adaption of technology must therefore be taken into consideration when reviewing quality in radiology. Clinicians have been found to have concerns that the introduction of technology may add burden and that if the burden of using the system does not outweigh the benefits the system will remain partially or fully unused [61] busy clinicians are likely to prefer direct with their patients rather than through reports in the medical systems [63].

Bearing in mind clinicians’ concerns and resistance to technology, as well as their power in final decision making, it is important to involve them early in the process [48]. “The focus on I.T. as enablers for improved patient safety and better quality of care continues to increase, and the investments in hospital I.T. departments are growing [64]. This is an area that is going to expand, and clinicians are going to have to respond to more data driven models of care as medical decision making is growing beyond the experience and judgment of individuals [62].

2.4.9 Clinical Governance

“Governance can be defined as the action or manner in which an individual or an organization conducts its affairs in accordance with agreed principles, standards and rules”
with the aim of providing patients with the highest quality of care [67]. It was defined in 1999 by the clinical governance support team as: a framework through which NHS organizations are accountable for continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish [66] [70]. Hospitals are very complex environments with many stakeholders working, sometimes with very different objectives. Clinical governance is the framework used to control, co-ordinate and standardise the workings of a hospital [68]. This framework may be crucial to the successful and safe management of a radiology department [69]. A study by [71] defines 10 facets of clinical governance:

- Quality improvement (includes clinical audit),
- Leadership,
- Evidence-based practice,
- Dissemination of good practice, ideas and innovation,
- Clinical risk reduction,
- Detection of adverse events,
- Learning lessons from complaints,
- Addressing poor clinical performance,
- Professional development programmes,
- High-quality data and record keeping (See Figure 2.2)

Figure 2.2: Clinical Governance Principles [36]
The literature indicates a need for uniformity and conformity of staff activities to support the success of hospital systems [49] [69] [70]. The hospital environment, as discussed previously, consists of autonomous professions working together towards, sometimes, differing goals. Thus, indicating the need for the implementation of an overall governance programme to exert a degree of control and co-ordinate those goals into one overall programme of quality assurance. The concept of clinical governance is relatively new and has received mixed reviews and mixed success rates. Research is beginning to be published with recommendations as to how to improve clinical governance and make it work more successfully. The researcher concurs with [70] that clinical governance must be a set of principles that organisations and individuals must aspire to, implement and abide by. Processes need to be defined for high volume conditions. Account must be taken of the complexity of practice for systematic evaluation mechanisms must be in place [71].

Dame Janet Smith professes a similar viewpoint indicating the need for an integrated system of different types of activity, all aimed at improving quality of care [72].

To make clinical governance work it is necessary to put clinicians at the center of clinical practice. It is not a magic solution to problems and individuals will be able to circumvent if they so desire. There is a view that shared governance would be beneficial whereby each profession is represented on a committee or a board; which agrees the activities, standards and outcomes required [73]. A process of continual assessment and re-evaluation is required and the programme must be flexible and responsive to changes in the environment [74].

2.4.10 Clinical and Healthcare Audit

To assure quality, clinical and healthcare audit are tools commonly used in hospitals and are recognised as key components of clinical governance [87] [175] [225]. The national institute for health and clinical excellence (NICE) is based in the United Kingdom (UK). NICE defines clinical and healthcare audit as: “A quality improvement process that seeks to improve care and outcomes through systematic review of care against explicit criteria and the implementation of change and advocates their implementation within a structured programme, with effective leadership, participation by staff, and emphasis on teamwork and support” [15] [77].
2.4.11 *Five Stages in the Audit Process*

There are five stages in the audit process, as illustrated in Figure 2.3.

![Figure 2.3: The Five Stages of Clinical Audit [15]](image)

**Stage 1: Preparing for Audit**

Preparation for the audit is very important as it entails detailed project management including topic selection, planning, resource allocation and communication of objectives. This requires the design of the audit project within a supportive environment [14] [15].

This stage includes:

- Defining the purpose of the audit,
- Defining the structure that will support the audit,
- Identifying skills needed and organising resources to perform the audit,
- Provision of training regarding the concept of audit to staff,
Selection of an area for audit is influenced by factors including:

- National standards and guidelines; particularly concerning conclusive evidence of effective clinical practice (evidence-based medicine),
- Practice based area of concern,
- Issues of concern to patients and public,
- Targeted service delivering improvements,
- Targeted areas of high volume, high risk or high cost, in which improvements can be made,
- Analysis of planned / unplanned outcomes,
- Referral of topics for audit by an external body such as the HSE or HIQA.

Stage 2: Selecting Criteria and Standards

Once a topic has been chosen, valid criteria must be selected. Valid criteria are measurable, evidence based and related to important aspects of patient care. In this stage a series of statements should be formulated to include the question you want the audit to answer and the action planned as a result of the audit [15] [77].

“Within clinical audit, criteria are used to assess the quality of care provided by an individual, a team, or an organisation. These criteria are explicit statements that define what is being measured and represent elements of care that can be measured objectively”. The clarity, relevance and measurability against which the audit is conducted will determine the effectiveness of the audit. The standards define the aspect of care to be measured and should always be based on the best available evidence. A standard is the threshold of the expected compliance for each criterion, usually expressed as a percentage in the results [15] [77].

Sources of standards against which local performance can be measured can be found from a variety of sources:

- National, European or International legislation: Compliance with these standards is compulsory,
- Peer reviewed research: These will provide benchmark standards but may have to be interpreted in the light of local facilities and expertise,
Recommendations or consensus statements from learned or National Societies and Organisations: These will usually have been developed to be applicable in routine practice,

Where no published or recommended standards are available, a standard can be implemented by local agreement,

It should be noted that standards, other than those governed by Legislation, are not necessarily pass or fail. NICE recommends that standards selected for clinical audit should initially be set at a high level to encourage the maximum improvement,

It is appreciated that these high standards might not be achieved in the first audit but will serve to motivate staff to strive to reach compliance with the set standard. The level of the standard selected should be considered in the interpretation of results [14] [15].

**Stage 3: Data Collection**

Data is collected to measure quality in current practice against the set standards. In a modern hospital, most data can be collected from a computer data base, but if this is not available a data collection form should be designed for this purpose. In both cases consideration, should be given to what data will be collected, where the data will be obtained from, and who will do the data collection. To facilitate that the collected data is precise, and that only essential information is collected, certain details of what is to be audited must be established from the outset.

**These include:**

- The scope of the practice being audited,
- The healthcare professionals involved in the practice,
- The time frame over which audit is to be conducted.

Patient confidentiality should also be considered. It is paramount that data should be presented with patient confidentiality maintained. The data collected must relate only to the objectives of the audit. The Local Research Ethics Committee should be consulted in the case of potentially sensitive topics [77].
Stage 4: Data Analysis and Implementing Changes

In this stage the data collected is analysed, results compared with criteria and standards before necessary change is discussed. A plan of action must be agreed between the relevant groups as to which changes are necessary and how they will be implemented. A definite time frame should be set for completion. The audit tool in some instances might have to be changed to be more effective or the audit might be extended to other departments. The quality improvement plans should be developed, and a person should be designated to oversee and monitor implementation. During this stage, it is necessary to assess how effectively the standards were met, and a root cause analysis is performed to establish the reasons for any failure to achieve standards. Some causes might be deemed acceptable and as a result be added to the exception criteria for the standard in future or could suggest the need for specific improvement measures. This decision will depend on the clinical significance of the parameter being audited. In some “serious harm or death” type cases, 100% compliance with set standard is critical while in other areas a lower result might still be considered acceptable. Once the analysis of the data has been completed the results should be recorded and findings should be formulated in a report. Audit reports should be archived on a centralised audit document management system. The audit reports are essential for external audit purposes.

It is necessary to include the following in the report:

- Background to the topic,
- Aim, objectives, criteria and standards,
- Methodology,
- Results,
- Action plan,
- Appendices,
- References.

Stage 5: Sustaining improvements

After an agreed period, the audit should be repeated. The same strategies for identifying the sample, methods and data analysis should be used to for comparability with the original audit. The re-audit should demonstrate that the changes have been implemented and that improvements have been made. Further changes may then be required, leading to additional
re-audits. This stage is critical to the successful outcome of an audit process as it verifies whether the changes implemented have had an effect and whether further improvements are required to achieve the standards of healthcare delivery identified in stage 2. A feedback system should be in place to distribute audit result to clinicians both locally and nationally where applicable [15] [77].

2.4.12 Types of Audit

There are various types of audits that can be used in the clinical setting.

**Quality (system) audit** assure the quality system (QS) of the hospital complies with given quality system standards like ISO 9001:2000. This assessment is carried out by an independent certification body [17] [15].

**Structure audit** assesses the systems within which we work. Structure audit evaluates the performance of the entire organisation or department, and may include management structure, the level of equipment available, staff competence, and level of training [80] [81].

**Process audit** focuses on the processes involved in the delivery of care from initial referral to delivery of a radiological report including for example quality management of the processes, justification, waiting times and examination practices and protocols. A process audit is the most common assessment undertaken in radiology, as they operate complex procedures with several intricate processes running simultaneously [81].

**Outcome** is an evaluation of the outcome or results of the delivery of care, which may include medical outcome and patient satisfaction. The outcome audit is often viewed as the most difficult to conduct in a tangible and productive manner. This audit looks at issues such as patient satisfaction, complication rates, diagnostic accuracy, and standards [81].

**Standards-based Audit** involves defining standards, collecting data to measure current practice against those standards, and implementing any changes deemed necessary [81].

**Adverse occurrence screening and critical incident monitoring** is often used to peer review cases which have caused concern or from which there was an unexpected outcome. The multi-disciplinary team discusses individual anonymous cases to reflect upon the way the team functioned and to learn for the future. In the primary care setting, this is described as a significant event audit. A significant event audit also involves measurement of quality of care against set standards of best practice [81] [77].
Rapid cycle audit is when small data sets are audited to monitor and improve care. This approach can make the change cycle quicker and is useful if a problem is suspected and results are needed quickly. Auditing a small sample can quickly show the nature of the problem. After implementing the action plan for improvement, a repeat of the audit on another small sample can quickly show if improvement has been achieved. Usually large samples are collected over a longer period. The implementation of change then also takes a longer period before the quality issue is rectified. The reliability of the rapid cycle audit is improved by repeated collection of data. The proposed programme employed by the author makes use of this type of audit [79]. RAD-QAP instigates several quality improvement cycles within the larger cycle of measuring and reporting overall compliance. Measurement should be taken weekly where protocol compliance is measured, it stimulates learning and correction where needed early on.

Prospective and retrospective audit: Data may be collected prospectively over a defined period of time, for a predetermined number of cases, or retrospectively from existing information sources. Prospective collection is the preferred option as it is more likely to support completeness of information even though the collection of data might take longer [81].

Internal audit: Data is based on the continuous measurement of clinical standards performed by staff on their own work (self-assessment). They are encouraged by the Irish Health Organisations, the Health Service Executive (HSE), Healthcare Information Quality Authority, the Irish Medical Organisation, the Irish Medical Council and National Council for the Professional Development of Nursing and Midwifery.

External audit: Healthcare audit involves the same process as clinical audit, but it extends beyond clinical evaluation to other areas of healthcare such as software systems and staff management. The Irish medical council [75] has made clinical audit mandatory for doctors, and it is also mandated for radiologists [77].

Clinical audit has been defined by the Health Service Executive (HSE), Ireland as involving the comparison of “current practice to evidence based best practice in the form of standards, identifying areas for quality improvement and implementing changes to practice to meet the standards [46]. Consequently, clinical audits are suitable tools for the management of quality data produced by information and software systems. The national institute for clinical
excellence went further and stated that “clinical audit not only includes the use of specific methods but also requires the creation of a supportive environment” [77]. Clinical audit involves a spiral of continuous improvement, where a standard of best practice is established; current practice is measured against the standard, where a quality deficit is indicated, Quality Improvement Plans are developed and implemented. Finally, current practice is measured again to assess the impact of the quality improvement plans and to develop further action plans if required. The Irish Health Service Executive’s clinical audit cycle (Figure 2.3) provides a five-step cycle and outlines how each step must be taken to support a systematic and successful audit.

2.4.13 Conclusion: Quality Assurance and Verification in Acute Hospitals

Review of quality assurance in radiology indicates the existence of a somewhat fractured environment with many stakeholders working independently. Quality assurance and overall control is an emerging field. Achievement of a quality assured, controlled environment incorporating standardised care is challenging. Increased measurement of outcomes and increasing use of performance indicators and audit can bring awareness and focus on quality improvement. Clinicians must respond to a more data driven model of care. Clinical audit is the most commonly accepted process for the measurement and improvement in the quality of care/outcomes. Clinical governance is a framework used to control, co-ordinate and standardise the workings of a hospital. It was essential that the quality assurance programme developed by this project take this into account [56] [67] [77] [94].

2.5 Legislation and Standards in Radiology

Activities in radiology are governed by legislation and standards. These provide guidelines for radiology practice and set parameters where radiation dose is concerned. These restrictions are only applicable to some of the activities in radiology and do not include areas of clinical accuracy and capacity for example [9] [11] [12] [78].

2.5.1 Radiation protection legislation

The system of radiation protection in Ireland is based on the recommendations of the international commission for radiological protection (ICRP). Relevant publications are ICRP 60 (1990) and ICRP 103 (2007) [11]. These publications reflect the concept of dose limitation through justification, optimisation of protection and the application of dose limits.
S.I. 478 of 2002 (amended S.I.303 of 2007) [12] implements the medical exposure directive and deals with patient exposure as part of their medical diagnosis and treatment, occupational health surveillance, health screening programs and medico-legal procedures.

**The requirements for radiology are:**

**Justification:** The benefit of each individual X-Ray must outweigh the radiation risks for the patient

**Optimisation:** Exposures should be kept as low as reasonable achievable.

**Dose limitation:** The dose to the individual should not exceed those prescribed by the commission (Patients are excluded from this limit). According to S.I. 478 every radiology department should be involved in audit [12].

2.5.2  *European Legal Framework*

2.5.2.1  *European Directives*

**The current statutory framework is governed mainly by two European directives:**

The basic safety standards directive for protection of workers and the public (96/29 EURATOM) is implemented by statutory instrument No 125 of 2000 [78].

The directive for the health protection of individuals against the dangers of ionising radiation in relation to medical exposure (97/43 EURATOM) implemented by statutory instrument no 478 of 2002 (amended 303 of 2007, amended 459 of 2010) [12] article 6.4 of this directive states that: “Clinical audit shall be carried out in accordance with national procedures”. The feeding of the various strands of European radiation protection legislation into Irish law is expressed in Figure 2.4. The European treaty covers the basic safety standards directive which includes the medical exposure directive, outside workers directive, directive on information for the public and hass directive. These directives are transposed into Irish legislation and govern radiation protection in Ireland.
2.5.3 **Irish Legal Framework**


SI 125 of 2000 transposes (96/29 EURATOM) into Irish law and relates to the basic safety standards (BSS) and other European directives on the protection of workers and the public against the dangers of ionising radiation in the workplace. A regulatory system for practices involving ionising radiation is developed using justification, optimisation and dose limitations as its foundation. All practices applying for a new license must consult SI 125 of 2000. This document specifies the requirements for authorisation, justification, optimisation and dose limitation (excluding exposures to patients arising from their treatment). The RPII is the competent authority for this statutory instrument. SI No 125 of 2000 forms the legislative basis for the use of dose constraints and application of dose limits for exposed workers, students and members of the public. This legislation determines that a radiation risk assessment should be done for all new practices. It also refers to classification of work areas and systems [12] [78].

SI 478 of 2002 implemented the medical exposures directive (97/43 EURATOM) in Irish Law and has subsequently been amended by SI 303(2007) and by SI 459 (2010). This
statutory instrument deals with patient’s radiation exposure as part of their medical diagnosis and treatment, occupational health surveillance, health screening programmes and medico-legal procedures. It also deals with exposure to individuals who willingly help in the support of individuals receiving medical exposures. This statutory instrument also refers to justification and optimisation in a context where dose limits do not apply to patients undergoing medical procedures. Responsibility for safeguarding patients is allocated to other relevant organisations such as: The department of health (competent authority), HSE – medical exposure radiation unit (MERU), medical council, dental council, RCSI (faculty of radiology), health information quality authority (HIQA). SI 478 of 2002 is mainly concerned with the regulation of patient radiation protection from the harmful effects of ionising radiation. SI 478 of 2002 places a strong emphasis on quality assurance and quality control. SI 478 of 2002 amended by SI 303(2007) and by SI 459 (2010) regulates quality risk and safety issues, clinical practice and equipment. It requires that quality management systems are established to facilitate safety and protection in these areas such as quality assurance programmes, risk management, incident reporting and clinical audit. Radiology departments therefore are legally obliged to participate and have an audit programme in place and this proposed clinical audit programme will endeavour to achieve compliance with this legislation. [12] [19] [78].

Medical Device Legislation

Before discussing medical devices, it is important to understand what they, and their context, are in the field of acute radiology in relation to magnetic resonance imaging (MRI), computer tomography (CT), and other x-ray equipment with software. According to [82] “Medical device” means any instrument, apparatus, appliance, material or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings for the purpose of: diagnosis, prevention, monitoring, treatment or alleviation of disease, diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap” [82]. The United States of America (USA) definition of a medical device extends to all the devices components of constituent parts and controlling software but excludes drugs. In Canada, the regulation of medical devices is limited to devices intended for use in the treatment of humans, in the United States’ definition of medical devices includes veterinary devices [83].
The USA food and drug administration (FDA) regulate the development, manufacture and import of medical devices to the United States of America (USA). The European Union is not bound by the FDA but as FDA legislation in the United States is more mature and more stringent, European hospitals are inclined to be guided by FDA approval. Table 2.1 summarises the major-medical device legislation [84] [85].

Radiology makes use of different machines and software systems to acquire images and carry out interventional procedures on a daily basis which interface with a central achieving system.

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Significance</th>
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<tbody>
<tr>
<td>Safe Medical Devices Act of 1990</td>
<td>Established Quality System requirements supported post-market surveillance allowed FDA discretion for PMAs brought to panel</td>
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<td></td>
<td>Supported for early collaboration, expanded Class I and Class II exemptions</td>
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<tr>
<td></td>
<td>Set the &quot;least burdensome provision&quot;*</td>
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<td></td>
<td>Supported dispute resolution</td>
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<tr>
<td>FDA Modernization Act of 1997</td>
<td>Established evaluation of automatic Class III designation (giving the sponsor the opportunity to request lower classification due to a minimal risk device, known as &quot;de novo&quot; review)</td>
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<td></td>
<td>Mandated free and open participation by all interested persons</td>
</tr>
<tr>
<td>Medical Device User Fee and Modernization Act (MDUFMA) of 2002</td>
<td>Established a fee schedule for most types of device submissions to achieve shorter review times</td>
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<td>Requires FDA to include paediatric experts on the panel for a product intended for paediatric use</td>
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<td>FDA Modernization Act of 2007</td>
<td>Reauthorized and expanded MDUFMA</td>
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Table 2.1 Software Legislation
Regulation reduces, but does not eliminate, the risks associated with using medical devices. It is not unusual for medical devices to be recalled. Between 1999 and 2005, it was found that “one in every three medical devices, making use of software for their operation, has been recalled due to failure in the software itself” [84] [85]. The use of products that are safe to use in isolation can produce risk when interfaced with other products. “Yet even though an FDA-regulated product has undergone testing and quality control measures prior to being sold, it is important to recognize how, nonetheless, real-time software interactions by different applications create the possibility for device conflicts and performance errors” [85].

Medical devices are becoming more sophisticated and some can now be described as mini computers. It is therefore important to adhere to standards and legislation in relation to medical device interoperability and integration.

2.5.4 Radiology Imaging Standards

One of the foundation principles of medicine is to ‘first do no harm’ [2]. The European Union council (2007) states that standards and legislation to control both the development of the procedures in a radiology department and quality assurance programmes within healthcare are needed to facilitate the effective and successful management of risk. The importance of setting standards is continually stressed in the literature and by [14] [19] [33]. “Urgent steps should be taken to develop standards, criteria and thresholds so that decision-makers will be able to reach reasonably consistent decisions” [88]. The Health Service Executive in Ireland (2007) states that “It is the duty of all healthcare professionals to assure they deliver the highest possible standard of care to their patients/clients so by definition staff should be auditing their work”.

Progression of this research, therefore, required an evaluation of healthcare standards and legislation and evidence-based practice in radiology. Through literature review, research meetings with staff in the hospital quality department and research meetings within Lero, relevant documents were identified. Each identified piece of legislation became a data item and was subjected to thematic analysis. To merit inclusion in this study the standard or legislation was required to have relevance to the management of data and set KPI measurements. Departmental radiography imaging protocols were developed using the correct legal requirement legislative measures to achieve the lowest dose reference levels (DRL) while producing a high quality diagnostic image. Therefore, the departmental
radiography imaging protocols was developed using the European guidelines on quality criteria for diagnostic imaging [33].

The royal college of radiologists’ referral criteria guidelines [87] was used to determine appropriate standards and referral criteria. In this study, the case hospital is a regional hospital serving a large number of both adults and paediatric patients daily. The diagnostic radiology protocols were developed referencing established techniques accepted as best practice in Ireland. The European guidelines for radiographic images in paediatrics [33] and European guidelines on quality criteria for diagnostic images (EUR 16260, 1996) [88] were used as peer reviewed guidelines to develop and updating of these protocols. The faculty of radiologists from the royal college of surgeons in Ireland (RCSI) has been to the forefront in providing guidelines for radiology departments for many years.

In the interest of patient safety, it is important to acknowledge these standards and find ways to measure compliance of set standards. The risk when standards are breached must be identified and managed within a predefined quality framework. In the context of this research risk management is an important element for effective quality management.

2.5.5  Health Care Standards

“Standards promote responsibility and accountability for the quality and safety of services provided. By incorporating national and international best available evidence, standards also promote healthcare that is up to date, effective and consistent. Importantly, standards for healthcare provide a basis for planning and managing services and measuring improvements as well as identifying and addressing gaps and deterioration in the quality and safety of the services provided” [19].

Standards are considered a major driver of achieving compliance and continuous quality improvement in the care provided. In Ireland, the health information and quality authority has the national statutory role to set and monitor compliance with standards for the quality and safety of health and social care services in Ireland. These national standards for safer better healthcare [19] have been developed by the authority in accordance with this function. These standards aim to give a shared voice to the expectations of the public, service users and service providers. They also provide a roadmap for improving the quality, safety and reliability of healthcare [19] [20].
In Ireland, health care quality information authority (HIQA) set the standards to achieve a high quality safe healthcare after reviewing international trends and other countries experience with setting standards. National reports were reviewed, and patient feedback was considered. “As quality in healthcare is a multi-faceted concept, there has been a growing trend internationally to describe quality according to quality dimensions. The most frequently used dimensions include: patient-centeredness, safety, effectiveness, efficiency, access, equity and promoting better health” [19].

**According to HIQA the main attributes of high quality, safe healthcare identified by the Authority’s review is that:**

- Service users are treated with kindness, consideration and respect and have the information they need to make decisions,
- Service providers put service users’ needs and preferences at the center of their activities service users have access to the right care and support at the right time,
- There is clarity about who is responsible and accountable for the quality and safety of services,
- Services are based on good evidence of what works best and strive for excellence by monitoring how they perform and making the necessary changes to improve,
- The safety of service users is paramount, and steps are taken to anticipate and avoid things going wrong and to reduce the impact if they do,
- Services are designed for reliability – minimizing inconsistency, variation in provision and the likelihood of things going wrong,
- People working in the service are recruited, organized, developed and supported so that they have the skills, competencies and knowledge to enable the delivery of high quality, safe and reliable care,
- Accurate and timely information is used to promote effectiveness and drive improvements service providers take every opportunity to enable people who use services to increase control over their own health and wellbeing and the factors that influence them.

The Authority has used the above to create eight themes under which the *national standards for safer better healthcare* (see Figure 2.5) [19].
Person-centered care and support – how services place the service user at the center of their delivery of care. This includes the concepts of access, equity and protection of rights,

Effective care and support – how services deliver best achievable outcomes for service users in the context of that service, reflecting best available evidence and information. This includes the concepts of service design and sustainability,

Safe care and support – how services avoid, prevent and minimise harm to service users and learn from when things go wrong,

Better health and wellbeing – how services identify and take opportunities to support service users in increasing control over improving their own health and wellbeing,
Delivering improvements within these quality dimensions depends on service providers having capability and capacity in four key areas:

- Leadership, governance and management – the arrangements put in place by a service for clear accountability, decision making, risk management as well as meeting their strategic, statutory and financial obligations,
- Workforce – planning, recruiting, managing and organising a workforce with the necessary numbers, skills and competencies,
- Use of resources – using resources effectively and efficiently to deliver best possible outcomes for service users for the money and resources used,
- Use of information – actively using information as a resource for planning, delivering, monitoring, managing and improving care.

It is paramount that the same categories be reflected in the quality assurance programme developed in this research. A natural alignment with the themes as set out by HIQA will streamline the programme and build on the foundation that is already in place.

2.5.6 Conclusion: Legislation and Standards in Radiology

The literature review highlighted the importance of legislation and standards in radiology and health care in general. It points out the importance of internal audit against the standards as well as external verification by independent bodies to maintain standards and compliance with legislation to achieve quality assurance radiology. Standards promote responsibility and accountability for the quality and safety of services provided to patients. In conclusion; standards for health care provide a baseline for quality planning based on the measurements to allow improvements and continuous identification of quality shortfalls in the service.

2.6 Risk Management in Radiology

According to [1] risk is defined as a chance or possibility of danger of incurring loss or injury. It is recognised that harm may befall a patient even in the best hospitals and departments delivering the highest possible standards of care and the practice of medicine is often a process of balancing a risk against the efficacy of a diagnostic or therapeutic procedure. Risk management is the appraisal of options to eliminate or reduce them and the recognition by all concerned of the implications of the remaining risks.
Johnson et al (2009) states that there is nothing revolutionary about risk management as the analysis of the benefit and the risk for any procedure is an integral part of a radiologist working day. Every health care establishment should work to minimise harm to the patient. However, the process of risk management encourages the radiologist to address potential problems in advance, so that the appropriate protocols and procedures may be put in place to minimise risks. The field of radiology is rapidly evolving from a technological (IT) perspective due to technology advances and the globalisation of healthcare. This on-going development will have a great impact on the level of quality of care and service delivery. Thus, risk management in radiology is essential in protecting the patients, radiologists, and the medical organization. “Retrospective error or “miss” rate amongst radiologic studies with significant pathological findings averages at 30% [225].

It is important to recognise clinical and non-clinical risks that could negatively impact on patient care. Health professionals must identify some of the issues that tend to cause harm to patients in advance and work on them before subjecting the patient to potentially faulty processes [13]. The concept of ALARP, or “as low as reasonably practicable”, essentially refers to the assessment of risk, and the comparison of this risk with the amount of time, money and resources needed to address it. It is used throughout the healthcare system and is particularly important when it comes to Radiology. When assessing whether a risk is ALARP (Figure 2.6), it is essential to compare the measures being proposed with those that would normally be used, also known as “good practice” [11] [13] [46]. High profile inquiries into errors and incidents internationally and nationally reiterate the importance of learning from mistakes in the event of undesirable outcomes for patients.
The most common medical errors encountered in malpractice suits are vascular injuries and complications after needle biopsies in interventional radiology [13], missed or delayed cancer diagnosis especially in imaging of the breast [13] and missing diagnosis in skeletal radiology [7]. The reduction of errors in radiology is attainable if every staff member in the department are aware of and up to date with new methods and protocols involved in risk reduction [24].

Incident and risk management is central to any quality assurance programme. Serious reportable incidents must be monitored on a monthly basis and be recorded with specific learning. Quality improvements as a result must be tracked and recorded to allow the root cause of the incident to be addressed. The different aspects needed to increase patient safety in radiology department.i.e. quality systems, proficiency, strategies such as protocol development and transparency for when things do go wrong in the clinical environment is illustrated in Figure 2.7.
Figure 2. 7: Risk Management Approach in Radiology [13]
2.6.1 **Investigations and Inquiries**

“All adverse events resulting in serious injury or death should be evaluated to assess whether improvements in the delivery system can be made to reduce the likelihood of similar events occurring in the future “[2] [89].

International reports identify unnecessary suffering of hundreds of people who were failed by a system which ignored the warning signs of poor care and put corporate self-interest and cost control ahead of patients and their safety [4]. “There is a need for a culture in which concerns raised by staff are taken seriously, investigated and addressed by appropriate corrective measures” [89] [92]. [174] points out the lack of transparency around doctors’ performance and the absence of “internal performance monitoring with a lack of accountability”. The Therac-25 incident is a good example of programme errors that can cause serious injury or death. This error highlights the need for standard operating protocols and quality control as part of a quality assurance programme [203].

High profile inquiries and reviews in Ireland such as the HSE North East, Radiology Look-Back Review of Chest x-rays and CT scans in May of 2008 [7], The Tallaght Hospital Review and Hayes Report of 2010 [8], Patient Safety Investigation Report into the care of Savita Halapanavar (2014) and Portlaoise Report [9] (May 2015) highlights the need for a quality assurance programme within a radiology Department.

These reports highlight the backlog of unreported images, the management process around referral letters, the absence of standardised policies and procedures, staffing issues and inadequate investment in technology as factors that contributed to the risks that were identified. The method of reporting, and the turnaround times and communication of critical results with supporting records were pointed out as risk areas in radiology. Governance of radiology and structures within in the wider organization is also prioritized as a risk that needs to be addressed. Lack of governance and oversight of appropriate recruitment and vetting of qualifications were highlights as a root cause for this failing. [8] stated that “Clinical governance reduce the likelihood of error and increases the likelihood of detecting those errors which do occur” (HSE, 2008). [7] stated that “locum radiologist should be properly trained, and professional competence should be verified during the recruitment process”. Hayes (2010) recommended “risk management training for staff in radiology”.


The reports highlighted appropriate protocols for complaints should be agreed and put in place to facilitate an effective response in the event of look back reviews. The implementation of national guidelines for reporting was prioritised by these reports. There is also emphasis on ensuring there is adequate capacity in the form of additional radiologists to avoid recurrence, in specific a backlog of unreported images [7] [8] [36]. It also prioritises the upgrading of the I.T. system. Voice recognition was singled out as an immediate action to allow the timeliness of reports. Poor performance of the integrated picture archiving communication system/ radiology information system (PACS/RIS) was identified as an area to be addressed [7] [256].

Poor performance of radiology workstations should be assessed and benchmarked with the performance of same in other hospitals. The introduction of a full electronic order-communication system was recommended with a short-term solution of scanning the requests onto the RIS or the PACS should be considered [7] [8] [36].

[8] made a wide variety of recommendations which included the following:

**Implementation of:**

- National guidelines on radiology reporting with appropriate written protocols and staff training,
- Formulation of structured equipment maintenance and replacement programme for each radiology department,
- Define code of conduct and relevant policies, procedure and guidelines for staff, including clinical staff. Staff must be accountable for behaviour and decisions made outside these parameters [8],

Higgins et al (2010) highlighted that” insufficient attention has been paid to demand and capacity planning and proposes that a detailed understanding of demand is required to plan effectively”. Litvak (2011) reaffirms this by stating “that the number of patients who must be treated in any given time period is a key condition under which a health care system must operate. Yet surprisingly, many hospitals ignore this key dimension in their improvement efforts”. The rapid expansion of services, the globalisation of healthcare and the imbalance between workload and workforce are a few of the factors that may threaten the standards of health services as well as patient safety [13]. Demand and capacity planning, efficient patient flow and meaningful escalation planning are intrinsically linked. One cannot be effectively
done without the other. Therefore, hospitals need to understand what is critical to quality in terms of understanding demand and planning realistic capacity. This includes understanding the data on patient intake (demand), throughput (capacity and patient flow). Understanding demand and planning capacity across the wider hospital will consequently strengthen operational grip on unscheduled care to facilitate elective capacity and support [9] [93] [95].

The introduction of PACS/RIS and NIMIS lead to increased efficiency in delivery of images and reports to referrers. NIMIS make use of a voice recognition system that places the burden of correction and editing on the radiologist and increase the time it takes to complete a report with 20%. Thus, the typist is no longer part of the equation [63]. The RCR also states that all the activities and variables should be taken into account when assessing work load. In 1990, the college recommended that radiologists reporting output per annum should be 12500 plain film images per year. It pointed out that individual radiologists’ output would vary because of the different subspecialties. In 1999, the faculty changed their position again stating workload calculations based on suggested levels of appropriate workload in a notional half day, broken down to plain film reporting, general ultrasound, barium studies, CT and MRI or vascular and interventional radiology. The literature review indicates that radiologist workload has changed significantly in recent times, with the development of the technology, for example that employed in CT. Modern CT scanners produce 1000’s of images with multi slice multi-phase studies as opposed to 50 images for single slice CT scanners 10 years ago.

In response to the findings of the reports the faculty of radiologists in the RCSI, has undertaken the development of a National Quality Assurance (QA) Programme in radiology. This QA programme focus on the radiologist and outlines a set of activities for quality performance monitoring and where necessary, initiate improvement [58] [94].

2.6.2 Identified Risks and Recommendations

The faculty of radiologists (RCSI) will facilitate the formalisation of audit activities as part of a quality improvement for [94].

- Including audit activity as part of the radiology registrar training programme,
- Encouraging health service providers to resource the audit process with personnel and time,
- Encouraging radiology to undertake standard radiology audits annually,
• Organising national audits as necessary.

The faculty of radiologists refers to all the following documents that relate to patient safety that was instigated by the HSE and recently by the directorate of quality and clinical care: report of the commission on patient safety and quality, safety and risk management framework [46].

There are other relevant programmes which focus on quality and clinical care:

• Access to diagnostic imaging: Director of quality and clinical care (DQCC) Programmatic approach [175],
• Incident management: quality and risk framework (DQCC, HSE National Service Plan, 2010) [46],
• Incident reporting: medical exposure radiation unit under SI 478 of 2002 [12],
• European commission guidelines on clinical audit for medical radiological practices [14].

The faculty of radiologists also recognises that “the quality of radiographic studies, appropriateness of examinations, equipment and maintenance programmes are key components of a radiology quality assurance programme” [94].

2.6.3 Conclusion: Risk in Radiology

Analysis of the different reports and inquiries; despite the differences in types of incidents that were reviewed, the findings tend to be similar. The reports acknowledge that mistakes in the clinical environment can be reduced by putting appropriate systems in place to reduce incidents that compromise patient safety. Pro-active and reactive risk management should be done on a continuous basis. The reports point out the importance of multi-disciplinary teamwork as well as the importance of fairness and transparency in each procedure implemented. The reports also highlight that strong clinical governance should be in place if the collective goal of the stakeholders is the provision of best practice in a safe environment. They emphasise that standards should be set in line with best practice. The optimisation of existing information systems is also referred to as an important area for improvement [7] [8] [36] [58].
Errors

To meet the expectations of quality services, systems should be put in place to pave the way for higher standards of care. Quality programmes are effective risk control measures, hence the importance of professional organisations to lead, establish, uphold and improve them [8]. Quality improvement measures range from quality maps, measurable metrics and performance indicators to audits and accreditation programmes. These collective efforts may decrease a department’s risk and benefit patients [9].

Risk management is founded on the idea that mistakes happen, and processes and procedures sometimes go wrong. Therefore, holding regular meetings where medical staff can report and evaluate discrepancies, errors and near misses is crucial [42]. Discrepancy meetings are invaluable in medical practice and offer the opportunity to assess current practice and highlight areas that might need improvement [13]. The royal college of radiologists recommends that radiologists attend discrepancy meetings and morbidity and mortality meetings. Evidence of attendance may be required to support the revalidation process, so doctors should carry out personal reflections [75] [94]. This research includes a quality profiling component based on KPI selection measuring areas presenting highest risk; therefore, addressing risk management within radiology.

Lessons can be learned

Aelvoet et al (2010) defines risk as “the probability of incurring a loss or enduring a negative impact.” Technological advancement in the radiology field increased the associated risks multi fold, so too must hospitals increase their efforts at risk management to mitigate these risks. Learning from adverse incident analysis can identify the risks and provide us with the knowledge and the skills to learn from the events to prevent repetition of the incidents [45]. Lessons, however, can be learned from failure analysis that can assess existing processes and principles or help develop new ones [57]. Fault analysis indicates that quality practices are not always adhered to and that there is no “silver bullet” that will reduce system failures, rather implementation of known quality practices [57]. This research will address the gap by stimulating focused training in the areas identified by non-compliant KPIs, thus instigating quality improvement plans in areas most needed.
Requirements

Craciun et al (2015) states that “the reduction of errors in a radiology is attainable if the relevant parties in the department are aware of and up to date with the methods and protocols involved in risk reduction”. To meet the expectations of quality services, systems should be put in place to pave the way for higher standards of care. Quality systems are effective risk control measures, hence the importance of professional organisations to lead, establish, uphold and improve them [8].

Radiology professionals must persuade administrators and managers that standards of care relate closely to performance metrics like workload, diagnostic precision and patient safety concerns [12]. Thus, managers must make sensible decisions about resource allocation and performance expectations to mirror this reality and curtail risks [74]. The essence of risk management is to survey potential reasons for an inaccurate report in advance so that procedures can be put in place to prevent them. This concept of proactive risk management should be adopted to assess risk in advance and involve identification of risk, quantification and evaluation of risk and consideration of measures that can be used to eliminate or control risk in a medical setting [13]. Therefore, a quality assurance programme must include risk management. This research will address these gaps by focusing on risk management and stimulate learning as part of a continuous training programme.

2.7 Data and Information

Clinical data is provided from a wide range of sources such as medical devices, paper records, electronic health records and clinical decision support systems. The FDA (2013) states that quality data must be accurate, available, have integrity, consistency, timeliness and completeness. The literature also indicates that quality data must be fit for purpose [109] [110]. Data in radiology is gathered from many different sources and in many ways. It is largely decentralized and autonomous, leading to difficulties in ensuring data quality [111].

“The building blocks of information is data” [112]. There is evidence in the literature of variances with data quality in hospitals and lack consensus regarding information quality [113]. Lingard et al (2008) found the quality of administrative databases to be poor with a lack of completeness and correctness. This leads to increased workload, data input errors and lack of reporting in some cases due to lack of efficient processes [115].
Bertoni et al (2009) and Berndt et al (2001) recognized the importance of placing emphasis on data analysis when designing a database. This is also backed up in the research by [116] pointing to the fact that it is natural that stakeholders would like to make use of available information, but that difficulties arise with accessing the data. The accuracy of data, and consequently, of information, is determined by the quality of the software systems producing the data. Data relating to patients must be readily available to appropriate staff and to the patients but equally patients should not need to be concerned the minutia of how it is managed [117]. Accurate data is a required for high standards of care but without quality software in place, patients will not benefit from improved data quality [118].

Leonard and Sittig (2007) describe I.T. availability “as the existence of, and access to, the requisite technology to collect, store, display, and transmit patient-identifiable, structured, clinical data in electronic formats.” Analysis of the literature indicates that quality data and quality information, and the requirements to implement it in radiology, is an area requiring research.

2.7.1 Data Confidentiality and Security

“Confidentiality is the cornerstone of medical practice and forms the foundation of the doctor-patient relationship; the increasing use of information systems in health care provides a new set of challenges to the maintenance of patient confidentiality” [104]. Individual staff or patient names are never used in audit reports and unnecessary data is not collected. The data protection advisor should be consulted to protect patient confidentiality (Data Protection Act, 1998) [120]. The eight rules of data protection must apply in audits (Data Protection Act, 1998). Storing patient data in electronic form raises concerns about patient privacy and data security [120].

To achieve an efficient cost-effective service, it is necessary to exchange data, but the patient’s privacy must also be protected [121]. To protect the privacy of information and to comply with law, medical systems must comply with legislative requirements such as the health insurance portability and accountability act (HIPAA), but healthcare is behind other industries such as the financial industry in this endeavour [123]. Despite the risks, which sometimes can be fatal, [124] associated with clinical informatics and the safety hazards these systems are poorly studied and this is an area requiring further investigation [125].
“The potential misuse of PACS can lead to the breach of patient confidentiality if staff browse images and reports of a patient when they not involved in the care of the patient” [104]. “As computer networks are an integral part of a radiology department, it is appropriate to raise concerns regarding their security” [207]. Firewalls do provide security to the internal network, but do not provide protections against attacks launched from computers within the firewall. Tele-radiology can be restricted by the speed of data connection between remote sites and high speed dedicated data links is very expensive. Medical images travel along the internet through many routing computers. “If any of these computers would be compromised, any sensitive data passing through them, such as passwords and account numbers would be discoverable by sniffing”. Thus, data security and network security must be taken seriously in a radiology department [207].

2.7.2 Quality of Data and Information

Information is vital for the safe care of patients. Consequently, hospitals are driven by information. “Information quality is an encompassing term comprising utility, objectivity, and integrity” [138]. Information is used by clinicians daily to make decisions on patient care. Outcomes are monitored, and the quality of care is assessed throughout the patient journey. The understanding of a patient’s individual condition changes as information is acquired, causing the types of care, treatments and medication dosages to change. Consequently, the value placed on high quality information in the hospital setting cannot be overemphasized. This is well recognised in literature, by hospital stakeholders and is increasingly reflected in legislation. However, the complexity of the environment makes it extremely difficult to model systems to support the acquisition of the requisite information. Furthermore, this need for information is leading to increased interoperability between new and existing systems. “Hospital information systems have turned a hospital into a gigantic computer with huge computational power; huge storage and wired/wireless local area network” [137].

Another point that needs to be considered, understood and addressed is that of the information overload which integration can create as this presents a risk of vital information not being analysed and acted upon. According to Sherer (2011) data is used to create information. It can be a challenge in the healthcare domain to extract comprehensible knowledge from data [139] even though better care can result from better information [119]. High quality information can only be provided through high quality information systems that are correctly managed and used. Therefore, the purpose of having quality information
systems is to produce and use quality information to improve patient care by providing timely and accurate measurements.

2.7.3 Conclusion: Data and Information

Data and information systems have a role in the provision of safe care to patients. Information systems and devices are very much at the core of a radiology service where numbers of issues were identified that need to be addressed. IT, including prevalence and use, is expanding in radiology. There is evidence of duplication of data entry on NIMIS, leading to transcription errors and discrepancies. The different sites of the case hospital require patients to have different chart numbers as the design of NIMIS does not allow for a unique identifier. This creates a significant risk for radiologists when reporting and comparing current studies with previous studies. There are large data sets in radiology and with a lack of quality assurance of the data. There can be difficulty extracting data from systems. Physicians who place usefulness above ease of use may be willing to work around systems to a degree. They are, however, reluctant to use data that cannot be quality assured. Ease of access to data can conflict with privacy and security arrangements. The use of data that is not quality assured and periodically verified can lead to risk of error, compromising the safe care of patients. The use of quality assurance metrics for information technology has been shown to lead to improvements in quality of information technology systems [131] [132] [133]. This research will deal with security and confidentiality by including clear policies and procedures and continuous audit of same as part of the programme. It will address the issue of large amounts of data by regular review of a set of appropriate radiology KPIs measuring the high-risk areas. This will facilitate digestible amount of information to review and act upon.

2.8 Technology in a Radiology Department

Magnetic resonance imaging, nuclear medicine and digital radiology has seen major technological advancements in recent years which ultimately benefitted patient care. Medical professionals have embraced this development; health informatics however has not been embraced with the same vigour and commitment. Kavaler and Speigel (2003) argues that the medical data management, data modeling and knowledge management need to advance considerably to get on par with other technologies in the health sector.
2.8.1 *Software Systems Specific to Radiology*

The institute of medicines report on health I.T. and patient safety: Building safer systems for better care [5] recognises the risks that poorly designed technology poses stating that “some case reports suggest that poorly designed health I.T. can create new hazards in the already complex delivery of care.” Clinicians are heavily dependent on information to inform decision making on the management of patients. Without quality software in place, there is little hope of patients benefiting “both directly and indirectly from improved data quality since accurate clinical data are a prerequisite for high standards of care and monitoring [77]. Medical devices are becoming smaller and more portable and we are seeing increased interoperability with systems. This increases complexity.

Radiology must proactively identify and manage risk prior to incidents. They must also reactively manage risk following incidents. Risk management for software systems is not just part of a software quality plan but should be an integral part of the overall risk management plan for radiology. It must be accepted that risks associated with software will never be eliminated rather risk reduction and management must be the goal.

Medical systems and medical devices are critical for managing the care and improving the outcomes to patients. “Health information technologies are tools that support the delivery of care; they do not, in and of themselves, alter states of disease or health [144].”

The literature indicates that technology can be viewed in two ways, as either a means of reducing error e.g. decision support, medication management, reducing human error or it can be seen as a source of error e.g. equipment failures, cognitive overload [89]. One of the prominent issues for the healthcare industry is the development and management of high-quality technology. In radiology, specific equipment quality checks and maintenance programmes for medical devices i.e. ct and MRI scanners are paramount as radiation is involved. It is essential that the nuclear medicine gamma camera, computer tomography scanner and ultrasound equipment be managed in a co-ordinated quality assurance programme to check daily that they operate within acceptable parameters [12].

Computer science and information cannot be separated in the hospital environment and medical informatics is the field where they cross. “Medical Informatics is a multidisciplinary learning area where outcome is supported by two main disciplines, Computer Science (CS) and the Health Sciences (HS)” [135]. Advances in technology have resulted in rapid increase
in the use of information systems within radiology, the purpose of having quality information systems is to produce and use quality information to provide safe care to patients.

2.8.2 National Integrated Medical Imaging System (NIMIS/PACS/RIS)

NIMIS allows ‘filmless’ and "paperless" operations and enables secure and rapid movement of patient image data throughout the health service. This new imaging system allows doctors to electronically view their patient’s diagnostic images, such as x-rays and CT scans, quickly and easily. The rapid access and availability of patient’s records to health professionals is a significant step for service responsiveness and patient safety. 34 hospitals are currently on the network operating nationwide on the new system [196].

The NIMIS/RIS is a web-based application allowing users to request and review local imaging studies. It is accessed via desktop computers by using a unique username and password. The introduction of NIMIS has facilitated the transition from a local, hard copy imaging service to one that is transferrable and easily accessible. It promotes collaboration between institutions and allows remote access to imaging in the acute setting. As with the introduction of any such system, there is a need for an iterative approach to continued improvement and user acceptance testing to support the system to evolve in line with changing clinical demands. The National Integrated Medical Imaging System (NIMIS) is used to store and retrieve medical imaging studies across hospitals in Ireland [208]. With NIMIS patient image data were moved safely and rapidly throughout the health service. PACS/RIS solutions delivered many benefits; to the patient, to the imaging service and to the hospital and the evidence of this are clear from the existing PACS/RIS installations as a software solution in Ireland and worldwide [140].

In medical imaging, picture archive and communication systems (PACS) are dedicated to the electronic storage, retrieval, distribution and presentation of medical images in a format and quality suitable for clinical diagnosis and review. PACS handle images from various medical imaging instruments, including ultrasound, magnetic resonance, PET/CT, computed tomography, endoscopy, mammograms and plain film x-rays. PACS replaced the hard-copy based means of managing medical images, such as x-ray film archives [211].
PACS has the following functions: [211]

- Allows the transfer of images throughout a hospital or region;
- Provides images to a variety of users simultaneously;
- Allows quick retrieval of historical examinations;
- Provides a permanent central store of images;
- Provides advanced image processing tools to clinical staff where required.

Like all other technology, PACS has continued to evolve over the past 20 years. In recent years, the main areas of development have been around improved user interfaces and functionality; web-based services, and improved availability and integration of 3D image processing packages.

2.8.3 Radiology Information System

McKesson provides a RIS solution to NIMIS hospitals, offering a workflow management solution for radiology administration, including integrated Voice recognition activated reporting and optimised radiology workflow. McKesson radiology is a comprehensive diagnostic imaging platform that surrounds its primary radiology imaging toolset with a complement of subspecialty solutions. Users have these tools at their fingertips while staying in one spot, making it the ultimate radiology cockpit [209].

A survey on NIMIS Survey conducted by [140] in an Irish hospital showed overall satisfaction with NIMIS it stated that “many respondents are satisfied with the overall NIMIS functionality and feel that it helps to reduce clinician workload” The survey also showed that clinicians felt that NIMIS was “step in the right direction.”

There were a few issues highlighted for improvement in the system in collaboration with end-users to improve functionality while promoting patient safety:

- Improving IT infrastructure,
- Increased clarity regarding patient records and accounts,
- Simplified image ordering,
- Improvement of communication between end-users and radiologists.
In addition, performance issues within RIS need to be addressed. Implementing such changes and ensuring an ongoing process for end-user involvement would support that NIMIS continues to meet current and future clinical needs to the highest standard [90].

The two major factors differentiating medical systems from conventional systems are critical to the safety of patients in radiology [119]. It must, therefore, be accepted that there is a degree of risk involved with the introduction of any software systems to radiology. The use of medical devices and health information systems in radiology create an inherent risk to the patient. Complexity of software has long been considered a critical I.T. project risk factor [143]. Failure of software in these systems/devices can have potentially catastrophic effects, leading to injury of patients or even death [142].

Risks specific to software, such as device conflicts and performance errors created by real-time software interactions by different applications as described by [139], must have a place in the quality management programme for radiology. The FDA (1997) defines risk management as “an organized effort to identify, assess and reduce where appropriate, risk to patients, visitors, staff and organizational assets”. These risks can be wide ranging from scheduling and timing risks to personnel management risks. Storing patient information on these systems further exacerbates the level of this risk factor [143]. The literature indicates a gap in how to address the lack of risk management and effective use of data captured by existing information systems. In the literature, there is evidence that the risks associated with data in putters using non-uniform methods to extract and analyse data in the live acute clinical environment must be prioritise for resolution.

2.8.4 Conclusion: Technology in a Radiology Department

As described by [90] “Radiology departments generate large amounts of complex information relating to patient diagnosis, monitoring, treatment and health management...” The literature indicates that this information is created using combinations of information sources such as paper, medical devices and various types of clinical information systems. These sources may or may not interface or interoperate with each other. Every radiology department has a different combination of systems. The systems may have been developed initially to different standards.

So, the question remains outstanding - What constitutes system success in the field of acute radiology departments and how may it be assured? A system may produce valid findings, but
they may be of limited use in the field. The research indicates therefore that a system must be fit for purpose. However, fit for purpose may not be enough as users may not have confidence in the system and may not actually use it, therefore user satisfaction and user perceptions of validity must be considered. Users must be aware of this and this must have safety and risk management processes around systems.

2.9 Information Technology Adoption, Infusion and Impact on Quality

Information Technology (IT) is notoriously slow to infiltrate into healthcare despite its obvious benefits such as accessibility, readability, reporting, completeness, decision support, diagnostic support, access to external knowledge sources, data analysis, treatment policy support, quality assessment, management and cost control [146] [147]. NIMIS is at the heart of image archiving in radiology and is widely used daily. Data captured by NIMIS and other information systems are not collated in a systematic co-ordinated way to provide actionable data that measures quality.

The human has a major effect on I.T. adoption and infusion, as do organisational change, workflow redesign, and project management [149]. Staffing issues need to be addressed to provide assurance that technology is successful. Radiology departments will need to invest in sufficient staffing and will require progressive management to allow for the “best technologies to be selected, implemented, and enhanced over time” [202]. One of the main reasons for the healthcare’s tardiness in using data provided by information systems for quality performance management and quality improvement is the perceived lack of benefit at the point of care [146] [151]. Additional information technology can be associated with managerial rather than clinical control [122] [152]. It takes time to learn how to use new systems and some staff may have more aptitude or be more resistant to it adoption and this effect the diffusion of IT. People, work process and social change must occur in the environment to use information technology. Resistance to change is also a recognised factor when implementing new quality assurance programmes [202].

Technology governance in the health care domain involves various stakeholders, medical devices, software systems, policies, and management is an area that is poorly understood and requires further investigation [237].
Information technology is a tool to assist with healthcare provision and can only contribute when the healthcare system is efficient “Computers are amplifiers. If you computerise an inefficient system, you will simply make it inefficient, faster” [255].

2.10 Research Phase 1: Version 1 of RAD-QAP

2.10.1 Literature Review

Each step of the literature review contributed to a greater understanding of the problems within the radiology and provided insight into possible solutions to those problems. The first version of RAD-QAP consists of a list of requirements identified in the literature review and is presented at the end of this section In Table 2.2. It includes a list of relevant groups of radiology KPIs identified in the literature (See Table 2.3).

2.10.2 Contributions to RAD-QAP from Phase 1 (Literature Review)

A number of contributions emerged from phase 1 of the research contributing to the first version of RAD-QAP. A list of requirements for a radiology assurance programme was identified. These are shown in Table 2.2. The literature review identified different approaches to the grouping of KPIs and in the methods used to select a set of KPIs to measure quality in radiology. A limited number of examples are listed in Table 2.3.

See Appendix I for the complete list of radiology KPIs identified in literature review.

These requirements have been grouped together to become RAD-QAP Version 1 (See Figure 2.8).
## 1. Authority

- Implement good leadership which is critical to success (Inquiries Review, Literature Review) [9][7][46][68][70][72][175][87][225]

## 2. Structure

- Quality spans across disciplines and professions and holistically come together to deliver the experience of the patient while passing through the hospital system. Quality can be achieved by effective risk management, both must managed in accordance with best practice, assure that the risk is managed appropriately (Literature Review, Legislation and Standards Review) [8][13]

- Put quality assurance structures in place where the main areas of quality of staff in the in a radiology department are reviewed regularly thus providing quality assurance (Site Visit, Inquiries Review, and Literature Review) [9][7][31][34][42][187][197][203]

- Decide on a quality assurance model and adapt it to fit (Legislation and Standards) [8][78][187][257]

- Robust quality assurance programmes should be in place to identify that when things do begin to go wrong in the clinical domain that the correct people are provided with the correct information and are empowered to address situations as they arise (Inquiries Review) [2][5][8][89][92][174][256]

- Focus on integrity, accuracy, privacy and security is required (Legislation and Standards Review, Literature review) [18][104][120][123][125][207]

- Develop and implement a standardised programme for quality audits (Inquiries Review, Standards Review) [8][12]

- Identify and manage stakeholders to achieve validity and success of each step of the journey (Literature Review, Inquiries Review) [36][194][241]

- Identify requirements of stakeholders (Inquiries Review, Literature Review) [36][241]

- Define stakeholder’s responsibilities (Inquiries Review) [66][70][68][69][179][198][241]

- Quality assurance is the responsibility of relevant stakeholders and must be co-ordinated throughout the entire process (Inquiries Review) [7][2][89][173][91]

- Develop and implement an integrated quality and risk management system. Proactive and reactive risk management processes must be in place (Inquiries Review) [7][8][175]

- Standards must be in place in radiology department. These standards must be regularly reviewed to remain robust and up to date. People must be aware of the required standards and must continually strive to achieve them (Inquiries Review) [5][8][203]

- Prioritise software be covered by the suite of standards developed. Regulation itself is still
3. Quality Data

- Identify possible KPIs in the domain that might be selected for the measurement and management of quality improvement (Literature Review)

  [13][10][21][55][76][91][107][126][131][132][133]

- Identification of usable information available on NIMIS systems that can be optimised as this can significantly improve patient outcomes and minimize the effects when things go wrong (Inquiries Review) [8] [36] [48]

- Data on Q-Pulse/NIMS re complaints incidents and risks must be analysed and used in quality management (Inquiries Review) [8]

- Strive to use all available data available on information systems are used to improve quality (Inquiries Review) [36][58]

- Identify key performance indicators as part as the Quality Assurance Programme. These provide a platform to assess whether the system has been modeled correctly and is practical for use, as an incorrectly designed system will have difficulty or will fail to provide the desired outcomes (Literature Review) [9][13][24][85] [29][144][185]

- Systematic risk assessment will identify whether resources should be targeted towards improving the system or in another direction (Literature Review) [5][6][10][28]

- Formal risk assessment should identify the risks associated with the use of medical the quality of the data produced by software systems. Processes put in place to manage these risks. It must be accepted that risk management will reduce not eliminate the possibility of risk (Literature Review, Inquiries Review) [2][4][5][36]175

- Lessons must be learnt from adverse events and complaints (Literature Review, Inquiries Review) [1][2][173][203][251][257][27] [31][24]

- Identify the safety classification of KPIs to measure quality and risk. Prioritise quality assurance accordingly. (Legislation and Standards Review) [14][19][33][58][77][85][12][78]

- Systems may be in place that are not fit for purpose and cannot achieve success. Systems must be modeled correctly and be practical for use. Assess whether it is worth further investment or should their use be curtailed (Inquiries Review, lietarature Review) [115][116][251][203]
### 3. Quality Data - Continued

- Quality issues must be identified and addressed (Inquiries Review) [8][7][9].
- Education regarding quality assurance process must be put in place (Inquiries Review) [7][58][251]
- Establish existing data quality. Where suboptimal quality is identified, these must be reviewed to identify where the system is failing as part of a continuous process of evaluation (Literature Review) [55][129][111][14][256]
- Regular review of data measuring quality is required (Inquiries and Literature Review) [8][34][31][58][117][118][197]
- Continuous review of structures will identify where the system does not support the process. Process must be modified and optimised or structure must be reviewed and expanded to support the process (Literature Review) [5][29][61][63][65][91]

### 4. Quality Assurance

- Clinicians reluctant to use systems where quality is not assured (Literature Review) [131][132][133]
- Assess achievement of goals (Literature Review) [67][80][81][94]
- Standards must be kept up to date and reviewed regularly (Legislation and Standards Review) [8][78][82][85][88]
- Continually review and update standards. Standards and legislation are continually changing and being updated (Legislation and Standards Review, Literature Review) [12][14][15][120][77]
- There must be robust communication of current status against required standard, so that no staff member can say - ‘I did not know it was happening (Inquiries Review) [8][92]
- Data and record keeping must be of high-quality (Legislation and Standards Review) [12][78][120]
- Demonstrate that there are processes in place to monitor the overall effectiveness of the approved documentation (Legislation and Standards Review) [12][78]
- Develop a suite of approved quality assurance documentation. This must describe the process for managing quality and risk. Demonstrate use of the approved documentation (Legislation and Standards Review) [3][12][18][46][78][223]

<p>| Table 2.2: Requirements for RAD-QAP Version 1 |</p>
<table>
<thead>
<tr>
<th>Summary of Radiology KPIs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality and Patient Safety</strong> [1] [16] [24] [29] [31] [58] [103] [34]</td>
</tr>
<tr>
<td>• No of serious reportable events</td>
</tr>
<tr>
<td>• No of Unreported Images</td>
</tr>
<tr>
<td>• No of critical findings reported within 24 hours</td>
</tr>
<tr>
<td>• No of Repeat images</td>
</tr>
<tr>
<td>• No of Sub optimal images</td>
</tr>
<tr>
<td>• No of Contrast extravasations</td>
</tr>
<tr>
<td>• Equipment Down time</td>
</tr>
<tr>
<td>• Justification for prescribing procedures</td>
</tr>
<tr>
<td>• Frequency of compliance with dose reference levels</td>
</tr>
<tr>
<td>• Hand hygiene</td>
</tr>
<tr>
<td>• No of audits</td>
</tr>
<tr>
<td>• Compliance with dose reference levels</td>
</tr>
<tr>
<td>• <strong>Clinical Accuracy</strong> [1] [16] [24] [29] [31] [58] [103]</td>
</tr>
<tr>
<td>o Timeliness of reports</td>
</tr>
<tr>
<td>o Peer view</td>
</tr>
<tr>
<td>o % Discrepancies</td>
</tr>
<tr>
<td>• <strong>Patient/employee Satisfaction</strong> [1] [16] [24] [29] [31] [58] [103]</td>
</tr>
<tr>
<td>o % satisfaction of staff/employees</td>
</tr>
<tr>
<td>• <strong>Access and Appropriateness</strong> [1] [16] [24] [29] [31] [58] [103]</td>
</tr>
<tr>
<td>o In-patients – time to next appointment</td>
</tr>
<tr>
<td>o Out-patients - time to next appointment</td>
</tr>
<tr>
<td>o Patient Turnaround times</td>
</tr>
<tr>
<td>• <strong>Activity and Capacity</strong> [16] [24] [29] [31] [58]</td>
</tr>
<tr>
<td>o No of reports s per radiologists</td>
</tr>
<tr>
<td>o No of new referrers</td>
</tr>
<tr>
<td>o No of examinations performed</td>
</tr>
<tr>
<td>• <strong>Research and Training (CPD)</strong> [16] [24] [29] [31] [58] [103]</td>
</tr>
<tr>
<td>o No of Peer view articles published</td>
</tr>
<tr>
<td>o CPD Activity</td>
</tr>
<tr>
<td>o Staff Development</td>
</tr>
<tr>
<td>• <strong>Resources</strong> [1] [16] [24] [29] [31] [58] [103]</td>
</tr>
<tr>
<td>o Ratio imaging staff</td>
</tr>
<tr>
<td>o Ratio of Radiologists</td>
</tr>
<tr>
<td>• <strong>Finance</strong> [24] [29] [103]</td>
</tr>
<tr>
<td>o Revenue – variance between actual revenue and revenue in line budget</td>
</tr>
<tr>
<td>o Expense - variance between actual revenue and revenue in line budget</td>
</tr>
</tbody>
</table>

**Table 2.3: Examples of KPI Groupings**
Figure 2.8: Output from Phase 1 - RAD-QAP Version 1
2.11 Influence of Literature on RAD-QAP Version1

There were several findings from the literature that influenced the first version of RAD-QAP. The literature indicated that quality must be managed within a structured programme that included quality audits and risk management as well as standardised methods of extracting information. The literature review also pointed out that the critical aspects responsible for the delivery of a quality care should be included in a quality assurance programme. This programme must be carefully managed by those in authority supported by those with knowledge. Quality assurance and improvement is the responsibility of all stakeholders, involve them in the iterations of the quality cycle. Audits must be implemented, and quality issues identified and addressed. Correct processes must be defined, and it must be established that staff are adhering to them.

Proactive and reactive risk management processes must be in place. Formal risk assessment should identify the risks associated with the use of medical devices, software systems and the data captured. It must be accepted that risk management will reduce not eliminate the possibility of risk. Systematic risk assessment will identify whether resources should be targeted towards improving the system or in another direction. This process will either identify shortfalls or will provide assurance that systems are functioning safely and reliably. Risk management must continually be reviewed, and standards must be set and reset in accordance with the findings. Software must be classified in accordance with a risk category and prioritised for quality assurance accordingly. Clear lines of distinction between hardware and software must be developed and both must be managed in accordance with best practice within known quality and the risk processes.

Use of existing data captured by software systems must be optimised as this can significantly improve outcomes and minimize the effects when things go wrong. These systems must have predefined standards of outcome and these must be measured against to the required standard to test compliance. Data management must be incorporated as part of a quality improvement programme.
2.12 Chapter Conclusion

Radiology is a unique environment functioning around information use. Safe and effective management of patients in radiology requires optimum use of available information. The NIMIS system in radiology systems collect and store of information on a large scale for use in patient diagnosing and treatment across the hospital. High quality information can be provided through high quality information systems. Systems can only achieve their full potential through correct management and use.

Lack of utilization of data produced by software systems within the radiology environment can result in poor quality of service making the goal of patient safety difficult. Radiology faces challenges in terms of managing information systems due to size, complexity of practices, parallel management and resistance to change. A good quality software system accompanied by poor managerial practices cannot provide the required quality of service. Additional problems in the radiology setting are the fractured nature of the domain and the variability of processes. Despite clinicians having such a strong role in hospitals, quality assurance and improvement is the responsibility of all stakeholders. Good intention is not enough; quality assurance is an on-going process which must be monitored and controlled.

While a literature review can provide some insight, it does not give a complete understanding of the reality of the domain. This research project identifies legislation and standards that must be adhered to by staff for the safety of patients in the radiology department. Reviews of the findings of inquiries into failures in radiology and the wider hospital domain observational case study research is required to understand the value of quality data available as output from software systems towards quality management within radiology. Failure to recognise this is demonstrated in the findings listed in Appendix II. Only after reviewing literature, inquiries, literature review, standards and legislation would it be possible to develop a theory, implement and evaluate it.

Current research yields few solutions to the quality data issue in acute radiology departments and this has been identified during this literature review. The aim of the research therefore is to address these issues by means of some practical solutions through the development and implementation of a quality programme or model for radiology, in Irish hospitals, using and adapting recognised healthcare and quality models and standards. This programme must be comprehensive to allow measurement of quality in a complex radiology setting.
Review of the published literature identified no suitable programme for management and extraction of statistical data for review in the clinical domain which would support clinical and healthcare audits leading to the development of the research questions presented.

Following the review of academic literature, standards, regulations, national and international inquiries the research questions for this thesis were derived. These are listed in section 1.5.

The evidence provided by literature review indicates that RAD-QAP must be patient-centric, with the patient at the center of the activity and recognised as the most important stakeholder in the clinical environment [3][2] [19].

Chapter 3 presents the research methodology developed to address the research questions. The remainder of this thesis outlines the development, implementation and evaluation of the quality assurance programme, RAD-QAP.
Chapter 3  Research Methodology

Research is always undertaken to generate new knowledge and, as [158] point out, “there is no single ‘right way’ to carry out investigations in the health field”. This chapter is divided into three distinct parts; research philosophy, describing a few major research philosophies and how they influenced the research model for this project, data management describing how the data was collected, reduced for analysis and displayed and finally research implementation describing how each individual step of the research model was conducted.

3.1  Research Philosophies

[156] states that one of the first stages of research is to “describe the aims and objectives of the research”. Reviewing the research philosophies identified the most suitable method to achieve the research aims and objectives. The researcher, based on work experience in the domain, began the study with concerns that there was no co-ordinated quality assurance programme in place in radiology. Software in the acute hospital was not efficiently providing the yields that they had the potential to provide. The research began with the unstructured idea of improving the quality of care delivered in radiology in the domain that is the acute hospital. Different research philosophies were reviewed and analyzed in relation to addressing this problem. These are discussed in subsequent sections.

3.1.1  Qualitative versus Quantitative Research Methods

Research can be classified based on the data used. The predominant types of research data are language data and numerical data.

Qualitative research generally refers to research using language data. Straus et al (1997) describe qualitative research as ‘any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification’. Qualitative research can lead to an evolving framework where the hypothesis might change. Bowling (2009) describes it as “social research which is carried out in the field (natural setting) and analysed largely in non-statistical ways.” There are many advantages to using qualitative methods of research. More information can be acquired by the researcher probing into the complexity of the problem rather than abstract it away [158]. Qualitative research provides a rich source of meaningful information and delves far deeper into the real-life scenarios, using a combination
of interviews and documentation reviews and was thus considered by the author to be suitable to this study.

**Quantitative research** generally refers to research using numerical data. The researcher develops a hypothesis and tests it using formal numerical or statistical techniques with the objective of developing unbiased results. Straus et al (1997) defines it as “the measurement and analyses of observations in a numerical way.” There was a place in this study for quantitative research, but it was not considered to be the most appropriate approach.

The objectives of the research required the identification of solutions to existing problems in the live clinical environment. To address the research objectives required implementing and tested their effectiveness and validity in the field. The successful use of data captured by software systems can be measured. The effectiveness and validity of the software systems can also be measured using numerical data, but this alone would not find solutions to the existing problems and thus answer the research objectives. A qualitative approach was taken, supported by quantitative analysis where relevant.

### 3.1.2 **Positivist Research versus Interpretive**

Positivism tests a predefined theory in a controlled manner. “Positivism assumes a stable, observable reality that can be measured and observed” [155]. Measures and systems for measuring the hypothesis are agreed in advance and followed rigorously, this is documented in such a way that others can reproduce the experiments; it is repeated and tested to assure the reliability of the data. Positivism can include empirical methods which involve studying observable phenomena. Bowling (2009) describes empirical research as research that is ‘based on observation’. This involves stating a hypothesis, developing a set of objective measures and measuring in a systematic, rigorous, reproducible and repeatable fashion. It involves the creation of a laboratory type scenario where the community under observation is controlled to maintain a stable environment. An example of this would be to undertake research into the” caesarean section rate for women with health insurance versus women without health insurance”. A hypothesis could be developed such as ‘Women with health insurance do not have a higher caesarean section rate than women without health insurance’. This is then tested.

Positivism was deemed unsuitable for this research due to the complexity of the domain and the fact that the researcher was unable to discover a similar quality programme, against which
to measure. The researcher needed to understand the requirements and to overcome the barriers to medical device software quality and success. Consequently, an interpretive approach is more suitable than a positivist one.

Using the interpretative approach, the researcher attempts to understand and explain the domain, the human behaviour and the reasons for the phenomenon being observed. For example, if interested in the reasons for pregnant women choosing to use private health insurance then the interpretative approach to research would be appropriate. ‘The most interesting questions are not about the reality of the world, but about people’s interpretations of it’ [160]. The research questions outlined for this thesis lent themselves to interpretative research as the researcher wished to discover the barriers to achieving continuous quality improvement in a Radiology department prior to the development of the quality assurance programme. “The aim of interpretative research is an understanding of the world from the point of view of the participants in it, rather than an explanation of the world” [160].

3.1.3 Exploratory Research versus Explanatory Research

Research can be used to explore or to explain phenomena.

Exploratory research is used to gain insights and ideas where the problem or the scope of the problem is not clearly defined. Common methods used to carry out exploratory research include literature reviews, focus groups, case analysis and interviews.

Exploratory research is necessary in this case to identify the key existing problems with software in acute hospitals. Exploratory research is suitable for this study allowing relevant themes to be identified.

Explanatory research is used to explain cause and effect in relationships. A hypothesis must exist prior to data collection. The relationship between the variables is then tested. An example being: *The surgical waiting lists are reduced because there is a new theatre management system in place.* This type of research was not suitable to this study as there was no intent to explore cause and affect relationships.

3.1.4 Inductive versus Deductive Research

In research, there are two substantive ways of reasoning to arrive at a conclusion, inductive and deductive.
Deductive research is used to test a hypothesis. Commencing with a theory, a hypothesis is developed and tested. It is a top down or waterfall approach whereby the researcher studies the work and theories of previous researchers and develops a hypothesis against which a test is carried out.

Inductive Research “begins with the observation and measurement of phenomena and then develops the ideas and general theories about the universe of interest. Inductive reasoning begins with the observations and builds up ideas more general statements and testable hypotheses from them for further testing based on further observations” [156]. It is open ended and exploratory in nature. It can be considered a bottom up approach commencing with observation-pattern-tentative hypothesis - theory.

The research questions for this PhD would be more likely to be answered using inductive methods of research rather than deductive. This was due to the lack of an existing quality assurance programme against which to test. Initially, therefore this quality assurance programme had to be developed through exploratory research.

3.1.5  Flexible Methodologies and Mixed Methods

This research project commenced with a general concern over the lack of a quality Assurance programme in radiology. ‘With deductive reasoning, the investigator starts with general ideas and develops a theory and testable hypotheses from it’ [156].

As the researcher gained a higher-level understanding of the methodologies and the research questions requiring answers it became evident that a mixed methods approach was required. [114] indicates that “central to the effectiveness of a mixed methods study is a clear and strategic relationship among methods to confirm that the data converge or triangulate to produce greater insight than a single method could”. The researcher began to develop a mixed methods study for the development, verification and evaluation of the research. It was necessary to provide a clear structure for a qualitative study incorporating mixed methods so that it will be possible for other researchers to repeat the study.
3.1.6  

*Case Study and Action Research*

Case study research: The researcher incorporated case study into the research design as it is a useful diagnostic tool to gain an understanding of the current status, activities and trends of a complex domain such as a radiology department in an acute hospital setting, it is conducted to study phenomena in its context [161] [160]. It is a method which focuses on circumstances, dynamics and complexity of a single case, or a small number of cases [156]. Case studies generate an understanding of real world phenomena, but what is gained in realism is lost in control”. Case studies do not generate the same results on e.g. causal relationships as controlled experiments do, but they provide deeper understanding of the phenomena under study” [16]. The case study design for this research was influenced by [160] who stated “They typically involve a combination of data collection methods, such as observation, documentary analysis and interviews”. Case study research was considered a useful diagnostic tool and as such has a place in the study.

However, the researcher wanted to influence change and therefore required a more interventionist approach. Action research with its focus on the change process was reviewed for suitability. Action research is a form of emancipatory social theory where theory and practice are linked. It is generally accredited to Kurt Lewin, who described a process of planning, fact finding and execution, whereby, following conception of an idea, a plan is developed, actions occur, results are studied, and further actions occur. Figure 3.1 demonstrates how action research effectively links theory with practice, “a three-step spiral process of (1) planning which involves reconnaissance; (2) taking actions; and (3) fact-finding about the results of the action [163].

Each phase resulting in a new version of RAD-QAP:

- **Phase 1**: Problem definition produced **RAD-QAP version 1**,  
- **Phase 2**: Engage with real world setting-define/observe/collection data produced **RAD-QAP version 2**,  
- **Phase 3**: Planning action and intervention produced **RAD-QAP version 3**,  
- **Phase 4**: Act/intervene/ analyze/ reflect produced the fourth and **final version of RAD-QAP**.

Figure 3.1: Action Research Cycle: Showing Research Phases [246]
On reviewing the literature around action research, it became apparent that since Lewin’s time there are different opinions on what constitutes action research and that there is a problem with defining it [164]. McNiff (2002) provided this description of action research. “Action research is a term which refers to a practical way of looking at your own work to check that it is as you would like it to be. Altricher et al (2002) divided action research into two distinct parts: an “axiomatic part”, indicating what is meant by action research and an “empirical part”, presenting an inventory of “rules of thumb” that collects reflected research experiences of action researchers. The researcher, according to [114] works closely with the researched, to identify problems and effect change. Miles et al (1994) provided a useful description of action research which was used in this research “The researchers, with local help, design the outlines of a “field experiment” where “The data are collated and given to the “activists”, both as feedback and to craft the next stage of operations.”

3.1.7 Participants on Action Research Projects

Four phases of research were undertaken, integrated within action research cycles as shown in Figure 3.1. Domain leads were identified to work as participants with the researcher during action research cycles. Discussions with senior management identified the most suitable person to take a domain lead on each project.

The person identified had to have a leadership role and be able to influence change in the department. They were required to be capable of contributing to both identifying problems and suggesting solutions and must have also been in a position to share learning arising from the project. A series of in depth interviews and meetings took place with the domain leads to establish where their respective departments lay in context with the findings from the research. The domain leads identified and provided documentation such as existing governance structures, audits, policies and procedures and quality improvement plans in relation to the measurements of selected KPIs. They provided documented evidence in relation to the timeframe and progress of the development and implementation of the agreed quality improvement plans. They also provided valuable input in evaluating the impact of the KPI measurements on the quality of the care delivered to patients in radiology. They also reported on the effect that the RAD-QAP had on the overall running of the radiology department. They also were involved in providing certain data needed to track quality improvement.
The domain also had a bearing on the choice of research methodology. As the researcher intended researching a broad domain, consisting of many stakeholders with a variety of needs, the researcher needed to incorporate their combined skills and expertise to analyse and to develop solutions to existing problems. The researcher’s role in the organisation necessitated that the researcher and researched worked closely with each other which made action research a suitable paradigm. The chosen methodology also aligned closely with the organization’s mission, strategic and operational goals. This method of research was noted to fit in with the hospital priorities for quality and audit where staff are encouraged to be involved in a plan, do, check, act cycle to improve process within their scope of practice. Senior management would endorse a well-designed action research project.

Mixed method research, involving site visits, interviews, literature reviews, white paper reviews, observational case and action research was conducted in three radiology departments, to achieve a state where quality and risk were managed effectively by means of KPI measurement within a predetermined framework as prescribed by the proposed quality assurance programme (RAD-QAP).

3.1.8 Role of the Researcher

The researcher worked as the quality and patient safety coordinator in the diagnostic directorate that includes radiology, occupational therapy, physiotherapy, speech and language therapy and pharmacy. The researcher was in this role during the first year of the research project. The quality coordinator reports directly to the clinical director of the diagnostic directorate and has no reporting relationship with radiography staff. In the 2nd year the researcher moved into another role that was removed from radiology.

The researcher engaged with the persons accountable and in charge of the daily operations in radiology in a structured manner through the reporting structure that was in place in radiology. Decisions regarding the appropriate next steps were taken by the focus group after collaboration and in-depth discussion of feedback from the action research. The researcher participated as a participant observer and noted the decisions taken and incorporated these into RAD-QAP. The different versions of RAD-QAP were presented to the focus group for their review and comments.

The domain experts are clinical specialist radiographers (See Table 3.1 overleaf) that are responsible and accountable for the running of their respective departments such as the
computer tomography department (CT), nuclear medicine department and emergency department (ED). They report to the radiography service manager. The clinical director (consultant radiologist) and the radiography service manager (also described in Table 3.1) provided governance (leadership) throughout the project.

<table>
<thead>
<tr>
<th>Domain Leads</th>
<th>Research Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiography Service Manager</td>
<td>Radiography Service Manager in Radiology has authority over the radiographers and was a participant in the Focus Group. She is in a position to influence and drive the quality agenda. Clinical specialist’s radiographers were identified to work with the researcher within the domain where the action research took place. They have a stake in management of quality. They are in a position to influence change within the department. They are capable of contributing to both diagnosing problems and suggesting solutions. They are in a position to share learning arising from the project. Clinical specialists are in charge of their own departments (CT, MRI, Nuclear Medicine, and Mammography) and report into the Radiography Service Manager.</td>
</tr>
<tr>
<td>Radiography Clinical Specialists</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Domain Leads: Research Roles

3.2 Research Data Management

3.2.1 Data Collection

The methods of data collection are as follows: site visits, interviews, Delphi consensus study, cataloguing of experience, focus groups, review of documentation, mapping studies with gap analysis, participant observer studies and score matrixes. In this section these methods are described and discussed in detail. The researcher engaged with participants at each stage of the research.

Triangulation of data items contributed to diagnosis. “Triangulation is important to increase the precision of empirical research. Triangulation means taking different angles towards the studied object and thus providing a broader picture [161].

It should be noted at this point that ethical approval was received prior to collecting data. Consent was also granted for to access the NIMIS System for the purpose of research. See Appendix III for a copy of the consent form.
3.2.1.1 Engaging with Participants

Throughout the course of this research the researcher endeavoured to engage with participants in a fair, open and transparent manner. Prior to engaging participants in the study, the researcher requested permission from their line manager. Radiology consultants were approached directly as they have professional autonomy. When permission had been granted by the participants’ line manager, the participant was contacted and asked to participate in the project. Prior to involvement on the project a preliminary discussion took place with each participant. The special delivery unit (SDU) of the HSE presents nine questions for agreement with study participants which were utilised and framed the discussion with participants:

- How much time and effort will be involved?
- What kind of data collection is involved (e.g., observation, interviewing, journal writing, life histories)?
- Is participation voluntary?
- Who will design and steer the study?
- Will material from participants be treated confidentially?
- Will participants’ anonymity be maintained?
- Who will produce descriptive and explanatory products?
- Will participants review and critique interim and final products?
- What benefits will accrue to participants—both informants and researchers?

Following line manager permissions and preliminary discussions with participants, interviews and data collection commenced. The researcher adhered to [93] who recommended that feedback be given to the participants to engender long term trust and for the validity of the research. Transcripts of interviews and observations were sent back to the participants to enable correction of raw data. Analysis was also presented to them to maintain their trust in the research.

3.2.1.2 Cataloguing of Experience

The researcher catalogued her own concerns and observations providing the first output of the research project. These were catalogued under the appropriate titles. Added to this
catalogue of experience were concerns identified during the site visits to other radiology departments.

3.2.1.3 Interviews

Interviews featured in both the problem definition phase and in the final evaluation of the project. The purpose of the interviews was to extrapolate the experience of staff at the different levels in the multi-disciplinary team working in the radiology department. In the diagnosis phase the purpose of the interviews was to identify both contributing factors and barriers to the success of a quality assurance programme for a radiology department. In the evaluation phase the purpose was to evaluate RAD-QAP.

The interviewer travelled to the participants. A quiet room was used to conduct the interview. Interviewees were thanked for their participation, informed that participation was voluntary and that they could terminate the interview at any time. It was explained that the interview would take approximately 30 minutes. The nature of the study was outlined to interviewees. It was explained that the interview was anonymous, that it would be recorded using a digital recording device, and that it would not be transcribed by the interviewer personally but would be given to an assistant for transcribing. Written consent was taken (See Appendices IV, V, VI) copies of the consent form). A series of open ended questions were developed in advance of the interview (See Appendix VII). Prompts such as ‘can you expand on that’ were also prepared prior to the interview.

Interviewees were asked to speak up so that the interview would be recorded accurately. Interviewees were offered a break 20 minutes into the interview or if they exhibited signs of fatigue. The researcher considered that the interview had reached saturation point when the interviewee was returning the same answers and no new information was forthcoming from that interviewee. A digital copy of the recording was given to the interviewee and one kept by the interviewer. A copy of the form stipulating the conditions for the interviews can be seen in Appendix VI.

3.2.1.4 Expert Focus Groups

Expert focus groups took place at intervals throughout the implementation of the research to review progress with the programme and give feedback to develop a practical effective and workable Quality assurance plan.
The focus groups reviewed the working version of the RAD-QAP programme and provided input and opinion. This was to explore its relevance and usability and to provide an objective overview. Proposed refinements were reviewed, and the members interpreted the quality of sources and the validity of the suggested changes and decisions were made by consensus to update the programme.

Membership of the focus groups varied according to availability but reflected the membership of the quality committee/audit committee/governance committee in radiology.

3.2.1.5 Documentation

The researcher had access to radiology documentation. This documentation was reviewed and was used to provide overviews of the quality assurance processes in the relevant areas being researched. The documentation was reviewed for formal evidence of quality requirements such as defined organisational structures, lines of governance, quality assurance processes such as risk assessments, audits and performance indicators. Documents were reviewed at a number of stages in the research including the case study research, the diagnosis steps in the action research cycles and of course the published evidence – literature review, inquiries, legislation and standards. Documents were selected for different purposes at different stages of the research.

3.2.2 Data Analysis

Thematic analysis was used to analyse the data. Thematic analysis is a well-recognised and widely used method to extract themes from data [168].

3.2.2.1 Thematic Analysis

The use of thematic analysis has been successful in the clinical domain, [169] [170]. A feature of thematic analysis is its independence from the major research approaches; it is a flexible tool which can be mapped to the different approaches of thematic analysis is its independence from the major research approaches; it is a flexible tool which can be mapped to the different approaches. Thematic analysis can be mapped to inductive research where the research questions evolve from the identified themes or it can map to theoretical research where the research codes answer a specific question. It was therefore suitable to provide consistency across the various stages of this mixed methods research project. However, the
flexibility that enabled it to be used across the various research phases was constrained by the use of a number of rules to bind and control the qualitative research to support the project and keep its focus and validity.

High profile inquiries and investigations were thematically analysed to identify common themes. Thematic analysis was also applied to the staff interview responses to extract common themes. Extracted themes were aligned to health care standards. The findings from this analysis were listed as requirements for RAD-QAP.

The six steps of research described [169] were used to control the data management.

- Familiarise yourself with your data,
- Generating initial codes,
- Searching for themes,
- Reviewing themes,
- Defining and naming themes,
- Producing the report.

Five of the six research steps are briefly described below. Step 6 (producing the report) will be described in Section 3.3.10.

1. **Familiarize yourself with your data**

With the first pass through the data the researcher looked for patterns of meaning or relevance in the research. To familiarise myself with the data it was necessary to read the data items a number of times, I wrote down ideas that occurred as I read the item. Ideas were put on paper and potential key themes were identified.

2. **Generating initial codes**

The list of ideas generated formed the source material for the coding [166] describe codes as ‘efficient data-labeling and data-retrieval devices’ used to ‘empower and speed up analyses. Coding was performed manually, I coded for as many potential themes as possible. On the first pass through the data, the open coding, I assigned a code to each piece of data. I undertook several further passes through the data items until I was satisfied that each piece was coded.
The data was coded using tags to give meaning to the findings: ‘tags or labels for assigning units of meaning to descriptive or inferential information compiled during a study’ [166]. The data was coded by marking sections of text with similar topics or information with the same label, a representative word or phrase. This enabled sorting of the data through a process of Grouping and re-labeling. Three classes of code described by [166] were used: descriptive, interpretive and pattern code. This shows each class placing more interpretation than the previous one.

3. Searching for themes

Axial coding was performed to organise the initial codes and to develop the preliminary themes. The relevant codes were gathered into the themes. Themes differ from codes in that they can be broader. Codes had the capacity to fit into many themes. Potential themes were highlighted with a marker and notes were written on the margin. I went through the codes many times until satisfied that no themes had been overlooked. At this point the themes were merely potential themes requiring further categorisation.

4. Reviewing themes

I reread the data items that made up the data corpus to include the themes were identified and to checked that I had a complete potential theme set. These themes were then further categorised and condensed. Some themes were classed as irrelevant to the research and some themes became subthemes of more dominant themes. A thematic map was defined (See Appendix II, VIII).

5. Defining and naming themes

The specifics of each theme were refined, and clear definitions and names were assigned so that the overall story of the analysis was clear

3.2.2.2 Consensus Studies

The list of KPIs selected for the first iteration of RAD-QAP was selected by employing a Delphi study. This is facilitated structured process whereby panels of experts’ complete questionnaires and, through feedback and scoring over a number of rounds where some KPIs are discarded, a consensus is achieved on a final set of KPIs. The panel need not ever meet
face-to-face and everyone’s feedback is provided anonymously to the panel, which eliminates the possibility of undue influence by dominant personalities within the panel.

The rand appropriateness method combines scientific evidence with expert opinion by facilitating experts to rate, discuss and re-rate KPIs. This method implies face to face meetings which in this research project did not happen. The Radiologists were supplied with appropriate scientific literature re the KPIs and asked to take the scientific knowledge into account when selecting KPIs. The aim was to encourage KPI selection on evidenced based literature [20].

This research project employed a combination of the above two methods for KPI selection. The Delphi assessment instrument can be seen in Table 3.2.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validity</td>
<td>Is the indicator satisfactory in terms of:</td>
<td>1-3 Low degree of relevance 4-6 Medium degree of relevance 7-9 High degree of relevance</td>
</tr>
<tr>
<td></td>
<td>Face validity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Content Validity</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>Is the indicator satisfactory in terms of reliability?</td>
<td>1-3 Low degree of relevance 4-6 Medium degree of relevance 7-9 High degree of relevance</td>
</tr>
<tr>
<td>Acceptability</td>
<td>Is the indicator acceptable?</td>
<td>1-3 Low degree of relevance 4-6 Medium degree of relevance 7-9 High degree of relevance</td>
</tr>
<tr>
<td>Feasibility</td>
<td>How is the:</td>
<td>1-3 Low degree of relevance 4-6 Medium degree of relevance 7-9 High degree of relevance</td>
</tr>
<tr>
<td></td>
<td>Availability of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burden of data collection</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2: Delphi Study - Assessment Instrument [16]
3.2.3 Mapping

This research project included three mapping studies; the first involved mapping RAD-QAP to the HSE, quality and risk management standard, the second mapping study mapped RAD-QAP to health care standards and the third mapping study compared of the 7 Components of RAD-QAP to a hospital quality assurance programme, H-QAP [23] [84]. This approach was used to map a version of RAD-QAP to a new national standard for better safer healthcare of the relevant aspects needed for a holistic approach to quality performance measurement. The mapping study produced scorecard divided under certain headings as identified by the mapping process.

To investigate the problems related to information flow in the radiology the researcher process mapped the intricate information pathway for an average patient on NIMIS System.

3.2.4 Data Display

Various forms of data display were utilised throughout this research. These included thematic analysis reports, score cards, posters, dashboards and relationship diagrams. The quality assurance scorecard was the most prominent method of display.

Thematic reports were generated at each phase of the research. These were provided to the research supervisor and to the domain leads and stakeholders at each phase of the project. A number of the reports were further developed and published as presentations at conferences.

A set of key performance indicators (KPIs) is encouraged in the radiology. A scorecard framework was developed based on the Norton and Kaplan model used in the finical sector. The scorecard was used to record, manage, track and trend, display and communicate the KPI measurements against set targets to determine the benefits from the quality assurance programme to determine if continuous quality improvement had been achieved. Achieving the benefits indicated successful performance. The status of the dependent variables was also measured as this is where the improvements must take place to achieve success. The set of KPIs were selected by and expert group through consensus after 3 rounds of elimination using a Delphi study.

A scorecard was used to provide a high-level overview of selected KPIs against set targets for departmental as well as senior management performance reviews. These were produced monthly and eventually could portray a complete year of information on one page. The
scorecard includes a traffic light system; red indicating standards needing action or review, amber; warning that standards had slightly breached and green indicating compliance with standards.

Posters were used as a simple and effective means to communicate information and to indicate where standards are required to change or improve. These were A4 printouts providing a combination of visual instruction using diagrams and text instructions. This communicated information to staff to provide evidence of current standards and where standards need to improve. RAD-QAP was displayed as a relationship diagram. The themes were implemented from the top to the bottom as per the diagram. This was color coded for increased clarity.

3.3 **Research Design (Phase 1-4)**

Following review of the research philosophies and paradigms, the challenge being, as [166] describe it, “to combine theoretical elegance and credibility appropriately with the many ways social events can be described; to find intersections between the propositional thinking of most conventional studies and more figurative thinking”. The researcher designed a four-phase mixed research methodology which produced four versions of RAD-QAP. RAD-QAP is developed in a four-stage iterative process as Figure 3.1 illustrates, the problem definition (phase 1), case study (phase 2), mapping (phase 3), implementation and evaluation (phase-4) with integrated action research cycles.

*Phase 1: Problem Definition*

An extensive systematic literature review was carried out to identify any existing radiology specific key performance indicators that could be used to construct an initial model of the RAD-QAP. The first phase of the research involved an in-depth literature review (described in Chapter 2) which included a review of academic literature, high profile inquiries and relevant standards and legislation. This phase produced the requirements for RAD-QAP as shown in Table 2.2). This information was used to develop the first **Version 1 of RAD-QAP** (See Figure 2.8).
Phase 2: Engage with real world setting / Define / Observe / Collect data

The second phase of the research involved an analysis using site visits, interviews, hospital observational case studies, service analysis a participant observer Delphi studies. Phase 2 was carried out in 3 radiology departments. Two of the radiology departments were in model 2 sub-acute hospitals and one in a large acute model 4 hospital. Version Two of RAD-QAP was the output from this phase. The interviews and observational studies enabled the identification of specific concerns in the radiology department. A score matrix was designed with set criteria for KPIs. This matrix was used to prioritise KPIs for inclusion or elimination. Elimination with an expert group (discussed in section 3.4.1), a set of KPIs with relevant metrics were selected. The score matrix rated KPIs on the basis of validity, reliability, acceptability and feasibility. The result of the process contributed to RAD-QAP version two. The output of this phase was **RAD-QAP version 2**.

Phase 3: Planning Action and Intervention

The next step involved the model being mapped to quality standards, health care standards and a hospital quality assurance plan. A gap analysis was performed to compare RAD-QAP with the HIQA standards for better, safer healthcare. The results of the gap analysis identified a few gaps in RAD-QAP, which were addressed by adding the relevant KPIs. A scorecard was constructed and populated with selected KPIs and set targets under the listed headings identified by mapping studies. **RAD-QAP version 3 was the output of this phase.**

Phase 4: Act / Intervene / Analyze/ Reflect

In the fourth and final phase the model was evaluated by implementation in a live clinical environment in a radiology department in a large model 4 acute hospital. Modifications were made on feedback from the expert consensus group as well as a participant observer study. This was done in two phases: face to face interviews with managers and feedback analysis. This feedback was taken on board and the model was adapted accordingly. This phase produced the **final version of RAD-QAP**.

Each phase is discussed in detail in the following sub-sections.

3.3.1 Research Phase 1: Problem Definition

Analysis of data, from separate sources, an academic literature review, high profile inquiries, standards and legislation reviews (see Figure 3.1) combined to make up the first phase of the
research. This resulted in problem definition, research objectives and version 1 of RAD-QAP. Key outputs were identified, analysed and categorised and the first version of RAD-QAP is presented as a solution to existing problems.

These were analysed using thematic analysis to identify where things can go wrong in the acute hospital setting. The findings were summarised and categorised to establish common themes in findings and recommendations. This provided insight into failures in clinical situations and how they may be avoided in the future. Recommendations were identified which were (a) focused on the use of data produced by information systems (b) would be supported by information systems and (c) had no information systems relevance. For the purpose of this research, only (a) and (b) were of interest.

**The output from Phase 1 is Version 1 of RAD-QAP, presented in section 2.**

3.3.2  *Research Phase 2: Case Study*

Research phase 2 consisted of site visits, interviews, service analysis, hospital observational case studies, and participant observer Delphi studies. The objective of phase 2 was to refine RAD-QAP Version 1.

3.3.2.1  *Site Visits*

The researcher had concerns with the fact that there was no co-ordinate quality assurance programmed to track and trend quality initiatives in the radiology department. To investigate externally, site visits were conducted outside the domain. They were 2 model 2 hospitals; the third was a radiology department in a large model 4 acute hospital. Practices and processes were observed in all three sites. The themes were compared and produced differences in approach to complying with the HIQA standards in one instance there was a complete absence of any quality performance measures or agreed KPIs. These observed differences provided insight into the requirements and barriers for a quality assurance programmed for a radiology department in an acute clinical domain.

3.3.2.2  *Hospital Observational Case Study Research*

The researcher utilised observational case studies to gain insight into the quality management processes in radiology. The researcher prioritised four observational case studies in radiology. One case study focused on the patient pathway from the emergency department
(ED) through the radiology department in the domain hospital. These observational case studies were conducted to gain an understanding of the use, value, success and barriers to success of the work flow in radiology, including relevant information systems. NIMIS/RIS/PACS were a focus in the live clinical domain. For inclusion, the observational studies had to provide a comprehensive overview of the management of quality performance in the domain. Therefore, they were chosen to include the complete patient pathways as well as the workflows surrounding the process.

3.3.2.3 Staff interviews

Initial interviews took place with staff across the 3 hospitals provided insight into staff perception and understanding of quality assurance in radiology. The interviews informed to possible barriers that might impact the development and implementation of a radiology quality assurance plan. The themes identified in these interviews were used to inform the design of RAD-QAP.

3.3.2.4 Participant Observer Delphi Studies

A Delphi study was undertaken to illuminate certain KPIs. Fifty-five KPIs were selected after eliminating the KPIs that did not apply to a public hospital setting. KPIs that were designed for old type of film-based departments were also excluded.

A decision was taken that a consensus group consisting of 10 consultant radiologists with an average of 10-15 years’ experience in the field of radiology would select the set of KPIs. The group included a radiographer service manager, quality and patient safety manager as well as a radiology nurse. A finance manager and a human resource manager were included in the group in the final round. Membership of the focus group varied according to availability but reflected the membership of the quality committee/audit committee/governance committee in the domain. The focus group was chosen to provide a broad spectrum of expertise and experience in the domain. The focus groups took place in established meeting rooms in the radiology. These generally took place while seated at a round table. RAD-QAP was projected on to the wall for the group members to review. Three rounds of elimination were carried out to refine the list of KPIs to a manageable number. KPIs that would be impossible to measure were not included in the set of KPIs. A score matrix was used to eliminate KPIs of the second list of 55 KPIs that was selected out of the literature. This delivered a set KPIs
relevant KPIs and metrics. The score matrix rated KPIs based on validity, reliability, acceptability and feasibility.

### 3.3.2.5 Service Analysis

A complete service analysis, including patient complaint analysis, incident analysis, risk assessment analysis, capacity studies, resource analysis, technological capability and capacity analysis, HIQA recommendations and external audits, was employed to identify the weaknesses in radiology that needed to be addressed as a matter of urgency. The KPIs that posed high risk were identified. KPI were prioritised for measuring according to risk rating. First measurement was undertaken in the high-risk areas.

**The second version of RAD-QAP was the output from phase 2 of the research** and is described in chapter 5.

### 3.3.3 Research Phase 3: Mapping Studies with Gap Analysis

Three mapping studies were included in this research. The first involved mapping the sets of KPIs to the HSE, quality and risk management standard (QRMS). Using excel as a mapping tool, the individual items of the HSE standards were mapped to the relevant KPIs. It was then possible to identify the aspects responsible for the delivery of a high-quality patient care were included in mapping between the standards and the relevant KPI sets. This approach was used to map a version of RAD-QAP to the national standard for better safer health care. RAD-QAP was also mapped to a hospital quality assurance programme (H-QAP) [23].

### 3.3.3.1 Construction of Scorecards

The set of KPIs produced by RAD-QAP Version 2 was formatted to construct as a scorecard, including the aspects that will provide and support a quality service. Scorecards were initially developed for the financial sector, and thus had to be adapted appropriately for health care, the national standards for better safer health care [20] were selected as most suitable for providing a grouping for this study as it maps almost intuitively to the categories that needs to be included in the scorecard. The scorecard [25] [26] was constructed to serve as a framework for recording and communicating KPI measurements and progress against set targets. This provided a management and display tool for collected measurement data. These were aligned with the priorities listed on the radiology service plan and with the strategic goals of
the organization [23]. The radiology service plan includes the goals agreed by senior management team, designed to enable the radiology department to meet the overall organizational goals. This resulted in a scorecard which showed KPIs in categories, and displayed the targets set.

3.3.4 Output from Phase 3: Version 3 of RAD-QAP

Phase 3 of the project produced the construction a scorecard with process of use as shown in Tables 5.10 -5.14.

3.3.5 Research Phase 4: Implementation and Evaluation of RAD-QAP

Phase 4 of the research involved action research cycles (see Figure 3. 1). Two action research cycles were completed to collect the initial data for the scorecard. For each action research cycle a suitable person was identified to take a domain lead and to work with the researcher in implementing and refining RAD-QAP throughout the action research phases. There was a continuous cycle of action research in place in each domain for approximately one year.

The domain lead was a senior member of staff and brought a working knowledge of the running of a radiology department both administratively and clinically and was in a position to contribute to diagnosing problems and suggesting solutions. This person was also in a suitable position to identify and provide existing documentation and to facilitate and lead in the dissemination of learning arising from the research. The researcher worked closely with the domain lead, but in a different capacity, as an advisor, from an academic perspective. The researcher also observed practice and documentation. Finally, the researcher recorded findings. The domain lead worked in an operational capacity implementing findings, providing feedback and operational advice to progress the research. The research progressed simultaneously on several strands in a live environment. Actions had varying timeframes; some were in progress while others were being evaluated.

Within the action research cycle, diagnosis, action planning, action taking and specifying learning were completed.

3.3.5.1 Engage in real world setting/Define/Observe/Collect

Findings from the Delphi study, mapping studies and gap analysis provided a current version of RAD-QAP. Quality meetings were held with the domain lead and personnel managing
quality and risk to discuss existing quality assurance initiatives in the department. Review of departmental documentation, processes and practices facilitated the diagnosis of the current state of the department in relation to the state indicated by an implementation of RAD-QAP.

Each of the action research cycles commenced with a meeting with the domain lead and relevant radiology staff. This was to establish which documentation was available and relevant for analysis. The objective of this was to gather the relevant data items for analysis to provide evidence to diagnose where the department lay in relation to quality and quality improvement. The diagnosis reports were developed following these meetings and used for the action planning step. Documentation in relation to the quality, the development of appropriate quality improvement plans, the tracking of quality improvement initiatives and any problems encountered by staff.

3.3.5.2 Planning Action and Intervention

Action planning was conducted to achieve quality assurance through implementation of RAD-QAP. The diagnosis reports and score cards provided an understanding of quality and risk success and diagnosed problems within radiology. Where KPI targets were not achieved, actions were planned to address the situation and take the department to the next level of improvement. A suite of quality improvement plans (QIP’s) was developed to address issues identified in the diagnosis phase. Monthly reviews of the scorecards with quality data and progress on the QIP’s took place.

Barriers to implementation and the successes achieved from the project were reviewed at the meetings. New knowledge resulting from diagnosis reports, the reviews of barriers to implementation and successes arising from implementation provided the roadmap to for further action planning, ensuring a continuous spiral of improvement. Appropriate stakeholders were involved, and quality improvement plans were assigned to the person with the authority to implement the required action.

A communication strategy was developed for radiology staff to keep them informed and aware of the quality assurance programme and initiatives in progress in the department. The researcher met with the domain lead regularly to identify solutions to plan activities to address issues that arose. These solutions provided input into the development of RAD-QAP. For consistency and validity of the project documentary evidence was the measure used to determine the success of the use of KPI data and scorecards as part of RAD-QAP.
3.3.5.3 Act/Intervene

The outcome of the action planning phase resulted in quality improvement plans requiring implementation to achieve targets set by RAD-QAP. Key stakeholders with the authority and knowledge were brought together to implement the changes. The risk of non-compliance and the scope of an issue dictated ownership of quality improvement plans. In some cases, the domain lead could address an issue, such as policy development. In other cases, the consultant lead was required to make changes (for example, changes to consultant practice). Implementing change in an organisation is recognised as difficult particularly in a domain such as a hospital which by its nature is resistant to change. When implementing change, it is useful to have a pre-planned strategy. Kotter’s 8 steps to transforming your organisation [150] were used in this study.

The steps are as follow:

- Establishing a sense of urgency,
- Forming a powerful guiding coalition,
- Creating a vision,
- Communicating the vision,
- Empowering others to act on the vision,
- Planning for and creating short term wins,
- Consolidating improvements and creating more change,
- Institutionalizing new approaches,

It should be noted that implementing change can be difficult and can result in tensions as shown later in the manuscript (Chapter 6). Quality improvement plans were developed and approved; each plan had a due date and an assigned responsible person. These were implemented and closed off.

3.3.5.4 Analyse/Reflect

Evaluation of the implementation of RAD-QAP took place monthly, whereby a review of reports on the progress of the department against the predefined standards indicated by RAD-QAP was undertaken. RAD-QAP requires that processes of verification and validation are implemented to verify that each KPI measurement is evaluated against the set standards, with
a review of quality improvement plan development and implementation as well as tracking of progress and discussion of any obstacles that might be encountered. Verification and validation are two distinct process areas. Agile thinking and lean principles were invaluable in developing the process of quality improvement. These are the processes which determine whether real quality improvement is achieved by means of developing appropriate effective quality improvement plans [222].

To achieve verification and validation of the quality assurance programme in the department, a set of objectives and performance indicators were developed. The objectives were developed in conjunction with the key stakeholders of the system, both clinical and non-clinical. This way the effectiveness of the system was reviewed to ascertain its’ ability to fulfill a defined suite of outcomes relevant to the current objectives of the organization. Where deficits in verification or validation occurred, actions were put in place to continually improve the status of the quality assurance programme leading to a cycle of action, verification and validation.

3.3.5.5 Learning

The learning from the action research cycles was incorporated back into the activities of the domains where the research was being conducted. It is stated by [156] that ‘action inquiry is primarily orientated towards change, but involves a conscious approach to action, in which an organisation or community develops a collaborative and reflexive awareness’ [76] [160]. To satisfy the action research requirement for specifying learning and to develop a collaborative and reflexive awareness the researcher incorporated three types of learning into the action research programme:

**Internal learning to benefit the organisation:** The internal staff education programme was broadened to incorporate learning from this action research. This is evidenced by staff continuous professional development points (CPD), poster size scorecards and learning notices were (and continue to be) on display. This provides continuous learning to benefit the organisation. Radiology has formalised critical policies as a result of the research, such as the formal criteria for the communication of significant findings on radiology reports and the effective communication of same.

**External learning to benefit the scientific community:** The quality improvement action research cycle benefited both the department and the wider hospital to satisfy the action
research requirement for specifying learning and to develop a collaborative and reflexive awareness the researcher incorporated learning into radiology during the action research phase.

**Learning from the researched:** Action research involves collaboration between the researcher and the researched. During the four research phases the researcher would work with the researched to gain opinions and insight through meetings, interviews and evaluation of plans by the researcher. Several interviews with the managers in radiology were carried out in this phase. The managers of the radiology were identified as suitable domain experts to evaluate RAD-QAP for two reasons. The managers of the radiology, radiologist in charge were interviewed as participant observers. This produced the final version of RAD-QAP.

### 3.3.5.6 Conclusion

The four phases diagnosis, plan/act/intervene and analyse/reflect with specifying learning implemented within the action research cycle; provided valuable information that was used to refine RAD-QAP into a mature working quality assurance programme.

### 3.4 Chapter Conclusion

This chapter described how a mixed methods research approach was used to develop, implement and evaluate a working quality assurance programme (RAD-QAP). The findings of the implementation of RAD-QAP are described in Chapter 5 and 6 and a description of the working programme may be found in Chapter 7. The next chapter, chapter 4, describes the governance structures of the domain and how they changed throughout the course of this research.
Chapter 4 Description of the Domain

Each phase of the research was carried out in a radiology department of 2 model 2 hospitals and a model 4 acute hospital. These radiology departments are managed under different radiography service managers reporting to one directorate manager as part of the diagnostic directorate. The governance of these hospitals is provided by a directorate structure; each directorate has a directorate manager and clinical director, responsible for the administration and daily running of the directorates.

4.1.1 Acute Hospitals

In Ireland acute hospital services are provided through seven hospital groups. The acute hospitals division works directly with acute hospitals across the country to provide patients with equal access to safe quality services. The reorganisation of public hospitals into seven hospital groups is designed to deliver improved outcomes for patients. The hospitals making up each group work together to provide acute care for patients and work to develop close relationships with health and social care services in the community. The objective is to maximise the amount of appropriate care delivered in local smaller hospitals while ensuring that highly specialised and complex care is safely provided in larger hospitals [196].

4.2 Case Hospital

Since 2012 the six hospitals run by the HSE in the greater Mid-West Region have been operating under a single operating and governance structure known as the University of Limerick Hospitals Group. The hospitals in the group are: University Hospital, Limerick, St. Munchin's Regional Maternity Hospital, Limerick, Mid-Western Orthopaedic Hospital, Croom, St John's Hospital, Limerick, Mid-Western Regional Hospital, Ennis and the Mid-Western Regional Hospital, Nenagh. Previously, each hospital had its own operating and governance structure. It is one of 6 groupings of hospitals in the country. University Hospital Limerick is the main teaching hospital of the group and is aligned with the graduate medical school at the University of Limerick [196]. (See Figure. 4.2)

UHL is the only model 4 acute hospital in the group and provides major surgery, cancer treatment and care, emergency department services, as well as a range of other medical, diagnostic and therapy services. Critical care services are in UHL which also has the busiest
Emergency Department in Ireland with annual attendances of 64,911 presentations in 2016 (BIU 2016) and the only 24/7 emergency service in the group.

The Model 2 Hospitals, Ennis, Nenagh and St. John’s Hospital provide inpatient medical beds, a medical assessment unit, local injuries unit and day surgery. The Maternity and Croom Hospitals are specialty hospitals which provide obstetric, neo-natal and elective orthopaedic care. UHL is large general acute hospital with a combined total of 698 beds and 2,344 employees. In 2016 there was an annual budget for a gross spend of €171,281,961. The hospital provides 522 beds, of which 375 are in-patient acute beds, while 97 are reserved for acute day cases. A further 50 beds are for psychiatric services. In-patient services include general medicine, general surgery, geriatric assessment, psychiatry, accident and emergency, intensive care/critical care, cardiology, dermatology, gastroenterology, haematology, nephrology, neurology, oncology, palliative medicine, respiratory medicine, rheumatology, dental surgery, gastrointestinal surgery, maxillofacial surgery, ophthalmology, orthopaedics, otorhinolaryngology (ENT), obstetrics and gynecology, paediatrics, anaesthesia, radiology, and radiotherapy. It is the location of the Mid-Western Cancer Centre [196]. An overview of the hospitals in the hospital group as outlined in Figure 4.1. and Figure 4.2.
## Hospitals within UL Hospitals Group

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Model</th>
<th>Beds</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Hospital Limerick</td>
<td>4</td>
<td>436 in-patient 150 day beds</td>
<td>1,942</td>
</tr>
<tr>
<td>University Maternity Hospital</td>
<td>Speciality</td>
<td>83 in-patient 19 neo-natal</td>
<td>294</td>
</tr>
<tr>
<td>Croom Hospital</td>
<td>Speciality</td>
<td>37 in-patient 13 day beds</td>
<td>144</td>
</tr>
<tr>
<td>Ennis Hospital</td>
<td>2</td>
<td>50 in-patient 16 day beds</td>
<td>206</td>
</tr>
<tr>
<td>Nenagh Hospital</td>
<td>2</td>
<td>49 in-patient 25 day beds</td>
<td>179</td>
</tr>
<tr>
<td>St. John’s Hospital</td>
<td>2 Surgical</td>
<td>89 Adult 10 day beds</td>
<td>268</td>
</tr>
</tbody>
</table>

Figure 4.1: Overview of Hospitals in the Group (Cowan, C., CEO UL Hospitals, 2016)
Figure 4.2: Overall Organisational Structure of Case Hospital Group Hospital [196]
4.2.1 Radiology Departments

In the case hospital, radiology consists of different modalities with different equipment to perform different image techniques. The type of scan or modality used will depend on the clinical details provided on the request. Figure 4.3 is showing an example of a computer tomography scanner (CT-Scanner).

The equipment and different scanning apparatus are connected to PACS (Mc Keeson). Radiology control stations allow radiographers to resolve issues and access study information in a convenient and efficient manner, including moving and deleting scanned documents. Picture archiving computer system (PACS) allows the radiologist and radiographer to organise and share images between wards and different sites and hospitals across Ireland. Teaching files and reference case information are pulled of PACS on a daily basis [211].

![Computer Tomography Scanner Control Station](image)

Figure 4.3 Computer Tomography Scanner Control Station
Hospital A - Model 4, University Hospital Limerick, Acute Hospital

The function of the acute hospital is to provide immediate and early specialist management of adult patients (i.e. aged 16 and older) with a wide range of medical conditions who present to hospitals. The aim is to rapidly assess, diagnose and commence appropriate treatment. The radiology department, university hospital limerick (UHL), employs 62 radiographers and 13 radiologists. This radiology department offer general x-rays, ultrasound, nuclear medicine, accident and emergency, magnetic resonance, theatre, mammography, catheter laboratory and fluoroscopy. Approximately 130 000 studies are performed annually. Every division has its own set of imaging protocols for the various studies performed. These protocols form the cornerstone of the activities in radiology. Figure 4.4 shows the staffing structures in the radiology department of the model 4 hospital.

Various medical devices and databases support the daily activities of the radiology. These include:

- X-Ray image intensifier, a medical device used in the theatre of a hospital to produce a live image feed which is displayed on screen,
- Picture archiving and communication system (PACS) which stores images to replace the traditional hardcopy x-rays,
- Radiology information system (RIS), a database that manages patient radiological data and images,
- Document management information system is used for the management of policies, procedures, protocols, guidelines, audits and quality improvement plans.

Hospital B – Model 2, Ennis Hospital, Sub-Acute Hospital

Ennis hospital provides local injuries and medical assessment units with a range of other services including cardiology, diagnostics, pharmacy, peri-op assessment and surgical day unit. This hospital is located in the same group of hospitals. The hospital also has a pain management clinic and rheumatology clinic. When operating at full capacity it has a total of 84 (inpatient and day case) beds, staffed by 6 consultants, 13 non-consultant hospital doctors, 75 nurses, 1.5 radiographers, 4 physiotherapists, 2 maintenance staff, 1 grade 6 and 2 grade 4 administrators, 55 support employees and 11.5 clerical officers. In 2016 there was an annual budget for a gross spend of €13,840,063.
Hospital C – Model 2, Nenagh Hospital, Sub-Acute Hospital

Nenagh hospital does not have integrated electronic patient records (EPRs); rather, it uses paper-based primary medical records. The following are the hospital information systems: Quality management information system (QMIS), patient administration system (IPIMS), hospital inpatient enquiry system (HIPE), colposcopy system, and viewpoint radiology system. The radiology department is on NIMIS system.

The information technology department that supports the software systems is located off site and supports a number of acute hospitals in a network.
Figure 4.4: Staffing Structures in the Radiology Department of the Model 4 Hospital
4.2.2  **Clinical Governance of each site**

**Access to Hospitals:** The researcher works in the quality, risk and patient safety department. This full-time role involves education, training, design and evaluation of quality and risk practices. The researcher took on a new role in 2\textsuperscript{nd} year of the research that was removed from radiology. For the purposes of this research project access was provided to the following:

- Quality, management and governance meetings,
- Internal audit documents,
- External audit documents,
- Training records, for hospital staff as required for this project.

The researcher used existing databases to audit quality of care. Access was therefore provided to the relevant sources for this project.

4.2.3  **Hospital Information Systems and NIMIS**

There are various types of data and databases utilised in the domain hospitals such as PAS, HIPE, care of the elderly database, breast database, and radiography systems. There has been an increase in the use of fourth generation programming languages such as Microsoft Access and Excel. This has led to the development and use of databases and other software systems by people who are not experts in fields such as software engineering and database development. Data from these systems is used in the management of these patients. The hospital is being advised by the national hospital’s office to make full use of existing databases for purposes of clinical audit. Yet, there is no programme to control and measure the quality of this data. There is also anecdotal evidence of increased use of mobile applications such as cameras and mobile data collection applications. The aim of this research project is to develop a practical and thorough quality programme to control and measure these systems to prevent that staff members using unsafe data in the diagnosis and treatment of patients and in the measurement of patient outcomes.

4.2.4  **Management of Data between the sites**

Historically, systems were stand-alone, but in recent years they are increasingly being networked. Radiology system and software systems comply with manufacturers requirements and be tested accordingly. Companies give an undertaking to provide performance upgrades
and software for the life of the system. Systems must comply with the medical device directive. Systems must comply with medical device standards and tender packages refer to these standards and to the medical device directive. Each country in the EU has a competent authority. IMB (Irish Medicines Board) is the authority for Ireland. Notified bodies are designated and monitored by the competent authority and carry out compliance monitoring on behalf of the authority. This body is responsible for auditing and compliance with requirements. There is constant monitoring. The onus is on the manufacturer to report and notify any faults with the systems. There is a mechanism but no requirement for users to report faults with systems.

4.2.5 Information Flow in the Study Hospitals

Information flow in the hospitals is a complicated mix between paper and electronic systems. Information flow in the hospitals is similar to those outlined in [186] as follows:

- For every patient, there is a detailed medical record with every episode of illness or type of healthcare delivered recorded. This record is paper based in the domain hospital,
- Patient referrals between are recorded on NIMIS Physician orders for diagnostic tests or procedures are paper based,
- An electronic system for hospital bed management went live in 2012. Prior to this bed management was a paper exercise,
- Scheduling of appointments is electronic,
- Research reports, clinical observation, results of new pharmaceutical clinical trials, and new guidelines,
- Guidelines and audit reports are currently paper based but are in the process of migrating to an electronic system,
- Discharge summaries are sent to referring clinicians,
- Information flow between the different sites is electronic but is still on separate facilities on the same system due to the absence of a unique patient identifier.

4.2.6 Quality Committee Structure in a Radiology Department

Findings from the literature conducted during this research led to the setting up of a quality committee to facilitate the implementation of the radiology quality assurance programme. The quality committee reflected the multi-disciplinary nature of a radiology department to
support the success of the programme over the long term. The multi-disciplinary nature of a radiology department is indicated in Figure 4.5.

**Figure 4.5: Multi-Disciplinary Interactions in Radiology**

4.2.7 **Radiology Quality Committee**

The aim of the radiology audit committee is to incorporate clinical audit as a daily activity in radiology. The committee was chaired by the radiologist in charge who has the final authority in implementing clinical change in the radiology department.

The literature review emphasized the need for a designated person to support the survival and maintenance of quality initiatives [23]. A radiographer was designated to co-ordinate the implementation of the quality programme. Staff in key positions was chosen to be members of the committee a consultant radiologist, the radiography service manager, the radiation safety officer (RSO), the clinical nurse manager and a medical physicist. These members are in key positions in the radiology department and have the capability to affect, implement and monitor change. Each member takes responsibility for audit within their area and the
radiologist in charge takes responsibility for interdisciplinary audits. The clinical specialists of each modality were thought to be best placed to take charge of audit activities in their own area.

The radiology quality committee liaises with the radiation safety committee, clinical audit development officer, clinical risk manager and the quality assurance committee on a regular basis or as needed for their input and expertise in their respective areas. The clinical audit development Officer liaises with the radiology audit committee on a regular basis. This is in accordance with guidelines on clinical audit issued by the HSE and the faculty of radiologists [94].

It was envisaged that the committee would have an important role to play in the selection of KPIs. The audit co-coordinator was to compile and present the audit results. The results were to be discussed in this forum.

4.2.8 Radiology Quality Management Stakeholders

Clinical audit in a radiology department is a multi-disciplinary process and should always include the relevant stakeholders to achieve the goal of the research. The audit committee played an active role in the selection of the audit type and the specific audit topics. Continuous protocol compliance was the chosen type of audit that would be introduced initially into the department. Roles and responsibilities of the stakeholders should be made clear and a two-way communication strategy should be developed so that their interests and opinions can continually be integrated as part of an on-going quality programme. The stakeholder analysis should be reviewed yearly. A stakeholder analysis [198] is a technique you can use to identify and assess the importance of key people, groups of people, or institutions that may significantly influence the success of your activity or project. A stakeholder analysis in radiology was performed at the outset to pinpoint the stakeholders, to establish their importance and interest in the success of this project.

4.3 Integrated Quality, Safety and Risk Framework

The integrated quality and safety framework is based on the HSE and risk standard. The framework was developed by HSE staff in the national hospitals office (NHO) and primary, community and continuing Care (PCCC) [46].
There are three key components to the framework as illustrated in Figure 4.6:

- Essential underpinning requirements
- Core processes and programmes that lead to good outcomes
- Performance indicators that demonstrate improvements in quality, safety and risk management and link, where possible to support positive outcomes for patients etc.

**Figure 4.6: Framework for Integrated Quality, Safety and Risk Management Standard [46]**

The HSE issued a *quality and risk management standard* that sets the criteria for implementation of an integrated quality, safety and risk management system across the HSE. The aim of the standard is to provide a common set of requirements that will apply across to service providers for safe and high quality, personal and social services [46].
4.3.1 Pro-active versus Reactive Risk Management

Pro-active risk management involves identifying risks and addressing them actively to prevent incidents occurring [45] [46]. Reactive risk management involves reaction to an incident that has occurred and need to be investigated to allow remedial action to prevent a repeat of the event (Figure 4.7) represents the internal, external, pro-active and reactive elements of the process [45] [46].

4.4 Chapter Conclusion

The organisation where I undertook my research covers a large area and caters to many patients. Numerous disciplines work together using many types of software systems capturing data and NIMIS/PACS/RIS for radiology. Management changes frequently both in terms of structure and personnel. This had consequences for this project in terms of continuity in the implementation of the quality assurance programme. The departmental managers were very supportive and prioritised quality assurance processes which enhanced the implementation of RAD-QAP as a project. The decision was made to implement RAD-QAP at departmental level with a view to roll it out hospital wide if proven successful. This was due to the stability of the departmental managers. RAD-QAP continues to be used in the hospitals where it was implemented. Chapter 5 discusses the findings following implementation of RAD-QAP in the case hospital.
Chapter 5  Research Findings from Phases 2&3

RAD-QAP was developed over four phases, each phase resulting in a version of RAD-QAP. Version 2 was developed based on the site visits, interviews, hospital observational case studies, service analysis and participant observer Delphi studies while mapping studies in phase 3 identified the gaps in RAD-QAP that needed to be addressed to include dimensions of quality were measured effectively.

5.1 Research Phase 2: Version 2 of RAD-QAP

5.1.1 Site Visits

Initial observations by the researcher noted some problems regarding quality assurance. Data was collected and not used, meaning that it had no benefit in the organisation and ultimately for the patient. Staff was doing audits that produced useful data that was not acted on or reported up through management. Absence of appropriate communication structures and dedicated quality improvement teams were an obvious gap that needed to be addressed. The reasons for this appeared to be varied and include a lack of incentive or knowledge by staff to extract data. In addition, a general lack of awareness, interest or trust regarding the data was also a contributing factor. There was evidence of increasing awareness of the importance of quality and risk management, but staff lacked training in quality and risk to enable effective use of the tools available. This knowledge prompted further investigation through site visits, interviews and case study research.

Action research carried out in the context of Irish hospitals. Site visits included 3 radiology departments, 2 model 2 sub-acute hospitals and an acute model 4 hospital. The site visits indicated that the lack of quality management was more widespread than just the radiology department. The researcher observed a radiology service meeting and noticed that quality and risk was not on the agenda for discussion. It was also noted that audit results were discussed, but no concerted effort were made to develop a quality and improvement plan in follow-up meetings. It was evident that the implementation and monitoring of quality improvement Plans were not managed or tracked. There was a widespread lack of defined quality, safety, structures and controls. Table 5.1 presents concerns identified during the site visits.
<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Location</th>
<th>Description</th>
<th>Concern Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Incident Management</td>
<td>Proactive risk assessments</td>
<td>(A) Domain Hospital Model 4</td>
<td>Not in practice</td>
<td>Lack of proactive risk assessments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(C) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reactive risk management</td>
<td>(A) Domain Hospital Model 4</td>
<td>Practiced</td>
<td>occurs after the event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) Hospital Model 2 site visited</td>
<td>Practiced</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(C) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence based best practice and legislation</td>
<td>(A) Domain Hospital Model 4</td>
<td>Sporadic</td>
<td>Legislation and evidence based best practice not clearly defined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) Hospital Model 2 site visited</td>
<td>Not always</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(C) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence based best practice and legislation</td>
<td>(A) Domain Hospital Model 4</td>
<td>Not clear as not defined</td>
<td>Lack of evidence of adherence to legislation and evidence based best practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) Hospital Model 2 site visited</td>
<td>Not clear as not defined</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(C) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
<tr>
<td>Data Reporting</td>
<td>Output Quality</td>
<td>(A) Domain Hospital Model 4</td>
<td>Not always</td>
<td>Purposes not specified and defined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) Hospital Model 2 site visited</td>
<td>Specified</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(C) Hospital Model 2 site visited</td>
<td>Not in practice</td>
<td></td>
</tr>
</tbody>
</table>
| Quality Improvement Plans monitoring from beginning to end | Quality Improvement | (A) Domain Hospital Model 4 | Not always identified | Desired outputs not identified
| | | | No Baseline to measure against |
| | | (B) Hospital Model 2 site visited | Clearly identified |
| | | (C) Hospital Model 2 site visited | Not in practice |
| Quality Output | (A) Domain Hospital Model 4 | Not always measured | Poor quality outputs not identified |
| | (B) Hospital Model 2 site visited | Not routinely measured | Poor quality outputs not addressed |
| | (C) Hospital Model 2 site visited | Not in practice |
| Formal Reviews of quality data | Quality data/documents | (A) Domain Hospital Model 4 | Not routinely reviewed | Lack of KPIs and set targets, Success not defined. No tracking |
| | | (B) Hospital Model 2 site visited | Not routinely reviewed |
| | | (C) Hospital Model 2 site visited | Not in practice |
| Data Quality | (A) Domain Hospital Model 4 | Not clearly identified in all incidences |
| | (B) Hospital Model 2 site visited | End user achieving some goals regardless of safety or quality reviews |
| | (C) Hospital Model 2 site visited | Not in practice |

Table 5.1: Concerns identified during site visits
5.1.2 Staff Interviews

Initial interviews with staff identified key themes across the three sites. Leadership, support, training and teamwork were important issues for the implementation and development of radiology quality assurance programme. The staff identified the following; parallel management with conflicting work practices with lack of clarity around leadership and responsibility in relation to quality management. This lack of clarity was the main reason for failed uncompleted or abandoned projects. Lack of a named person that owned responsibility for quality improvement project completion was a main reason for failure. Staff indicated that quality and risk management training were needed. This related to the authority component, structure component, quality data and quality improvement component of RAD-QAP.

5.1.3 Hospital Observational Case Studies

The researcher carried out 4 observational case studies including the following:

1. Hospital observational case study 1: Radiologist workflow,
2. Hospital observational case study 2: NIMIS Work Flow Case Study,
3. Hospital observational case study 3: Radiographer Daily Work Flow,

5.1.3.1 Hospital Observational Case Study 1: Radiologist Daily Workflow

Reconfiguration of services, difficulties in recruiting of radiologists and a moratorium on staff recruitment placed increased pressure on the department as it struggles to image more patients, with fewer resources. Conversely the advancement in technology in the form of NIMIS has revolutionized the workflow for radiologists. Requests for imaging are electronically ordered by referring clinicians from wards via workstations with the advantage of previous images for comparisons and reports at the touch of a button. Correct patient data is fundamental to a high-quality radiology service. It is used by clinicians to make decisions on patient care throughout the patient journey. The radiologist vet requests electronically on NIMIS, using a clinical vetting system based on clinical justification. Clinical justification is based on the clinical detail provided by the referring clinician. The radiologist can also ask the referring clinician to further discuss the request if information incomplete, before the examination will be vetted and scheduled. A complex pathway in which the radiologists must
log on and off different screens to view patient data and images from different hospitals in the group was observed. This process is complicated because of the lack of a unique patient identifier that can be used across the different sites. The researcher identified problems in relation to information flow and opportunity for error that exists in the current workflow around the NIMIS system, uncovering the root causes of information and data which lacks quality. NIMIS has addressed many problems from the preceding disjointed paper-based system that it replaced. The hand delivered request cards placed in various boxes were completely illuminated by NIMIS which streamlined the process. However, despite NIMIS being a great improvement overall, the researcher has identified risks that still need attention within the quality system.

Difficulties in the management of radiology reports caused frustration to ED consultants as there were difficulties with diagnosis creating risk to the patient. Incorrect referring clinician was still an issue in which led to reports being sent to incorrect clinicians, this highlighted the fact that NIMIS is only as good as the user that is inputting the data. During the study the researcher observed a radiologist trying to determine the correct patient file for a patient with the same name - same date of birth. Treweek and Flottorp (2001) point to the fact that it is natural that stakeholders would like to make use of available information, but that “a major problem, however, is simply getting at the data” [182] arrived at similar conclusions on reviewing electronic medical records.

The reality of the situation is that it is ideal for a radiologist to view previous images for comparison carried out on a different site as the case hospital consists of 4 different sites. The sequence of patient treatment episodes is also not reflected correctly in records displayed. Data is not being properly updated. There is also no record whether the referring doctor is in breach of best practice and not reviewing patient’s diagnostic results.

Interviews with clinical staff indicated concern with the difficulties of incomplete information provided in the requesting of x-rays. Radiographers were required to make judgment calls based on clinical details provided on the electronic order. Difficulties were also found where a patient should be recalled following discharge. It is a regular occurrence that the demographics and GP details or contact details are incorrect leading to failure to contact the patient.

Storing patient data in electronic format raises concerns about patient privacy and data security [121]. To comply with regulations, hospitals must guarantee adequate protection of
the confidentiality, integrity, and availability of patient information. There is the risk that the department may breach the data protection act [20]. In practice, there was evidence of doctors logged on to three systems at any one time, thus systems remaining open, compromising, data protection guidelines. NIMIS allows access to other hospitals image data base and patient demographics. The system allows staff to access patient records with a warning alert if the users are not authorized to access a certain file. The system will record the access to the file against the password but there is no alert to highlight the breech. Hence regular audit is necessary to prevent unauthorized access of patient files. Patient files are not locked in case access is needed in emergency cases at short notice as might be the case in STEMI out of hours for example. “ST-Elevation myocardial infarction (STEMI) is a very serious type of heart attack during which one of the heart's major arteries (one of the arteries that supplies oxygen and nutrient-rich blood to the heart muscle) is blocked” [230].

Inefficiencies in patient flow, such as patients presenting for x-ray with incomplete clinical details and having to return to the outpatient department without being x-ray, often occurred. Another example is that of female patients presenting for x-ray in breach of the ten-day rule; i.e. female patients cannot have an x-ray for ten days after the first day of menstruation, due to inappropriate risk factors to the unborn child should the patient be pregnant. Recognised algorithms such as the Canadian c-spine rules [234] and the Ottawa ankle rules [177] could significantly reduce the number of x-rays ordered. Appropriate training for requesting clinicians will improve understanding for purpose of each modality. In many cases, junior doctors do not understand the difference information gained by the modalities i.e. ultrasound vs. CT vs. MRI and as a result they request the incorrect test to answer a particular of clinical question which leads to the test being delayed as it will be declined at vetting stage and must be re-ordered electronically. The patient will thus wait longer to pass through the system and possibly delay diagnosis and/or treatment.

There are various reports generated throughout the department. At no point are they co-ordinated to produce a comprehensive view of the quality achieved in the department.

**Conclusion to Observational Case Study 1: Radiologist workflow**

Inadequate recording systems compromise, communication of clinical activity and stifles the opportunity for quality improvement [173]. There are currently systems in place that can be used for audit, but it is not currently possible to engage in a comprehensive program of clinical audit. This requires the continual measurement against a set of standards; this must be
complemented by a pre-planned programme of audit projects to extract data for a set of agreed KPIs.

The NIMIS system can be considered reasonably successful but have certain weaknesses:

- The absence of a unique identifier across the different sites of the case hospital poses a risk to the patient. Radiologists must work between 3 different screens to review and compare previous studies done on other sites,
- The vetting of referrals to radiology on NIMIS is quite cumbersome and allows only one cycle. Requests are vetted and justified based on clinical need which is decided based on the clinical details provided. In some instances, the radiologist needs more information to make the decision and further discussion with referrer is required. The NIMIS system does not allow for this activity and in some cases, such a request marked “as for further discussion” gets lost or is overlooked,
- “Peer View” is used to communicate unexpected findings to the referrer. This system does not allow for follow-up to confirm communication took place and to close the quality cycle additional administrative staff is needed to verify that the referring doctor was notified within 24 hours. A back log of unanswered e-mails makes verification difficult and pose a risk to the patient,
- Sub optimal images need management from the PACS radiographer to recall patients in a timely manner,
- The voice recognition software is considered very problematic and time it has been time consuming to train the system to respond to the radiologist. The typist has been eliminated from the equation, which now leaves only the radiologist to read the report. A second pair of eyes previously assured the report was read at least 3 times before it was sent out,
- Assignment and even distribution of workload between radiologists are difficult,
- Log in and log out is time consuming. There is no advance thumbprint application available on NIMIS,
- Not all radiologists are using the system optimally.

5.1.3.2 Hospital Observational Case Study 2: NIMIS Daily Work Flow Case Study

In August of 2007 the HSE initiated the National Integrated Medical Imaging System (NIMIS) project to achieve several over-arching objectives. These are:
The installation of PACS/RIS solution to deliver a filmless solution for radiology & cardiology imaging in every hospital that currently does not have such,

To deliver a “paperlite” solution for Radiology including test requesting and result reporting,

To integrate new and existing sites to facilitate the controlled, rapid and secure movement of patient image data throughout the health service,

To deliver on a large range of identified benefits obtained with the installation of such systems,

To act as a facilitator to the HSE transformation programme [211] [2016].

Access to the NIMIS system requires a correct user ID and password. User management (with permissions and passwords) will be set according to the HSE or hospital’s security policies. There are no generic logins to NIMIS. Every account must be traceable back to an individual user who is responsible for the actions taken under his or her login. Accounts will be disabled by their hospital when a staff member leaves; undertakes a Career, Maternity or other such break; or moves to another facility [211] [216].

**Data security Policies and Procedures:** The case hospital adopted standard policies and procedures around information security and password standards [211].

The NIMIS solution provides significant audit capabilities including actions such as:

- The activities performed by a user,
- All types of access performed on a patient's record including individual exam reports or image studies,
- Information about failed login attempts.

Audit reports were run periodically against a random selection of patients and system users to determine if any inappropriate access to patient records was occurring. These audits were performed at the local level and reported at national level.

**Data Protection Legislation:** The NIMIS solution is a national solution. The confidentiality of patient records in this system is paramount and required by the Data Protection Acts 1988 & 2003, under which personal data must be obtained for a specified purpose and must not be disclosed to any third party except in a manner compatible with that purpose [120].

**NIMIS /RIS /McKesson Radiology Manager to NIMIS PACS - Imaging Communication:** Information is shared between the PAS system and the NIMIS system
including patient demographic information and MRN and Account assignment. Radiology orders placed in the NIMIS RIS are sent to NIMIS PACS on ‘arrived’ status only, to support the modality work lists used by the radiographers are limited for ease of navigation. This information is displayed on the scheduled studies list within NIMIS/PACS. Once the exam is completed, the radiographer sends the images to NIMIS/PACS and the exam will appear in the unreported studies List (in-box). The diagram below depicts the data flow between the PAS and NIMIS RIS/PACS. Note that radiology orders placed in NIMIS RIS will be sent to PACS on ‘arrived’ status, in order to limit the number of studies displayed in the modality work list for the radiographers.

![Diagram of data flow between PAS and NIMIS RIS/PACS](image)

**Figure 5.1: NIMIS Work Flow [211]**

The PACS System (on which the x-rays are stored electronically) is interfaced with the x-ray image intensifier; in order for an image taken by the x-ray Image Intensifier; to be stored successfully on PACS; the demographics and patient identification number (PID) of both systems must match exactly. PACS is populated with patient details via an interface with the radiology information system (RIS) which, in turn, is populated with patient demographics via an interface with patient administration system (IPIMS) as demonstrated in Figure 5.1.

**Review of the Success of the workflow around the NIMIS System**

The NIMIS system can be considered to be successful as it fulfills its objective of achieving image data and storing patient demographics. Interviews with the PACS staff indicate however that there are weaknesses in the system, which are out of the control of the staff of the PACS Department, as they must use data imputed by the referring by clinicians. White
paper review of [173] [187] indicated that systems such as NIMIS should be used for clinical audit and review.

**Conclusion to Observational Case Study 2: NIMIS Work Flow Case Study**

Review of the NIMIS system provided an overview of a system with good management structures, good control and good feedback. The system contains built-in quality checkers and a robust quality assurance program was seen to be in place. However, the weakness with the system is that the source data is retrieved from the paper record in some instances (GP referrals) that is not quality assured. The system would benefit from multi-disciplinary stakeholder quality processes. Further use of the system by clinicians for clinical audit could have the added benefit of incentivising managers to assure the quality of the data that they provide as they will have an interest in using it at a later date to plan and manage the service.

5.1.3.3 **Hospital Observational Case Study3: Radiographer Daily Work Flow**

The radiographer workflow was one of two workflows observed as part of this PhD. Clinical specialist radiographers are highly specialised in roles that involving clinical care of patients and patient flow management to pro-actively mitigate risk ensuring best quality care for the patients in their care. It was therefore, vital that radiography clinical specialists had access to accurate and timely data.

The retrieval of patient files to obtain previous images taken on different sites posed a significant risk due to the lack of a unique identifier. The problems are varied and indicate a lack of formal quality assurance programs. The case study research also indicates shortfalls in the use of the system and a lack of formal plans to utilise the data to produce meaningful information. A planned programme of use for the system would be beneficial. This reflects the literature, “Efforts to improve data analysis and use at the local level could in turn stimulate improvements in the accuracy of the data collected, as staff may take an interest in their own data, and value the opportunity to demonstrate local achievements and guide local planning” [184]. Improvements are possible if the problems are reviewed and the system adjusted appropriately.

Outcome from these studies indicated that a formal quality assurance process was needed. Implementation of a quality assurance program highlighted problems that currently exist within the systems. This would lead to identification of requirements from the system that
will lead to development of quality improvement because of regular reporting from NIMIS. The reports from the systems must be used to advance the clinical care of the patients, or to provide benefits to the organisation. NIMIS can be utilised to compare total throughput per modality per hospital around the country. Outcomes for patients could be improved extracting information monthly for pre-agreed KPIs. Data can be extracted from RIS/PACS/NIMIS to measure access KPIs as well as the quality of service delivered by means of the MDM meetings. NIMIS can be fully utilised to produce formal reports for a set for pre-agreed KPIs monthly extracted and reported on to senior management to facilitate decision making.

**Conclusion to Observational Case Study 3: Radiographer Daily Work Flow**

The use of health information systems in a hospital is an inherent risk to the patient. Storing patient information on these systems further exacerbates the level of this risk factor [144][185] found that data needs to be modeled correctly first and then be correct, adequate and available.

Quality assurance is an on-going process which must be monitored and controlled. Quality assurance and improvement is the responsibility of the relevant stakeholders. Lack of correct structure and processes within the hospital environment results in poor quality of service and makes the goal of patient safety much more difficult. A predefined quality assurance programme is needed as part of a quality management system. Appendices II, III, IV and V summarise these observations.

**5.1.3.4 Hospital Observational Case Study 4: Patient flow to and from Radiology**

The patient flow was observed as part of this PhD to gain insight into the pathway patients follow to gain access to radiology. A patient was followed from the emergency department through to radiology and back again. The patient was observed checking in at the reception desk in the emergency department after waiting about 40 minutes in the waiting room. She was followed to the triage room where she was seen by a consultant, following the 20-minute consultation the consultant made a decision to request a CT scan on the patient. The patient was asked to wait in the waiting room outside the triage area until the porter could take her to radiology for the CT scan. The patient was in ED at this point for 2 hours. The nurse explained that there was no porter available to accompany her to radiology and that it was protocol for CT patients to be brought to CT in a wheel chair for safety reasons. Half an hour
later the porter arrived, and the patient was taken to CT. When the Patient arrived in the CT department the radiographer checked her details and asked her if she had any underlying illnesses. The patient replied she has kidney problems. The radiographer then explained that the CT scan requires intravenous contrast media to enhance the image quality and she needed to clarify that the patient’s kidney function was within normal range for safe as contrast administration. The radiographer contacted the nurse in the emergency department to enquire if blood had been taken from the patient. The radiographer informed the patient that there were no recent blood results available to determine her kidney function. The nurse in radiology proceeded to take the blood and it was sent to the laboratory. At this point the patient was in the radiology department for half an hour. The radiographers then proceeded with another patient on the CT scanner while waiting for the blood test result. Twenty minutes later the radiographer accessed the blood test result on the Laboratory Information System (LIS) and the patient was told the results were normal and the scan could ahead. The patient was called for the scan after waiting another 10 minutes. The porter arrived 15 minutes later to take the patient back to Emergency Department (ED). The patient waited for approximately 20 minutes to see the consultant. The consultant accessed the radiology report on NIMIS and the patient was told her scan her was normal, she got her prescriptive treatment and she was then free to go home. In this case the turnaround time from access to ED to patient discharge is 4 hours 20 minutes. The turnaround time from scan request to patient discharge is 3hours. Turnaround time from arrival in radiology to patient discharge is 1hour 50 minutes. The turnaround time from patient arriving in radiology to scan complete was 70 minutes. Turnaround time from scan complete to scan reported in 15 minutes. The actual CT scan only took 15 minutes.

It is clear from the turnaround times that the portering service is contributing to patients waiting unnecessary long to be transported to and from radiology. The radiographer wasted time to enquire about the patient’s kidney function as the clinical details was incomplete. The blood test could have been performed in ED while the patient was waiting for the porter. Time lost due to no available porter was 1 hour and 15 minutes. Time lost due to incomplete clinical details provided by the referring clinician approximately half an hour.

**Conclusion to Observational Case Study 4: Patient flow to and from Radiology**

Delay in getting MRI and CT scans carry an inherent risk to the patient. Portering service must be effective to support patients that can’t walk, get to radiology in a timely and safe
manner. Referring consultants must provide the relevant clinical details when requesting scans to avoid delayed diagnosis and treatment as a result of inaccurate or incomplete clinical information. Outcomes for patients could be improved if patient flow is streamlined and managed effectively to avoid delays in accessing diagnostics. Aligning appointment schedules between the clinics can reduce waiting times significantly. Clinical details should be fully captured on NIMIS to reduce incomplete requests and delay in access to diagnostics. KPIs are needed to measure patient turnaround times reduce the risk.

5.1.3.5 Key Findings Identified from the Case Study Research

Many healthcare staff members have little understanding of the connection between quality management and extraction of the data of software systems as part of a patient centered quality assurance programme. Data reporting can receive little emphasis, even when the option of standardised reports is available. NIMIS can produce specific data, if set up correctly to provide reports for a set of relevant KPIs used as a template to extract data. There was a lack of awareness of the data provided by NIMIS as part of a quality measurement system and quality improvement tool.

The significant investment in the NIMIS system resulted in integrating old and new systems. This made it possible to create a database that could provide statistics and measurements from the critical aspects of the service in terms of the whole patient pathway from request, to scan, to report, to multi-disciplinary meetings, to follow scans in the case hospital to even elsewhere in the country if the hospital in question was on NIMIS. This also created the opportunity to compare data from the different hospitals country wide. However, this was not being effectively exploited. A lack of proactive co-ordinated management relating to the extraction collating and reporting of KPI data from NIMIS led to a missed opportunity to use the available data provided by NIMIS to set a baseline and improve the patient service.

The vetting process on NIMIS were found to be problematic and work around had to be found to address this weakness to allow the patient flow to be optimized. Investigations within the hospitals have demonstrated that problems with quality data currently exist and can be traced back to the lack of co-ordinated quality management. Weltzer et al (2002) found that data needs to firstly be correctly modeled then be correct, adequate and available. The problems ranged from potentially lower standards of patient care due to lack of quality data to measure care, under funding due to inefficient use of staff time ‘working around’ the
weaknesses in NIMIS. The research identified that valuable data can be extracted from NIMIS to produce a quality profile, for example, waiting lists measuring patient access to the service. Multi-disciplinary team meetings as well as discrepancy meetings can produce in depth data about the clinical accuracy of patient diagnosis and treatment and provide valuable KPI data to measure the success of the service delivered.

Overall, case study research demonstrated a need for structured quality data management in the form of KPI data extracted from NIMIS in radiology. This will optimize the use of data provided by NIMIS to improve the service and allow for quality improvement. Using data makes it and objective exercise based on evidence as oppose to a subjective view. The benefits of using data produced by NIMIS will allow radiology service managers to build up quality profile of the service delivered based on KPI data. It is then reasonable to expect that a quality assurance programme consisting of a preselected set of KPIs would raise awareness and prioritise quality management and quality improvement in radiology.

This quality assurance programme must be the responsibility of many stakeholders with a designated lead as well as a robust governance structure and robust communication structures in place. A central point of control was needed, as disparate stakeholders may have disparate goals, leading to lack of quality control. Periodic review of the quality data is paramount to manage action and follow-up. Escalation pathways are needed when compliance is not achieved. One of the key findings from this phase of the research was the lack of defined definitions for a successful quality assurance programme. Ad hoc quality improvement was taking place without clearly defined outcomes or established baselines. No measurements of whether outcomes were being successfully achieved were being observed.

From the viewpoint of the Health Service Executive, the clinical audit program within the radiology should be expanded so that the use of data captured by information systems is increased. However, this program must simultaneously incorporate a program of data validation and standardisation for data extraction methods to allow for tracking and trending over time. KPI measurement can pro-actively identify risk areas and stimulate quality improvement plans to prevent incidents.

Budget and staffing cuts have decreased the time and resources traditionally given to programmes focused on quality, and there was a reported reduction in the effort put into quality assurance and verification. Structured risk management processes were not identified, and this was of concern. Issues with data integrity, availability, and use were a feature of the
case study research and there was in many cases a lack of process in place to overcome those issues. The case study research identified many problem areas within hospitals which must be addressed to enhance the quality of service.

Therefore, the following requirements have been identified:

- Strong leadership and direction are required to implement such a programme,
- Enforce standards, legislation and management processes,
- Modify structure to support the process of quality improvement,
- Determine duties and responsibilities of staff in the process,
- Improvement of weak processes within the radiology environment would improve patient safety,
- Training needed for standardised extraction of data,
- Training for staff in quality management is a necessity.

Combining these with RAD-QAP Version 1 resulted in the implementation of a complete quality performance measurement programme from beginning to end, from quality shortfall identification to quality improvement plan implementation and escalation route for failure to correct or comply. The information provided by the service analysis was expressed in a set of relevant KPIs describing the quality profile of the specific radiology department.

5.1.4 Service Analysis

The service analysis included a risk assessment analysis, technological capability and capacity analysis, incident analysis, resource analysis with capacity studies, HIQA recommendations and external audit analysis and a patient complaint analysis.

The risk assessment analysis produced the “number of voice recognition errors per radiologist” as a KPI. The consensus group selected this KPI as NIMIS was just installed in the radiology department and it was deemed a high risk to send out inaccurate radiology reports that can lead to incorrect clinical intervention. The capacity studies identified several issues around inadequate resources. The consensus group selected the following KPIs as a priority for measurement in the first iteration of RAD-QAP.

The technology capacity and capability study identified the following KPI, “total number of hours lost due to unscheduled down time of equipment” on the MRI scanner and CT scanners.
Furthermore, the Incident Analysis identified “access to CT for paediatric patients” i.e. median turnaround time for pediatric CT’s. The group also differentiated between the “complete patient turnaround time” from “patient referral to radiology until report complete” and “reporting turnaround time” which refers to “time from scan complete to report complete”.

The HIQA recommendations gap analysis identified “% of critical findings reported within 24 hours” was prioritised for KPI measurement by the expert group as the faculty of radiology and HIQA have emphasised the importance of this element in their reports and recommendations. 100% of critical findings are expected to be communicated to the referrer within 24 hours.

The complaints analysis identified the “number of inappropriate interruptions per radiologist” was identified as a KPI by the consensus group. Internal audits and complaints by the radiologists justified the selection of this KPI for the first iteration of RAD-QAP.

The capacity study identified “number of reports produced per radiologists per month” Number of radiologists needed to increase to align capacity with actual demand on the service’. The resource analysis identified the “number of full time staff members on long term sick leave” and “sum of hours lost”.

The risk analysis identified the “number of serious reportable events” and was selected as a high priority KPI. The consensus group agreed that the metrics should reflect the context and reality of the specific radiology department, i.e. the number of staff hours worked versus the number of incidents reported as well as the type of incidents must be recorded and measured for accurate reflection of quality of patient care. KPIs identified by service analysis are shown in Table 5.2.
5.1.5 Requirements of a Holistic Radiology Quality Assurance Programme

The new measure of success is that captured data can be extracted from information systems can be interpreted in the correct context and reality. If done properly this will express the quality of the service delivered in hospital departments through a quantifiable set of data and can be used as part of a co-ordinated quality assurance programme to improve the outcomes for patients.

Robust periodic reporting and review processes of sentinel events, performance and compliance with policy are imperative. It is more important to have a few high-quality key performance indicators than to have reams of unused poor-quality data. It is the responsibility of selected staff to participate in report development. This reporting function must be supported by strong communication strategies. Multi-disciplinary audits must be to the core of this programme. There must be a single source data collection with no dual reporting of

Table 5.2: KPIs identified by the service analysis

<table>
<thead>
<tr>
<th>Analysis</th>
<th>KPI selected as a result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Complaint Analysis</td>
<td>Access to MRI - MRI waiting times &gt; 30% pts waiting longer than 6mths</td>
</tr>
<tr>
<td>Incident Analysis / Risk register</td>
<td>unreported images, waiting lists us, incorrect names No of unreported images/pm</td>
</tr>
<tr>
<td>Analysis of all risk assessments</td>
<td>Voice Recognition software – errors % of VR errors per radiologist/pm</td>
</tr>
<tr>
<td>Capacity Studies Resource Analysis</td>
<td>Unreported images, capacity versus demand, pt in risk category No of reports per radiologists/pm No of WTE needed to align with demand No of WTE on long term sick leave sum of hours lost</td>
</tr>
<tr>
<td>Assessment of technological capability and reliability to provide reliable reports for e.g.</td>
<td>Unscheduled down time of equipment Total number of hours lost due to down time</td>
</tr>
<tr>
<td>HIQA Recommendations</td>
<td>Access for pediatrics to CT in AE Median turn report around time for Pediatric CT’s no of serious reportable events</td>
</tr>
</tbody>
</table>
data. There must be a strong focus on achieving high quality data. There must be investment in information technology so that this goal may be achieved [8].

Proactive and reactive risk management are vital for on-going quality and risk management of the patient and are fundamental to the success any quality assurance programme. Robust mechanisms for risk management must be in place. Where risk is identified, it must be managed in an open and transparent manner. There must be openness and transparency when risks are identified, and they must be analysed. This is also true for sentinel events which must be reported daily so that staff remains aware of them. There must be learning from incidents and sentinel events. There must be independent mechanisms of regulation; these must include external and internal reviews. Peer review from peers in other organisations was strongly recommended in the reviews. This is important for cross fertilisation of ideas and so that silos of independent activities that deviate from the norm of practice do not develop [8] [7]. Having quality assurance processes in place is of no benefit unless effective actions are planned and implemented and co-ordinated where problems are reported. Senior decision makers and enforcers are critical for maintenance of quality assurance programme in any hospital. The Tallaght Inquiry particularly stressed this as there were many reviews and reporting mechanisms but little action on findings [8] [7].

5.1.6 Participant Observer Delhi Studies

An expert group of consultant radiologists and relevant service managers, human resource and finance manager took part in the process to identify the most relevant KPIs to prioritise high risk, high volume and high cost. Stakeholders accountable for the clinical outcome of patient care should be part of this process. [1] recommends that the initial list of KPIs be a manageable number to facilitate implementation and manage staff apprehension when implementing a quality assurance programme in radiology,

- It is imperative that KPIs that measure quality shortfall are selected,
- The set of KPIs must express the context and reality of the state of the quality in Radiology,
- KPIs should be measurable and data should be accessible,
- Each KPI should be well defined,
- KPIs selected should be maintainable and repeatable over time.
Using a Delphi study, a list of relevant radiology KPIs was selected through consensus by the expert focus group. The objective was to reduce the initial list of 128 KPIs identified in the first phase of RAD-QAP to a manageable number of KPI measurements. The initial list (see in Appendix I) was reduced to a set of 55 KPIs after 3 rounds of elimination. These KPIs measured high risk and need to be prioritized as a matter of urgency. A sample list of the KPIs prioritised by the expert group is shown in Table 5.3. These KPIs were mainly aligned with recommendations made by the health information quality authority that was not yet implemented in radiology. This was aligned with a gap analysis of external audits and reviews following specific incidents in radiology across Ireland [7] [8] [9]. A decision was taken by the consensus group to “park” the comprehensive list of KPIs identified by the literature review in the “parking lot” for later use. The KPIs would be added and others “parked” as compliance of set targets were achieved in the iterations of RAD-QAP. The uses of a service analysis as a method to derive a set of urgent KPIs for measurement lead to development of the quality profiling component of RAD-QAP.

5.1.7  Contributions to RAD-QAP from Phase 2

A quality profiling component was added to Version 1 of RAD-QAP. The purpose of this component is to provide a standardised method for identification of relevant radiology KPIs. The list of KPIs selected by the consensus group is shown in Table 5.3.

The output from research phase 2 was RAD-QAP Version 2. The components of RAD-QAP Version 2 can be seen in Figure 5.2.
High Priority KPIs selected by Consensus Group after 3 rounds of elimination:

1. Access to MRI -MRI waiting times
2. Number of unreported images, waiting lists us, incorrect names
3. Number of unreported images/pm
4. Number of Voice Recognition Software – errors
5. % of Voice Recognition errors per radiologist/pm
6. Unreported images, capacity versus demand, patient in risk category
7. Number of reports per radiologists/pm
8. Number of WTE needed to align with demand
9. Number of WTE on long term sick leave sum of hours lost
10. Unscheduled down time of equipment
11. Total number of hours lost due to down time
12. Access for pediatrics to CT in AE
13. Median turn report around time for Pediatric CT ‘s
14. Number of serious reportable events
15. Number of Sub optimal images
16. Communication of critical findings within 24 hours
17. Communication of unexpected findings within 48 hours
18. Number of inappropriate interruptions per radiologist
19. Complication rate for invasive procedures

Table 5.3 List of KPIs Prioritised by Consensus Group
1. Authority Component

Determine Authority / accountability/responsibilities/duties in Hospital/Radiology

2. Structure Component

Put in place Structure and Quality Committee/ Strategic Plans/Service Plans/ PPPG’s

3. Quality Profiling Component

- KPI Identification based on High risk areas
- Literature Review
- Service Analysis
- Capacity / Capability Analysis

Targets
Benchmarks

4. Quality Improvement Component

- % Compliance against set target
- Measurement/Quality Baseline Established
- Quality Improvement Plans
- Variation Removed
- Initiatives
- Training

5. Quality Assurance Component

- Quality Meetings

Figure 5.2: RAD-QAP Version 2
5.1.8  Conclusion to Phase 2

During this phase problem areas within Radiology were identified which must be addressed to enhance the quality of service.

- KPIs must be significant and data to allow measurements must be readily available,
- Extraction of data needs to be standardized,
- A designated person must be responsible for this task,
- This person must be appropriately trained,
- Statistical methods for analysis must be standardized.

The root causes of many problems lie in the absence or lack of measurement tools of the level of quality achieved and the lack of enforcement of standards, legislation and management processes. In addition, there is urgency for information to be provided in a timely manner. Both issues are leading to the existence of large amount of quality data available on information systems that are not used for this purpose. The quality data provides a golden opportunity for driving research, audit and decision making and ultimately an improved service for the patient.

Within a radiology quality plan, each KPI selected is well defined with agreed targets that must be achieved. Stakeholders and requirements must be defined. A communication strategy for stakeholders must be developed. The potential risks associated with non-compliance with the set targets must be identified and rated according to severity and likelihood. A plan generated and implemented to measure each KPI for integrity and availability, the use/under use and fit for use of each KPI must continually be assessed and improved.

This phase also highlights that service managers learns valuable information about their service in the quality profiling phase. They learned about the context and reality of incidents and risks that exists in the department and the process produced relevant KPIs that represented and measured real quality shortfalls’ and weaknesses in the system.

5.1.9  7 Components of RAD-QAP

The requirements for a holistic quality assurance programme identified by the research were configured to become the 7 components of RAD-QAP. The 7 components of RAD-QAP are discussed in detail in Chapter 7.
Component 1 - Authority Component

A fully implemented, mature quality assurance programmes requires effective governance arrangements to be in place. Authority is the key in this component. Where authority is not established and where the person with the most authority is not driving the programme, it will not progress [9] [7] [46] [68] [70] [72] [175] [87] [225] (literature review, inquiries review, action research).

Component 2 - Structure Component

This component requires that management structures to be in place. The quality assurance team implements quality assurance, producing and providing evidence of acting on the findings. This assures from the outset that high standards are identified and the staff strive to achieve them [9][7] [31] [34] [187] [197] [203] (literature review, inquiries review, action research).

Component 3 - Quality Profiling Component

The quality profiling component is fundamental to RAD-QAP and this component involves selecting the set of KPIs that connect quality and risk in one framework. A complete service analysis that include complaints analysis, incident analysis, resource analysis and capacity with capability analysis as part of the quality assurance programme and include the relevant aspects that contribute to a high-quality radiology service [46] (Action Research).

Component 4 – Quality Data Component

The quality data component defines the KPIs and sets compliance levels. This component maps the set of KPIs to health care standards and quality standards to identify which aspects must be included in a radiology quality assurance programme. It defines data to be collected as well as the methods for analysis [13] [10] [21] [55] [76] [91] [107] [126 [131] [132] [133] (Literature Review, Inquiries Review, Action Research).

Component 5 – Quality Improvement Validation Component

In this component a quality baseline is established with initial measurements and quality improvement plans are developed for KPI measurements falling below target to remove any variance in the process to achieve compliance [222] (Literature Review, Action Research)
Component 6 – Quality Verification Component

The purpose of this component is to verify that actual quality improvement has been achieved. QIP are modified when the measurements still do not meet the set target [222] (Literature Review, Action Research).

Component 7- Quality Assurance Component

The four levels of quality emerging improvement (EI), continuous improvement (CI), sustained improvement (SI), excellence (E) are then determined to provide quality assurance of KPIs measuring the critical aspects of the service. This component provides KPI measurements against a set target over time to provide documentary evidence of quality improvement and thus assurance that quality processes are continuously reviewed and improved [67] [80] [81] [94] (Literature Review, Standards and Legislation Review, Action Research)

5.2 Research Phase 3: Version 3 of RAD-QAP

In this phase of the research RAD-QAP was further developed by mapping the 7 components of RAD-QAP to the HSE, quality and risk management standard (QRMS) and to the HIQA healthcare standards. RAD-QAP was also mapped to H-QAP. The mapping study to the enabling elements of high quality of care in radiology were measured and included in the quality programme, this exercise brought structure to the programme. A gap analysis was carried out to align the programme with the requirements of health care standards.

5.2.1 The HSE, Quality and Risk Management Standard

The HSE quality and risk management standard (QRMS) includes a statement of standard and the following supporting criteria, objectives, communication, stakeholders, consultation, monitor, review, learn, improve, independent assurance, accountability, core processes, programmes, capability and outcomes. The criteria reflect the elements of an internal control model. The HSE has outlined 3 levels to assess compliance with the standard [46].

5.2.1.1 Mapping Study to HSE, Quality and Risk Management Standard

The 3 levels of QRMS were mapped to the 7 components of RAD-QAP to include aspects for high quality care as prescribed by HSE; QRMS RAD (see Table 5.4).
### Table 5.4: Mapping Study: QRMS to 7 Components of RAD-QAP

#### 5.2.1.2 Findings from HSE, Quality and Risk Management Standard Mapping

**Level 1** - The service has approved documentation which describes the process for managing quality and risk as outlined for each criterion in the standard. This documentation should outline responsibilities, policy procedures and guidelines (PPG’s) and implementation plans including the learning and development needs of relevant staff.

**Level 2** - The service can demonstrate implementation of the approved documentation which describes the process for managing quality and risk as set out in this standard.

**Level 3** - The service can demonstrate that there are processes in place to monitor the overall effectiveness of the approved documentation which describes the process for managing quality and risk as set out in this standard. The importance of effective governance and structure is strongly emphasized in the quality standard.

#### 5.2.1.3 Conclusion to the HSE, Quality and Risk Management Standard Mapping

The key point from the review of the standards is that standards must exist within a strongly managed structure, but that this structure must be flexible. Standards must be kept up to date.
and reviewed regularly. Within QRMS, the project planning and project monitoring and control process areas bring a degree of structure to the radiology quality plan [242] outlined the importance of project and operations management working together to as a critical factor to achieving project success.

5.2.2 Health Care Standards in Ireland

The health information quality authority (HIQA) is an independent regulator for health and social care services, established in 2007, reporting to the minister for health. The organisations’ role is to “promote quality and safety in the provision of health and personal social services for the benefit of the health and welfare of the public” [193].

The HIQA standards for better safer health care consist of eight standards (See Table 5.5) and “describe a vision for high quality, safe healthcare” (168). Each of the eight HIQA standards is further subdivided into several criteria. Version 2 of RAD-QAP was mapped to the HIQA standards. This exercise was carried out to facilitate the design of a holistic quality assurance programme that included the eight health care standards.

<table>
<thead>
<tr>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Person-Centered Care and Support</td>
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<tr>
<td>2) Effective Care and Support</td>
</tr>
<tr>
<td>3) Safe Care and Support</td>
</tr>
<tr>
<td>4) Better Health and Wellbeing</td>
</tr>
<tr>
<td>5) Leadership, Governance and Management</td>
</tr>
<tr>
<td>6) Workforce</td>
</tr>
<tr>
<td>7) Use of Resources</td>
</tr>
<tr>
<td>8) Use of Information</td>
</tr>
</tbody>
</table>

Table 5.5: HIQA Standard Themes
Table 5.6 provides a table of the HIQA Standards and relevant criteria.

<table>
<thead>
<tr>
<th>1. The Standards for Person-Centred Care and Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The planning, design and delivery of services are informed by services users’ identified needs and preferences.</td>
</tr>
<tr>
<td>1.2 Service users have equitable access to healthcare services based on their assessed needs.</td>
</tr>
<tr>
<td>1.3 Service users experience healthcare which respects their diversity and protects their rights.</td>
</tr>
<tr>
<td>1.4 Service users are enabled to participate in making informed decisions about their care.</td>
</tr>
<tr>
<td>1.5 Service users’ informed consent to care and treatment is obtained in accordance with legislation and best available evidence.</td>
</tr>
<tr>
<td>1.6 Service users’ dignity, privacy and autonomy are respected and promoted.</td>
</tr>
<tr>
<td>1.7 Service providers promote a culture of kindness, consideration and respect.</td>
</tr>
<tr>
<td>1.8 Service users’ complaints and concerns are responded to promptly, openly and effectively with clear communication and support provided throughout this process.</td>
</tr>
<tr>
<td>1.9 Service users are supported in maintaining and improving their own health and wellbeing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. The Standards for Effective Care and Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Healthcare reflects national and international evidence of what is known to achieve best outcomes for service users.</td>
</tr>
<tr>
<td>2.2 Care is planned and delivered to meet the individual service user’s initial and ongoing assessed healthcare needs, while taking account of the needs of other service users.</td>
</tr>
<tr>
<td>2.3 Service users receive integrated care which is coordinated effectively within and between services.</td>
</tr>
<tr>
<td>2.4 An identified healthcare professional has overall responsibility and accountability for a service user’s care during an episode of care.</td>
</tr>
<tr>
<td>2.5 All information necessary to support the provision of effective care, including information provided by the service user is available at the point of clinical decision making.</td>
</tr>
<tr>
<td>2.6 Care is provided through a model of service designed to deliver high quality, safe and reliable healthcare.</td>
</tr>
<tr>
<td>2.7 Healthcare is provided in a physical environment which supports the delivery of high quality, safe, reliable care and protects the health and welfare of service users.</td>
</tr>
<tr>
<td>2.8 The effectiveness of healthcare is systematically monitored, evaluated and continuously improved.</td>
</tr>
</tbody>
</table>
3. The Standards for Safe Care and Support

3.1 Service providers protect service users from the risk of harm associated with the design and delivery of healthcare services.

3.2 Service providers monitor and learn from information relevant to the provision of safe services and actively promote learning both internally and externally.

3.3 Service providers effectively identify, manage, respond to and report on patient-safety incidents.

3.4 Service providers all reasonable measures are taken to protect service users from abuse.

3.5 Service providers fully and openly inform and support service users as soon as possible after an adverse event affecting them has occurred or becomes known and continue to provide information and support as needed.

3.6 Service providers actively support and promote the safety of service users as part of a wider culture of quality and safety.

3.7 Service providers implement, evaluate and publicly report on a structured patient-safety improvement programme

4.0 The Standards for Better Health and Wellbeing

4.1 The health and wellbeing of service users are promoted, protected and improved.

5.0 The Standards for Leadership, Governance and Management

5.1 Service providers have clear accountability arrangements to achieve the delivery of high quality, safe and reliable healthcare.

5.2 Service providers have formalised governance arrangements for assuring the delivery of high quality, safe and reliable healthcare.

5.3 Service providers maintain a publicly available statement of purpose that accurately describes the services provided, including how and where they are provided.

5.4 Service providers set clear objectives and develop a clear plan for delivering high quality, safe and reliable healthcare services.

5.5 Service providers have effective management arrangements to support and promote the delivery of high quality, safe and reliable healthcare services.

5.6 Leaders at all levels promote and strengthen a culture of quality and safety throughout the service.

5.7 Members of the workforce at all levels are enabled to exercise their personal and professional responsibility for the quality and safety of services provided.

5.8 Service providers have systematic monitoring arrangements for identifying and acting on opportunities to continually improve the quality, safety and reliability of healthcare services.

5.9 The quality and safety of services provided on behalf of healthcare service providers are
monitored through formalised agreements.

5.10 The conduct and provision of healthcare services are compliant with relevant Irish
and European legislation.

5.11 Service providers act on standards and alerts, and take into account recommendations and
guidance, as formally issued by relevant regulatory bodies as they apply to their service.

6.0 The Standards for Workforce

6.1 Service providers plan, organise and manage their workforce to achieve the service
objectives for high quality, safe and reliable healthcare.

6.2 Service providers recruit people with the required competencies to provide high quality, safe
and reliable healthcare.

6.3 Service providers ensure their workforce have the competencies required to deliver high quality,
safe and reliable healthcare.

6.4 Service providers support their workforce in delivering high quality, safe and reliable healthcare.

7.0 The Standards for Use of Resources

7.1 Service providers plan and manage the use of resources to deliver high quality, safe and
reliable healthcare efficiently and sustainably.

7.2 Service providers have arrangements in place to achieve best possible quality and safety
outcomes for service users for the money and resources used.

8.0 The Standards for Use of Information

8.1 Service providers use information as a resource in planning, delivering, managing and
improving the quality, safety and reliability of healthcare.

8.2 Service providers have effective arrangements in place for information governance.

8.3 Service providers have effective arrangements for the management of healthcare records.

| Table 5.6: The 8 HIQA Standards and Relevant Criteria |

5.2.2.1 *Mapping Study to Health Care Standards (HIQA)*

Mapping the 7 components of RAD-QAP to the HIQA standards identified the strengths and
weaknesses of RAD-QAP and was useful in further improving the programme. First pass
through the criteria established that all criteria were relevant to a holistic quality assurance
programme. A complete list of the criteria for each standard is shown in Table 5.6. The
mapping study between RAD-QAP and HIQA standards can be seen in Table 5.7.
<table>
<thead>
<tr>
<th>RAD-QAP Components 1-7</th>
<th>HIQA Standards 1-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Authority Component</td>
<td>1.8, 1.7, 2.4, 4.1, 5.2, 5.6, 5.7,</td>
</tr>
<tr>
<td>2. Structure Component</td>
<td>1.1, 1.5, 1.6, 1.9, 2.5, 2.7, 3.1, 3.4, 5.10, 5.11, 6.2, 6.3, 6.4, 8.2, 8.3</td>
</tr>
<tr>
<td>3. Quality Profiling</td>
<td>1.3, 1.4, 2.1,</td>
</tr>
<tr>
<td>4. Quality Data</td>
<td>1.2, 2.2, 2.3, 2.8, 5.4, 7.1,</td>
</tr>
<tr>
<td>5. Quality Validation</td>
<td>2.6, 3.2, 3.3, 3.5, 5.5, 5.8, 5.9, 7.2</td>
</tr>
<tr>
<td>6. Quality Verification</td>
<td>3.6, 3.7, 6.1, 8.1,</td>
</tr>
<tr>
<td>7. Quality Assurance</td>
<td>5.1, 5.3,</td>
</tr>
</tbody>
</table>

Table 5.7 Mapping Study: 7 Components of RAD-QAP with Health Care Studies/Enabling Elements/Quality Dimensions

5.2.2.2 Findings from Health Care Standards (HIQA) Mapping

Mapping to HIQA standards for better safer health care in Table 5.5 [20] presents the requirements for organisations, among other things, that:

- Appropriate management and workforce structures are in place to oversee information governance arrangements, standard 7.0 (7.1-7.2)
- Information is used ethically in a manner that protects the rights and best interests of patients and service users and information within computerised and paper-based systems is held securely and is accurate and available when and where it is needed. For example, in the event of an unplanned attendance/admission, processes and procedures for information and records management must be efficient and effective, standard 8.0 (8.3)
- The workforce is provided with guidance and appropriate effective training, and information is shared appropriately to facilitate the safe transfer and sharing of care, standard 6.0 (6.1-6.4)
HIQA requires that information is held securely and confidentially, obtained fairly an
efficiently, recorded accurately and reliably, used effectively and ethically and shared
appropriately and lawfully, standard 8 (8.2)

Service providers have systematic monitoring arrangements for identifying and acting on
opportunities to continually improve the quality, safety and reliability of healthcare
services, standard 5 (5.8).

The gap analysis shown in Figure 5.8 identified patient feedback, staff feedback and self-
development as the missing pieces of puzzle and they were added to complete the set of KPIs
to effectively measure the quality shortfalls identified by the selected KPIs.

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLERS THE DELIVERY OF</td>
<td>QUALITY DIMENSIONS</td>
</tr>
<tr>
<td>1. Governance and Leadership, and Management</td>
<td>1. Person-Centred Care and Support</td>
</tr>
<tr>
<td>• Finance KPIs</td>
<td>2. Effective Care and Support</td>
</tr>
<tr>
<td>• PPPG’s Development</td>
<td>3. Safe Care and Support</td>
</tr>
<tr>
<td>• Management Structure</td>
<td>4. Better Health and Wellbeing</td>
</tr>
<tr>
<td>2. Workforce</td>
<td></td>
</tr>
<tr>
<td>Responsive workforce</td>
<td></td>
</tr>
<tr>
<td>• HR</td>
<td></td>
</tr>
<tr>
<td>3. Use of Resources</td>
<td></td>
</tr>
<tr>
<td>• Capacity and Demand KPIs</td>
<td></td>
</tr>
<tr>
<td>• Access KPIs</td>
<td></td>
</tr>
<tr>
<td>• Productivity KPIs</td>
<td></td>
</tr>
<tr>
<td>4. Use of Information</td>
<td></td>
</tr>
<tr>
<td>• Patient feedback</td>
<td></td>
</tr>
<tr>
<td>• Staff Feedback</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.8: Mapping Study with Health Care Studies/Enabling Elements/Quality Dimensions

5.2.2.3 Conclusion to Health Care (HIQA) Standards Mapping

Reviewing health care standards pointed out that the eight themes must be incorporated into a
holistic quality assurance programme. The quality assurance programme structure must align
with the national health care standards and must be flexible to allow measurement of the
different themes and criteria as needed. This exercise produced the headings of the radiology
quality assurance scorecard.
5.2.3 *Hospital Quality Assurance Plan (H-QAP)*

H-QAP is a 5-component hospital quality assurance plan developed Reid in 2014, H-QAP implemented and evaluated in an acute hospital. This quality assurance plan is not radiology specific but provided a model against which to map [23] [84].

5.2.3.1 *Mapping Study to H-QAP*

The mapping with H-QAP allowed the 7 Components of RAD-QAP to be compared with a hospital quality assurance plan (See Table 5.9).
Table 5.9: Mapping Study with H-QAP
5.2.3.2 Findings from H-QAP Mapping

H-QAP [23] [84] refers to departmental KPIs, but do not stipulate a template for determining a department quality profile. H-QAP evaluates quality improvement but does not verify the improvements in a predefined framework. H-QAP does not provide a template for selecting an appropriate set of departmental KPIs based on a service analysis to identify quality shortfalls. H-QAP does not identify compulsory standardised documentary evidence that tracks quality improvement initiatives. H-QAP lacked a central recording tool to track selected KPI measurements.

5.2.3.3 Conclusion to H-QAP Mapping

Following the mapping to H-QAP [84] the following were introduced into RAD-QAP:

- Profiling of the service delivery and the service received by the patient by including a service analysis,
- Resource analysis with capacity /demand studies as part of the model,
- Development of a template for selection of appropriate Radiology KPIs,
- Development of a holistic scorecard,
- Quality assurance achieved through measuring KPI - Pro-active: Reactive risk management ratio,
- Alignment of the hospital and radiology governance structure with the scorecard card,
- Alignment of the scorecard card with the operational and service plan of radiology that in turn aligns with the organisational service plan,
- Regular performance reviews in a pre-defined framework with set timeframes,
- A set of standard documentary evidence as output from RAD-QAP.

5.2.4 Amendments to Version 2 of RAD-QAP

Mapping between the HIQA standards for better safer health care uncovered a number of gaps in RAD-QAP and was amended to include the following were included:

**Education** and continuous professional development: In version 2 of RAD-QAP the researcher had considered that education and continuous professional development to be included as part of the programme as they were included in the audit programme as part of the feedback loop. It became apparent following the mapping study to the HIQA standard
that this would not be enough, and that education must be a primary item in the programme. It must be included as a topic and a defined education programme, appropriate to each staff profile, to be put in place. The education programme must be developed to support the needs of the organisation.

Service User: The HIQA standards indicated that the service user must be included at the levels of quality assurance, with the previous version of RAD-QAP service users’ views were sought through complaints management and satisfaction surveys. Analysis of the HIQA standards identified that this would not be adequate and that the service user must play a more proactive and pivotal role in quality assurance and must have membership on quality assurance teams. New implementations of RAD-QAP would have service users involved in review processes and quality assurance processes and “Formal consideration is given to service users’ collective priorities, needs and preferences in the planning, design and delivery of services” [77].

Referral management was not included in RAD-QAP and must be considered for review. Patients must be able to access a service easily and quickly, there must also be a seamless handover between professionals, departments and services external to the hospital. Passing the care of patients from one team to another for specialist review such as cardiology consults or specialist episodes of care generates risk. The HIQA standards for better safer health care acknowledge these risks and recommends that they are addressed. The quality assurance programme must therefore be cognisant that there are structures in place to support seamless transfer of patients and patient’s information between teams and departments.

Staff feedback such as staff satisfaction surveys/suggestions, Version 3 of RAD-QAP therefore must put the focus on patient feedback. HIQA standards however indicated that staff feedback in the form of surveys/suggestions had a valuable role to play in a QA programme and should therefore be sought and considered. Staff working in the domain are very well placed to understand where problems lay, their causative factor. They are also very well placed to suggest solutions to problems.

KPIs from prescribed by national clinical programmes such as the programmes for prostate and breast cancer staging were included as a result of the mapping study. KPIs measuring excellent performance for example compliments received was added as a result of senior managers felt that the initial performance reviews were only focused on the discussions of red risks. To give a positive tone compliments were also discussed at the end of each meeting.
KPIs generated by MDMs (multi-disciplinary team meetings) were included following a quality improvement project that was launched to record the discussion at MDM’s. This included change to treatment and diagnosis of patient. Clinical accuracy was the heading included as a result.

Discrepancy meetings were also established. Multidisciplinary meetings were held where discrepancies were recorded on NIMIS as part of pilot study.

The number of pro-active versus reactive quality improvement plans was added as a KPI as it became evident that this will be the KPI that will determine the overall factor of the RAD-QAP. The aim is to shift the organisation from the reactive state to a pro-active state in quality management.

5.2.5  Contributions to RAD-QAP from Phase 3

5.2.5.1  Mapping KPIs to Health Care Quality Standards

Main Quality Dimensions

- Person-Centered Care and Support,
- Effective Care and Support,
- Better Health and Wellbeing,
- Safe Care and Support,
- Better Health and Wellbeing (See Figure 5.3).

Main drivers for the delivery of above quality dimensions

- Governance and Leadership, Governance and Management,
- Workforce,
- Use of Resources,
- Use of Information (See Figure 5.3).
The mapping to health care standards identified the enablers to achieve the different dimensions of quality (See Figure 5.3). This exercise facilitated the design of the radiology quality assurance scorecard. Governance, workforce, use of resources and use of information are the enablers to achieve the quality dimensions of person centered care, effective care, safe care and support, health and well-being.

**KPIs were divided in 2 main Groups: [19]**

- KPIs measuring access to service,
- Effective Safe and Patient Centered Care.

**Access to service - Equity of care:** **KPIs measuring access to service:** Validation of waiting lists was completed by the administration staff to determine compliance with set turnaround times. Where targets were not achieved quality improvement plans were developed. Resources were maximised and workflow were optimised to reach compliance. Where compliance still fell below the set target business cases were made using the data as evidence to evaluate the case. Official monthly performance reviews provided the platform for these presentations where data were tracked, and outcomes compared to allow decision
making based on data produced by RAD-QAP captured on the scorecards in a focused co-ordinated manner.

**KPIs measuring the quality of service delivered to the patient (Clinical Accuracy): Effective Safe and Patient Centered Care**

A **set of KPIs were selected by consensus** for the department using evidence based best practice, current legislation and existing standards was drawn up. These KPIs were divided into patient experience, practice standards, access, clinical accuracy, quality and risk. Following development of the standards, compliance was evaluated using healthcare audit and any non-compliance with standard is measured

**National KPIs were included for MRI staging scans for Breast and Prostate cancer.**

These KPIs had to be included as non-compliance with national KPI turnaround times and access can have serious effect on timely diagnosis and treatment. Selected KPIs pertaining to radiology that was reported nationally were included in RAD-QAP. Phase 3 focused on displaying the scorecard populated with the relevant most urgent KPIs under headings as prescribed by national health care standards with set targets and time frames to manage quality and risk in the same framework. The red measurements in the “finance section” of Table 5.10) show for example an overspent for the “overall pay for radiology”. It is far over the target and hence is marked red. The reason can be seen in the quality improvement section. Agency staff were recruited and were paid higher rates than the budget allowed.

The measurements flagged with the colour amber in the “human resource section” shows that the numbers of full time radiographers were below the required and approved number (See Table 5.11). The absenteeism KPI explains the reason for the breach as four radiographers were on sick leave at the same time for two of the months displayed. The KPIs marked with the colour green in the “use of resources section” shows compliance with set targets for national KPIs for clinical care programme that dictates set turnaround times for MRI staging for rectum, breast and prostate cancer (See Table 5.12). The KPIs in the “use of Information section” measures patient and staff satisfaction (This section can be seen in Table 5.13). The safety and effectivity section records the KPIs that measures quality and patient safety for example complication rates for invasive procedures (See Figure 5.14).
## Leadership, Governance and Management

### 1. Finance

<table>
<thead>
<tr>
<th></th>
<th>Feb 2016 Budget TARGET</th>
<th>Feb 2016 Actual</th>
<th>Current Month</th>
<th>Current Month Variance %</th>
<th>Responsible Person</th>
<th>Graphs</th>
<th>Quality Improvement Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ennis Non-Pay (Stock and Non-Stock Consumables)</td>
<td>42,099</td>
<td>41,454</td>
<td>645</td>
<td>1.50%</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nenagh Non-Pay (Stock and Non-Stock Consumables)</td>
<td>€21,734</td>
<td>19,448</td>
<td>2,285</td>
<td>10.50%</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Pay Dooradoyle</td>
<td>€525,562</td>
<td>552,644</td>
<td>27,083</td>
<td>-5.20%</td>
<td>MDOB</td>
<td></td>
<td>922 agency costs for Dooradoyle. There are no agency radiographers in Dooradoyle. Most of this overspend is medical pay</td>
</tr>
<tr>
<td>Overall Pay Ennis</td>
<td>€59,395</td>
<td>48,582</td>
<td>10,812</td>
<td>18.20%</td>
<td>MDOB</td>
<td></td>
<td>Still waiting for Agency conversion in Ennis</td>
</tr>
<tr>
<td>Overall Pay Nenagh</td>
<td>€39,452</td>
<td>36,762</td>
<td>2,690</td>
<td>6.80%</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Pay (across all sites)</td>
<td>€186,614</td>
<td>223,643</td>
<td>37,029</td>
<td>19.00%</td>
<td>MDOB</td>
<td></td>
<td>47,360 agency fees</td>
</tr>
<tr>
<td>Paramedical Pay (across all sites)</td>
<td>€327,953</td>
<td>322,489</td>
<td>5,104</td>
<td>2%</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Pay (across all site)</td>
<td>€66,588</td>
<td>365,35</td>
<td>30,053</td>
<td>45%</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Agency spend</td>
<td>€2,148</td>
<td>1,096</td>
<td>5,337</td>
<td>264</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Overtime</td>
<td>0</td>
<td>1120</td>
<td>1120</td>
<td>100</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paramedical Overtime</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>MDOB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.10: Departmental Scorecard Finance Section with relevant KPIs and Metrics as mapped to Health Care Standards Enablers/Norton and Kaplan [25][26] [19]
## 2. Responsive Workflow

### 1 Human Resources

**Ratio of Radiologists/Radiographers/ Attendants/ nurses per machine**

<table>
<thead>
<tr>
<th></th>
<th>48 per Week</th>
<th>48 per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of full time Radiographers per week</td>
<td>44.6</td>
<td>43.4</td>
</tr>
<tr>
<td>No. of WTE Radiologists</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>No. of WTE Nurses</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>No. of Agency Staff</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>No. of Attendants</td>
<td>8.4</td>
<td>4</td>
</tr>
<tr>
<td>No. of Absences</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>No of Long- term Absences Radiographers</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>No of positions not filled by permanent full-time staff</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>No of locum staff</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>No of Long - term absences administrative staff</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>No. of VAPS/Form Be submitted for Radiology</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>No. of VAPS/Form B's rejected for Radiology</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>No. of vacation days available: versus no. of days taken</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5.11: Departmental Scorecard Human Resources, Responsive Workflow Section with relevant KPIs and Metrics as mapped to Health Care Standards

Themes/Norton and Kaplan [25][26] [19]
## 3. Use of Resources

### 3.1 National KPI's / Clinical Programmes

<table>
<thead>
<tr>
<th>Staging MRI scans</th>
<th>Target</th>
<th>Achieved Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>10 days from receipt of request</td>
<td>9.8 11 10.8 BK</td>
</tr>
<tr>
<td></td>
<td>Prescribed National KPI achieved</td>
<td></td>
</tr>
<tr>
<td>Prostate</td>
<td>10 days from receipt of request</td>
<td>11 9 10 BK</td>
</tr>
<tr>
<td></td>
<td>To be determined nationally</td>
<td></td>
</tr>
<tr>
<td>Rectum</td>
<td>10 days from receipt of request</td>
<td>9.7 11.2 11.6 BK</td>
</tr>
<tr>
<td></td>
<td>Prescribed National KPI achieved</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 Access to Examinations

| CT out-patients         | 15% waiting longer than 3 months                                       | 112 118 309 BK                                      |
|                         | 1. Centralisation of CT Vetting and utilisation of Ennis and Nenagh CT scanners |
| CT in-patients          | 85% in 24hr                                                            | 100% 100% 100% BK                                  |
| MRI out – patients      | < 30% waiting longer than 6 months                                     | 2100 2100 2100 BK                                  |
| MRI in-patients         | 80% in 24hrs                                                           | 65 74 55 BK                                        |
| Ultrasound out-patients | Less than 30% pts waiting longer than 6 months                         | 186 152 174 BK                                     |
| Ultrasound in-patients  | 95%                                                                   | 100% 100% 100% BK                                  |
| GP patients - time to next appointment | 95% in 2 weeks                                                       | 97% 98% 97% BK                                     |

1. Centralisation of US Vetting
2. Training programme complete
3. 10 additional scans/per day performed 200P/M
### 3. Use of Resources Continued

#### 3.3 Productivity/Modality

<table>
<thead>
<tr>
<th>Modality</th>
<th>WTE</th>
<th>Target</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiologist Reporting Activity</td>
<td>13</td>
<td>1000 reports/radiologist as per RCR guidelines</td>
<td>1350</td>
<td>1350</td>
<td>1460</td>
<td>BK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity per radiographer/month/CR</td>
<td>8.3</td>
<td>33pd</td>
<td>996</td>
<td>1003</td>
<td>1050</td>
<td>BK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity per radiographer/month/CT</td>
<td>4</td>
<td>50pd</td>
<td>85</td>
<td>85</td>
<td>60</td>
<td>BK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity per radiographer/month/MG</td>
<td>2</td>
<td>8.5pd</td>
<td>206</td>
<td>235</td>
<td>245</td>
<td>BK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity per radiographer/month/US</td>
<td>2</td>
<td>9pd</td>
<td>164</td>
<td>164</td>
<td>176</td>
<td>BK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity per radiographer/month/NM</td>
<td>1.9</td>
<td>32pd</td>
<td>35 (open 2 days/week)</td>
<td>35</td>
<td>32</td>
<td>BK</td>
</tr>
</tbody>
</table>

#### 3.4 Model 3 Hospitals - Total no of studies Site/Radiographer

<table>
<thead>
<tr>
<th>Site/Radiographer</th>
<th>WTE</th>
<th>Output</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity per radiographer/month/Mat</td>
<td>0.2</td>
<td>2.5</td>
<td>84</td>
<td>84</td>
<td>53</td>
<td>GN</td>
</tr>
<tr>
<td>Productivity per radiographer/month/Croom</td>
<td>2.25</td>
<td>18</td>
<td>358</td>
<td>358</td>
<td>367</td>
<td>GN</td>
</tr>
<tr>
<td>Productivity per radiographer/month/Nenagh</td>
<td>4</td>
<td>6.25</td>
<td>375</td>
<td>375</td>
<td>378</td>
<td>GN</td>
</tr>
<tr>
<td>Productivity per radiographer/month/Ennis</td>
<td>5.5</td>
<td>13.85</td>
<td>208</td>
<td>208</td>
<td>210</td>
<td>GN</td>
</tr>
<tr>
<td>Support Staff Productivity</td>
<td>4.4</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Capacity studies completed Work schedules to ensure even distribution of work load per radiologist
### 3. Use of Resources Continued

<table>
<thead>
<tr>
<th>3.5 Total no of studies / Site</th>
<th>No of Studies</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Limerick (Croom + Mat)</td>
<td>11000</td>
<td>11120</td>
<td>11120</td>
<td>11233</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>Ennis</td>
<td>1800</td>
<td>1694</td>
<td>1694</td>
<td>1620</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>Nenagh</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1490</td>
<td>BK</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.6 Radiology Reporting</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Reporting Turnaround Time</td>
<td>35 – 60min</td>
<td>38</td>
<td>45</td>
<td>35</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>Urgent Paediatric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median turnaround time for urgent</td>
<td>1-2 hours</td>
<td>55</td>
<td>50</td>
<td>45</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>adult CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations completed but not</td>
<td>0</td>
<td>6700</td>
<td>6800</td>
<td>0</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>reported</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of unreported images</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnaround time for GP from request</td>
<td>95% in</td>
<td>2 weeks</td>
<td>2 weeks</td>
<td>2 weeks</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>to report</td>
<td>4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report turnaround time from scan</td>
<td>3-7days</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>complete to report complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of VR error per audit sample</td>
<td>less than 5%</td>
<td>7%</td>
<td>8%</td>
<td>6%</td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>No. of reports amended returned</td>
<td>0%</td>
<td>9</td>
<td>15</td>
<td></td>
<td>BK</td>
<td></td>
</tr>
<tr>
<td>from referrer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VR software inadequate</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.12 Departmental Scorecard Use of Resources Section with relevant KPIs and Metrics as mapped to Health Care Standards Themes/Norton and Kaplan [25][26] [19]
## 4. Use of Information

### 4.1 Patient and Employee Satisfaction

| % Overall patient satisfaction rate per audit results for all areas | 90% | 95% | 94% | 96% | GN | Patient experience from entering department until exam complete |
| % Overall satisfaction rate per employee | 90% | 94 | 85 | 92 | GN | Additional resources |

Table 5.13: Departmental Scorecard Use of Information Section with relevant KPIs and Metrics as mapped to Health Care Standards Themes/Norton and Kaplan [25][26][19]
## 5. Safety and Effectivity

### 5.1 Hygiene

<table>
<thead>
<tr>
<th>Compliance</th>
<th>87%</th>
<th>86.50%</th>
<th>92%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Departmental Compliance with hand hygiene policy</td>
<td>85</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>NUC MED</td>
<td>85</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>CT</td>
<td>85</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>US</td>
<td>85</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>GEN</td>
<td>85</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>MRI</td>
<td>85</td>
<td>80%</td>
<td>90%</td>
</tr>
</tbody>
</table>

### 5.2 Quality Improvement Plans (QIP’s)

<table>
<thead>
<tr>
<th>No. of QIP’s developed</th>
<th>YTD 2016</th>
<th>BK</th>
<th>1. controlled reporting environment</th>
<th>2. Reduce DNA rate</th>
<th>3. Centralisation Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>3</td>
<td>7</td>
<td>INDEX in development</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5.3 Discrepancy Meetings

| No. of discrepancy meetings | 8 p/w | 8 | 8 | 60 |
| No. of patients discussed at DM | % of total cases | 500 | 496 | 1012 |
| No. of Urgent findings communicated and acknowledged | % of total cases | 100 | 100 | 100 |
| No. of Unexpected significant findings communicated | % of total cases | 2 | 0 | 2 |
### 5. Safety and Effectivity   Continued

#### 5.5 Quality and Patient Safety

| Complication rates of invasive procedures. No. of complications intravenous extravasations, pneumothoraxes rates, post procedure hematomas, contrast media reactions, adverse drug reactions | 0 | 0 | 0 | 0 | BK |
| Frequency with which patients are screened for pregnancy | 100% | 100 | 100 | 100 | GN |
| Frequency for MRI screening patients for ferromagnetic objects | 100% | 100 | 100 | 100 | GN |
| No. of pts. recalled for repeat imaging or further imaging | 10% | 0 | 1 | 0 | GN |
| No. of suboptimal images not recalled | 10% of total pt load | 4% | 5% | 2% | GN | Audit Programme to be implemented |
| No. of extravasations | 0 | 1 | 2 | 0 | BK | Protocols followed new pump reduced extravasations by 50% |
| No. of misidentified patients | 0 | 0 | 0 | 0 | GN |
| No. of slips trips and falls reported | 0 | 0 | 0 | 0 | ML |
| No. of pts not within guidelines of dose reference levels | 0 | 0 | 0 | 0 | GN |
| No. of errors due to lack of unique identifier | 0 | 0 | 0 | 0 | BK |
| No. of hours Equipment unscheduled down time | 0 | 0 | 0 | 1 | GN |
| No. of equipment included in the Quality Assurance Programme | 47 | 0 | 0 | 0 | GN |
| No. of PACS related issues network issues | 0 | 0 | 0 | 1 | GN | Mammography Image compression |

Table 5.14: Departmental Scorecard Safety and Effectivity Section with relevant KPIs and Metrics as mapped to Health Care Standards Themes/Norton and Kaplan [25][26] [19]
The red KPIs shown under the “access” heading in the “use of resources section” (Table 5.11) flags the breached turnaround times for MRI and ultrasound outpatients as more than 30% of patients were waiting longer than six months for their scans. The productivity KPIs flags the number of reports per radiologist as red. There are national guidelines for radiology reporting, (RCSI). In this case, the measure is red as the radiologists in fact were reporting too many reports per individual. This can become risky in terms of other duties being neglected or indeed have a negative impact on the radiologist’s well-being over the long-term. In the” use of information section” (Table 5.12) the patient satisfaction KPI is green and then goes amber before improving to green again. This can be related to the long waiting times for MRI and ultrasound scans.

The number of unreported images KPI in the “use of resources section” (Table 5.12) is flagged in red for two consecutive months. Unreported images are a high risk. This KPI target breach pointed to inadequate capacity in the system to device the demand on the service. The KPIs measuring radiologists output showed that radiologists were already working over maximum capacity.

KPIs flagged as risks the “quality and patient safety section” (Table 5.14) point to policies that were out of date and not reviewed in the required time. Other risks identified as a result of non-compliant KPIs were; number of errors recorded due to the lack of patient unique identifier when moving from one hospital site to another, PACS related network issues that caused lost time and high number of voice recognition errors due to unsatisfactory voice recognition (VR) software.

Mapping RAD-QAP to H-QAP [84] highlighted the importance of having a standardised method in place to allow profiling of the ability of an organization to deliver a service and the quality of the service received by the patient. The mapping identified the absence of a method to determine the quality profile of a radiology department with set of relevant KPIs to measure performance. A standardized method to record and measure the performance in a structured format with regular performance reviews to verify compliance

5.3  Conclusion to Phase 3

The third version of RAD-QAP came about by grouping KPIs against set targets as described in version 3 to facilitate the construction of the scorecard. The scorecard became the quality
The different elements needed for a holistic quality assurance programme for a radiology department were identified by mapping RAD-QAP to health care standards quality dimensions. These elements were used to group the selected KPIs to construct a scorecard with the headings of governance and leadership (finance), responsive workflow (human resources), use of resources, (access and productivity), use of information (patient and employee feedback) and safety and effectivity (quality and patient safety, hygiene). A short description of the KPI, the set target to be achieved, the monthly performance measurement, the responsible person with action needed, with a short description and quality improvement plan were populated. Legends were added to explain the units of the measurements i.e. monthly or weekly. Red, amber and green colour coding was used to indicate compliance against the set target. If the measurement was within 10% of the target it was marked as green, if the measurement was within 20% of the target it was flagged as amber and red and the colour red was used to flag when a KPI measurement was more than 30% of target. Month on month and year on year figures allow for tracking and trending. This central data recording tool is represented as part of RAD-QAP Version 3. The 7 Components of RAD-QAP Version 3 can be seen in Figure 5.4.

5.4 Chapter Conclusion

Research Phases’ 2 and 3 of RAD-QAP a produced a radiology quality assurance scorecard as part of RAD-QAP. The scorecard reflected the quality shortfalls in the specific radiology department of the case hospital. The KPI measurements displayed in the scorecard format, highlighted KPI breaches and the relationships between them with confounding factors that might have been hidden before. The scorecard introduced a standardized method of quality data collection into the data component of RAD-QAP. It highlighted the need for the verification component of RAD-QAP. A quality profiling component was introduced to provide a standardised method of selecting KPIs that reflects the quality profile of a radiology department. In the mapping studies to quality standards, health care standards and H-QAP, all three highlighted the importance of governance and structure in quality management. The authority component and structure component enabled RAD-QAP with the requirements of approved documentation; evaluation and monitoring of quality activities.
**1. Authority Component**

Determine Authority / accountability / responsibilities / duties in Hospital / Radiology

**2. Structure Component**

Put in place Structure and Quality Committee / Strategic Plans / Service Plans / ORMS / PPPG’s

**3. Quality Profiling Component**

- KPI Identification based on High risk areas
  - Literature Review
  - Service Analysis
  - Capacity / Capability Analysis

- Targets
- Benchmarks

**4. Quality Data Component**

Radiology Quality Assurance Scorecard

- Structure KPIs
  - Enablers
    1. Governance leadership and management
    2. Workforce
    3. Use of Resources
    4. Use of Information

- Outcome KPIs
  - Quality Dimensions
    1. Person-Centred Care and Support
    2. Effective Care and Support
    3. Safe Care and Support
    4. Better health and wellbeing

- KPI / Metrics / Agree set Targets & Statistical methods
  - Quality and Patient Safety KPIs
  - Demand Capacity KPIs
  - Human Resources KPIs
  - Finance KPIs

- Align with Strategic Objectives

**5. Quality Validation Component**

- % Compliance against set target
- Measurement / Quality Baseline Established
- Quality Improvement Plans
- Variation Removed
- Initiatives
- Training

**6. Quality Verification Component**

- Regular Performance with Balanced Scorecard KPIs
- Add or delete KPIs / feedback to staff / Display Data
- Continuous Quality Improvement achieved

**7. Quality Assurance Component**

Data Output / Documentary Evidence

Figure 5.4: RAD-QAP Version 3
Chapter 6  Implementation and Evaluation of RAD-QAP

6.1  Research Phase 4: Final Version of RAD-QAP

6.1.1  Action Research Cycle in Radiology

In phase 4, RAD-QAP version 3 was implemented and evaluated through action research in the radiology department. This allowed exploration of the advantages and disadvantages of using the proposed programme and gaining an understanding how quality of service is improved through the implementation and improvement of existing quality processes.

The action research cycle commenced with a meeting with the domain lead and relevant radiology staff. This was to establish which documentation was available and relevant for analysis. The available documentation increased as the project progressed, and further documents were developed. The objective of this was to gather the relevant data items for analysis to provide evidence to diagnose where the department lay in relation to quality and quality improvement. The diagnosis reports were developed following these meetings and presented to the focus group for discussion and next actions.

The researcher developed and monitored a series of metrics. Data was collected, results analysed and changes were made to RAD-QAP throughout the action research phase in the department. Lewin (1947) describes a process of planning, fact finding and execution, whereby, following conception of an idea, a plan is developed, actions occur, results are studied, and further actions occur, was used to link theory with practice and this produced a more refined version of RAD-QAP.

6.1.2  Defining the issue, observing and collecting the data

Action research in the radiology department commenced with diagnosis. The preceding phase of the research had provided an understanding of factors that could lead to non-compliance of protocols, resulting in risk and breaches of patient safety. Diagnosis was undertaken to identify quality processes and activities in the department and to identify the appropriate documentation for review to establish the quality and ultimately to discover how successful they were. Quality processes around clinical and non-clinical processes according to the
identified quality shortfalls. Meetings with the domain lead established that there were no formal departmental quality assurance (QA) team or programme in place in radiology.

Documentation was sought to ascertain whether outcomes from quality improvement plans (QIP’s) were established and whether achievement of these outcomes was an integral part of running the department. Documentation in relation to the quality, the development of appropriate quality improvement plans, the tracking of quality improvement initiatives quality as well as the information contained in the systems support provided when problems arose using systems, staffs’ intention to use systems and actual use of systems was analysed.

In the first instance, it is important to realise that there are several stakeholders involved in any quality system within a department. These include both internal and external stakeholders such as patients, clinical and nursing staff, the Health Service Executive, external stakeholders and researchers. It is necessary first to define the stakeholders and then to gain an understanding and to document their individual requirements. A stakeholder analysis was conducted to identify staff within the radiography department with both power and knowledge to implement the RAD-QAP, to pinpoint the stakeholders, establish their importance and interest in the success of the project. Stakeholders in the radiography department included radiographers who use the radiology equipment and radiologists who review the images and provide the diagnostic report. An example of an external stakeholder would be the doctor receiving the report who would generally be associated with another department such as the emergency department. The patient was central to activity and was considered to be the primary stakeholder. The management structures within the hospital were reviewed to establish the internal stakeholders and to gain an understanding of accountability. It was recognized that “people and machines cannot be separated in the radiology department.” Internal and external stakeholders, along with their goals, with an interest in departmental activity were identified.

The patient, or service user, is the primary stakeholder of the department; the diagnosis meeting established that they are entitled to a timely accurate diagnosis, with as little radiation as reasonably achievable. They must also be treated with dignity, respect, equity and privacy. A copy of the stakeholder communication strategy can be seen in Table 6.1.
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Internal/External</th>
<th>Power</th>
<th>Interest</th>
<th>Communication/Consultation Process</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Users/ Patients</td>
<td>External</td>
<td>Low</td>
<td>High</td>
<td>Report results of patient experience and staff actions</td>
<td>Monthly/on request</td>
</tr>
<tr>
<td>Radiologists</td>
<td>Internal</td>
<td>High</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Radiographers</td>
<td>Internal</td>
<td>High</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Nursing</td>
<td>Internal</td>
<td>High</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>Internal</td>
<td>Low</td>
<td>High</td>
<td>Dissemination of appropriate audit results</td>
<td>As required/on request</td>
</tr>
<tr>
<td>Clinical Risk Advisor</td>
<td>Internal</td>
<td>Medium</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>As required/on request</td>
</tr>
<tr>
<td>Quality &amp; Accreditation Manager HSE Mid-West</td>
<td>Internal</td>
<td>Medium</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Clinical Audit</td>
<td>Internal</td>
<td>Medium</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>General Manager</td>
<td>Internal</td>
<td>High</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Clerical Support</td>
<td>Internal</td>
<td>Low</td>
<td>High</td>
<td>Dissemination of appropriate audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>Technicians</td>
<td>Internal</td>
<td>Low</td>
<td>High</td>
<td>Dissemination of minutes and audit results</td>
<td>Monthly</td>
</tr>
<tr>
<td>ICT</td>
<td>Internal</td>
<td>High</td>
<td>High</td>
<td>Dissemination of appropriate audit results</td>
<td>As required/on request</td>
</tr>
</tbody>
</table>
Desired outcome can only be achieved in a structured, holistic environment of different stakeholders. Therefore, each step must happen separately, and the risk of non-compliance must dictate the amount of effort applied to improvement. The existing version of RAD-QAP was reviewed and a stakeholder analysis was conducted to identify the stakeholders with the required skills to implement the project. It was planned to commence the research by putting 10 facets of clinical governance [68] in place.

- Quality improvement (includes clinical audit)
- Leadership,
- Evidence-based practice,
- Dissemination of good practice, ideas and innovation,
- Clinical risk reduction,
- Detection of adverse events,
- Learning lessons from complaints,
- Addressing poor clinical performance,
- Professional development programmes.

The ten points would be used as a guide to assure of RAD-QAP addressed each point listed. This process was facilitated by the researcher. A manageable continuous programme was developed to manage non-compliant KPIs as part of RAD-QAP. It continues to be used to identify quality improvement plans that form the basis of in-house training programmes for radiologists, radiographers and other staff. However, this was required to run as part of a fully integrated quality assurance programme. Radiographers would earn CPD points for participating in quality improvement and audit activities. This incentive encouraged staff to take part and engage in the programme.

6.1.3 Planning Action and Intervention

Action planning meetings took place between the domain lead and the researcher, between the domain lead, the researcher and the QA team and between the domain lead and the QA team. A plan was put in place to introduce a structured, manageable programme as part of daily hospital activity. It was agreed that the department would focus improvement on areas where quality is low, or priority is high. It was clear that a “creative approach is paramount if you want to convince staff to take on something new such as quality assurance on a daily basis.”

The NICE guidelines for clinical audit [77] were used, as there were no existing Irish guidelines in place at the time. It was agreed by the committee that audit would be used in certain KPIs to extract data to measure against the set target and instigate quality improvement plans where the target not reached. The decision was made to seek the advice of the ethics and research committee in cases where the audit was of a sensitive nature though it is accepted that this is generally not required.

To determine capability of the stakeholders an educational needs analysis was performed to assess the training requirements of the staff.
The following goals incorporating both the stakeholders’ needs, and expectations were developed:

- To measure full compliance with established standards and procedures for the Radiology Department,
- To provide quality assurance of service by continuously monitoring and changing the process, practices and outcomes as indicated by KPI measurements,
- To verify risk is managed both proactively and reactively,
- Share patient data information as necessary without breaching patient confidentiality,
- Secure patient information in a distributed environment (e.g. between various hospital systems and personnel),
- Enable accurate up-to-date quality data is available when needed (Integrity and Availability),
- To facilitate each KPI well defined,
- Manage time frames for data collection agreed and clearly communicated,
- Responsible person for provision of data for specific KPI should be identified.

These goals provided direction for the action taking phase.

Figure 6.1: Quality Improvement Mechanism
Arrows in Figure 6.1 indicates the flow of information to and from the different grade levels and the different professions to the radiology quality committee to come together as a multi-disciplinary quality improvement approach.

6.1.4 Act / Intervene

A continual quality performance measurement programme was developed and staff at every level would need to be motivated to engage fully with the programme. Weaknesses in current work practices were identified by the service analysis in phase one of the research and appropriate KPIs measuring these quality shortfalls were further defined by the Delphi consensus study. Appropriate KPIs was identified and it was accepted that audit was one of the accepted methods to extract data to measure the state of quality in selected areas over selected timeframes to provide reassurance that protocols were at the expected standard.

Information meetings were held to inform staff about the quality assurance programme. Staff were made aware that audit is compulsory under EU Law [12]. There was initial apprehension with regards to audit throughout the department, and time was invested in managing this apprehension.

Radiologists have time constraints and find it difficult to allocate time to audit. Releasing staff to attend information sessions is an obstacle due to resource issues. The implementation and monitoring of the changes generated by audit takes further time and resources which are not always available. It proved difficult to establish audit as a daily activity as opposed to a one-off exercise. It takes determination and resource allocation if quality assurance is to be maintained in every department in the long term. Two different aspects of the implementation of RAD-QAP overcame these obstacles. Audit was identified by RAD-QAP as an educational requirement and therefore staff were carefully taught about audit, how to conduct it and the benefits that audit would bring to the programme. Outlining the benefits to staff of the quality assurance programme was also included as part of the training. The benefits of gaining continuous professional development points in a simple fashion were reiterated. The benefits of quality assurance became self-evident when the results started to come in and standards in the department began to gradually rise. Positive feedback was given to the staff in relation to same.

Governance is integral to the success of the programme. Therefore, the lead person was clearly identified, and roles and responsibilities were communicated to each staff member.
(Component1of RAD-QAP). Given the requirement that governance drives the quality programme, specific structures were put in place. These included a quality committee, a communication strategy and a stakeholder analysis to produce a list of relevant stakeholders.

An implementation team was developed. This was chaired by a senior person in the department who signed decisions into effect. The aim of the team was to incorporate quality assurance as a daily activity in the department. Membership of the team consisted of staff in key positions in the department: consultant radiologist, radiography service manager, radiation safety officer, clinical nurse manager and physicist. These members had the capability to affect, implement and monitor change. Each member took responsibility for quality assurance within their area and the radiologist in charge took overall responsibility. The clinical specialists of each special modality were thought to be best placed to take charge of quality in their own domain due to their specialist knowledge and senior role in the department. The implementation team also liaised with the radiation safety committee, Clinical risk adviser and the hospital quality assurance committee on a regular basis or as needed for their input and expertise in their respective areas (Component 2 of RAD-QAP).

The researcher did the literature review for this project, but when a department implemented RAD-QAP the quality committee should complete a literature review twice a year. This will keep the focus on evidence-based standards. In addition, a service analysis, capacity and capability analysis must be carried out. KPIs were selected through consensus. Targets for compliance were agreed for each KPI. The KPIs selected were aligned with the organisational goals (RAD-QAP Component 3). The scorecard was then constructed according to the headings in RAD-QAP Component 4 (See Table 5.10-5.14).

A training programme was developed and implemented to provide training in both audit and quality assurance. It was accepted that the training would be updated as relevant based on changes in role, changes in standards, in the event quality deficits are discovered or following significant event.

Audit was used to measure compliance against the set target. The audit result would stimulate the development of a quality improvement plans to address the quality shortfall. Where the audits indicated that compliance was suboptimal the implementation team would then implement the plan in a co-ordinated manner within a pre-agreed time frame.
An escalation process was put in place where compliance was not achieved after the first quality improvement implementation. The first escalation involved communication. A scorecard poster, in a standard recognisable template, was displayed in a prominent location was developed and displayed. Failure to achieve the standard resulted in a second escalation to compulsory education. Student radiographers prepared presentations and it was compulsory for staff to attend. The staff were awarded continuous professional development points (CPD). If compliance remains consistently low, level 3 audits involves review of the protocol to ascertain if it is designed correctly. Each quality improvement plan had a source, a number, an issue, a required action, and an identified person responsible. Time frames were also included in the quality improvement plan. The date the action was agreed, the due date and the completion date were recorded. Each quality improvement plan had a status – complete, not yet due or overdue. The development of formal quality assurance plans enabled identified actions were truly followed up and completed (component 5 of RAD-QAP).

Regular performance reviews were then held with the quality committee with CEO present to review the scorecards and KPI measurements. KPIs flagged as red were discussed. The root cause and solutions for non-compliance were discussed by the team. The team discussed expansion of the services and resources with the CEO as Access KPIs were flagged as red. KPIs that achieved compliance were also discussed and a decision to add or delete KPIs was made based on sustained compliance. The scorecard verified and tracked quality improvement against a set target using KPI measurements over time (component 6 of RAD-QAP).

The scorecard identified risks that produced the risk register, which in turn produced the quality improvement plans with project trackers and audit forward plans. At this stage the quality assurance committee had documentary evidence of quality improvement activities in radiology. It included the following governance organogram, list of duties and responsibilities for each staff member, service plan, scorecard with KPI targets, risk Register, quality improvement plans, project tracker and audit forward plans (Component 7 of RAD-QAP).

6.1.5 Setting Departmental Standards

The departmental radiography imaging protocols were developed using the correct legal requirement legislative measures to achieve the lowest diagnostic reverence levels (DRL) to
produce a high quality diagnostic image. “Radiologists, medical physicists, radiologic technologists, and supervising physicians have a responsibility to minimize radiation dose to individual patients, to staff, and to society, while maintaining the necessary diagnostic image quality [88].

6.1.6 Internal Audits

A number of internal audits were conducted to establish a baseline measuring against the set standards to serve a guide to show improvement or otherwise. Internal audits are matched to the KPI data set. Audit is the best method to generate data to measures quality in radiology. Policies, procedures, protocols, guidelines, audits and quality improvement plans are to be managed and tracked through a central document control system. The benefit of the system was that radiology staff in the organisation would have access to up to date versions of documentation.

For a correct, safe diagnosis, several stakeholders must work together to achieve quality:

- Software engineers must develop and maintain the systems correctly,
- Physicists must calibrate the equipment to assure it performs as it should (for example, it must provide the exact dose of radiation asked of it),
- The radiographer must use the systems correctly to take a clear image, link the image to the correct patient, and archive it,
- The radiologist must review the image and report a diagnosis on the correct patient to the correct treating physician in a timely fashion,
- Quality data must be extracted and analysed correctly with agreed standardised methods.

When PACS was reviewed initially no timeframes were identified so there was no possibility of knowing whether the department was in breach of standard. There were no structured attempts to achieve timeframes and no reviews of delayed diagnosis.

There was no analysis of the communication process of unexpected findings between radiologist and referrer. This subjected the patient to the risk of a delayed diagnosis or treatment. In this scenario, the radiologist will annotate the unexpected finding on PEERVUE a facility on NIMIS that will be reviewed by a clerical officer who will send an e mail from a centralised email to the referrer. The policy states that the referrer should open and read the
email and then acknowledge receipt of the e-mail to close the quality feedback loop. This procedure was developed in response to an inquiry to back log of unreported images [7].

**Unexpected findings:** “These are findings, typically of relatively low acuity, but that constitute a condition that may pose some significant proximate risk to the patient that requires careful and relatively prompt follow up. These would likely be in the “orange” of the critical results hospital policy statements. Following implementation of RAD-QAP, regular logging and review of these lists were performed, and this has led to a reduction in the number of un-communicated unexpected findings” [131] [220] Staff were found to be overwhelmed by the sheer thought of performance management through KPI measurement, hence the programme was introduced to digestible small projects at first. It was decided by the radiology quality committee that only 55 KPIs would be selected for measurement in the first iteration of RAD-QAP. KPIs falling below target were identified and quality improvement plans were then developed by the team leaders. This was done in a practical, manageable way suited to a busy working area. At first not as much emphasis were put on the turnaround time of the quality improvement plan implementation to allowed staff to get used to the programme and regular KPI measurements. It was accepted from the start that it would take time to embed the quality programme in radiology.

6.1.7 **Quality Assurance of the Audits**

Forward plans were developed to prevent the initiation of ad hoc audit for KPI measurements and audits. These were directly aligned with KPIs and feed into the quality framework as proposed by RAD-QAP. Forward plans are categorised in accordance with non-compliance with set targets as indicated on the scorecard. KPI data collection are prioritised on the forward plan according to high-risk, high cost, high volume, complaints, area of concern/quality shortfall. New initiatives, outcomes and unplanned outcomes can also stimulate audits and lead to the selection of new KPIs depending on the consensus by the quality committee. Significant events requiring audit may override the forward plan. The audits were lined up at time frames to render results on a monthly basis to allow population of the scorecards for regular review.

The most senior line manager for the discipline that the KPI pertains to must take ownership and responsibility for the audit, though this person may not necessarily undertake the coordination, data collection or report development. The quality team leader of the audit must
take the lead in coordinating the development and implementation of quality improvement plans as a result of findings.

Time is invested in the development of effective audit tools. The tools measure evidence-based standards. The initial KPI audits were kept simple to allow staff to get used to the process.

**Protocol Compliance:** Lack of quality was investigated under three headings: structure, process, and outcome. For an example of this; analysis indicated that radiologists lacked standard requirements for shoulder x-rays requests that they required from radiographers. This was compounded by radiographers lacking standardisation in what they provided.

To address this problem the team leaders for radiographers and radiologists developed policies for shoulder x-ray requirements (regarding angle, contrast, views and centering point). The policies provided a gold standard technique for shoulder imaging which in turn facilitated the standardisation of the images. Regular audit of small numbers of shoulder X-Rays quickly led to > 95% compliance. This in turn led to a reduction in rejected images because. This fed into an in-house continuous professional development (CPD) programme for radiologists and radiographers. CPD points are required to prove professional competence for statutory registration. Staff can audit CPD points by being involved in audits and quality improvement.

- Staff would collect data by recording the percentage of suboptimal images taken,
- Staff would report data using, for example, information posters, formal department meetings,
- The quality committee would inform staff when re-audits were necessary,
- The learning from the root cause analysis from non-compliant images was discussed at these training sessions. Quality improvement plans were discussed here and demonstrations for optimum technique were given by the students. This in turn provided a learning opportunity for staff and students,
- Poster and scorecards displayed at workstations with KPI measurements flagged with red, amber and green to communicate the non-compliant KPIs to staff.

Where audit indicated low compliance with gold standard quality improvement plans were developed.
6.1.8 Quality Improvement Plans

Quality improvement plans were developed to support improvement in practice. Shortfalls in the implementation of RAD-QAP were identified early the implementation. The fact that the quality improvement plans did not always result in actual quality improvements was identified and recorded by the researcher. To resolve this issue the researcher in association with the domain lead developed a formal process for quality improvement plans. This involved the development of the formal quality improvement plan template (QIP template). These were included in RAD-QAP as part of the quality improvement validation component.

In radiology, the domain lead led the audits, for the KPI measurements that fell below set targets. The researcher designed the audit template to be followed and reporting on the findings. The quality assurance programme at this point began to lose effectiveness with the domain lead not having the authority to effect change where enthusiasm or interest was low. The radiology department is divided into ten modalities; each modality has a person in charge. It was found that the audit findings resulted in quality assurance activities in some but not all the modalities. At this point the quality improvement template was developed to address this issue.

6.1.8.1 Quality Improvement Plan Design:

Six Sigma principles were incorporated in the design of quality improvement plans utilising the process. “Six sigma simply means a measure of quality that strives for near perfection. Six sigma is a disciplined, data-driven approach and methodology for eliminating defects. Sigma Six System is built around measure, analyze, improve and control” [249].

**Sigma Six Lean principles involve** the following steps. Sigma Six Principles were adapted and incorporated in RAD-QAP as part of the quality improvement management process [249].

**Measure:**

- Define project scope,
- Select output characteristics,
- Assess performance specifications,
- Evaluate Measurements Systems,
- Establish initial capability.
Analyse:

- Define Performance objectives.

Improve:

- Screen potential causes,
- Identify appropriate operating controls.

Control:

- Determine Process capability,
- Implement process controls.
- Document what you have learned.
Table 6.2: Example of Scorecard used as Communicating and Display Tool
The scorecard (in Table 6.2) format is a simple representation and summary of the quality and risk standard in radiology. It provides information about compliance against a set target, risk posed by certain KPIs as well as time frames for QIPs. It displays information regarding responsibility and accountability. Finance KPI figures are withheld in the scorecard due to commercial sensitivities. The scorecard provides the relevant quality and risk information in one place.

The two main methods for communication of results were formal scheduled meetings to discuss KPI measurements and posters were displayed in a designated visible area adjacent to the workstation. The poster contains the relevant information regarding the KPI measurements achieved against the set targets. Results were displayed in a purely statistical format was annotated on information posters. This is a very simple, inexpensive, but effective way of refreshing the qualified as well as student radiographer’s knowledge. The posters are modular and A4 in size which allows for filing of the quality performance measurement on a monthly basis. Power Point slide shows can also be used where relevant.

### 6.2 Impact of RAD-QAP

Implementation of RAD-QAP stipulates that a departmental quality assurance team was created to assure management of process and outcome in the department. The action research cycle led to the development of Table 6.3 to measure the structures required for a successful implementation of RAD-QAP. It provides an overview of the structures that were in place to assure quality prior to implementation of RAD-QAP and following implementation, this table was developed by the researcher in association with the domain lead. It identifies that there were initially poorly structured quality assurance processes in place, without formal communication strategy. It also indicates how the professions were not initially working together in a structured manner. Prior to implementation of RAD-QAP there was little stakeholder involvement with quality assurance.
<table>
<thead>
<tr>
<th>Radiology Department Quality Assurance Team</th>
<th>Before RAD-QAP</th>
<th>After RAD-QAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>QA Team</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QA Lead</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QA Deputy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QA Annual Report</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Communication Strategy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Pre-agreed set of KPIs selected by consensus by Expert Group</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Forward Plan</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QA Strategy Developed</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QA Activities being conducted</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Information systems fully utilized</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Each Profession Engaged in QA</td>
<td>Partial</td>
<td>Yes</td>
</tr>
<tr>
<td>from Reid 201 Multi-Disciplinary Audit</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Patient Involvement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Radiologists Involvement</td>
<td>Partial</td>
<td>Yes</td>
</tr>
<tr>
<td>Radiographers Involvement</td>
<td>Partial</td>
<td>Yes</td>
</tr>
<tr>
<td>Nursing Involvement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Radiology Administrative Staff Involvement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Engineers Involvement</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Technicians Involvement</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>HR involvement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Finance Involvement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6/18</td>
<td>18/18</td>
</tr>
<tr>
<td><strong>Percentage</strong></td>
<td>33%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 6.3: Quality Assurance Implementation Team Activity, Adapted from (Reid 2014)
6.2.1 Quality Improvements Achieved as a result of RAD-QAP

Changes in radiology were significant; this is just a small sample of changes made in Radiology as a result of the implementation of RAD-QAP.

Examples of these changes include:

KPI: Length of time in queue:

Problem: Audit results showed that patients from the orthopaedic clinic were dissatisfied with the delays in getting their images done once they arrived in the department. Patients could wait from 30 min up to an hour from arrival until they were called for imaging.

Root cause analysis identified that the appointment system in the orthopaedic clinic was not aligned with the appointment scheduling in radiology.

QIP: Quality Committee decided to develop an appointment system in consultation with the orthopaedic clinic to eliminate the long delays and facilitate effective patient flow.

Result: A reduction of 30% in the waiting times was achieved over a three-month period with this corrective action.

KPI: Out-patient access to MRI: Waiting Time:

Problem: A capacity study as well as an analysis of the waiting time for access to MRI was carried out. The analysis showed that the waiting times were excessive and posed a high risk to patients not getting diagnosed and treated in a timely manner.

Root Cause Analysis: Two issues were identified. (1) Not enough MRI trained radiographers available and (2) The demands for MRI scans were double that of the capacity of the available scanner.

QIP1: Additional MRI radiographers were trained from the cohort of radiographers

QIP2: Business plan was submitted for a 2\textsuperscript{nd} scanner based on capacity studies.

Result: Approval for additional funds was secured to clear the waiting list pending the approval for the 2\textsuperscript{nd} scanner. This quality improvement plan took time to implement as the application had to go through central procurement. The scorecard with periodic monthly reviews kept us informed as to the progress and allowed for effective monitoring and follow-up.
**Out-patient Access to Ultrasound – waiting time:**

**Problem:** On analysis, more than 50 % of patients were waiting longer than 6 months for access to ultrasound scans.

**Root Cause Analysis:** Inadequate number of trained ultrasonographers available for recruitment

**QIP:** Additional ultrasonographers were trained to address the problem and additional patients were added to the work lists after hours with additional shifts to reduce the waiting times.

**Result:** This initiative was implemented over a nine-months’ period and a reduction of 58% of the patients waiting longer than 6 months were achieved. Sample of the results captured over a six-month period is shown in Table 6.4.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound out-patients</td>
<td>less than 30% of patient on WL should wait longer than 6 months</td>
<td>31.00%</td>
<td>30.00%</td>
<td>28.00%</td>
<td>26.00%</td>
<td>31.00%</td>
<td>20.00%</td>
<td>25.00%</td>
<td>47.00%</td>
<td>↓</td>
</tr>
</tbody>
</table>

**Table 6.4: Ultrasound Out-Patient Access**

**Number of inappropriate interruptions during reporting sessions:**

**Problem:** The radiologists made an official complaint regarding the number of inappropriate interruptions by junior doctors during reporting sessions. An audit showed that the number interruptions were at times more than 20 inappropriate interruptions per day per radiologist. While appropriate interruptions are essential, it was clear that the situation needed to be addressed.

**Root Cause Analysis:** Free access to Radiology caused easy access to the radiology reporting rooms. This problem was exacerbated by the bad layout of the department.

**QIP:** A decision was taken by the quality committee to implement restricted access to the Radiology Department with scheduled and controlled access to each radiologist. Protected
reporting sessions were implemented to include high quality reports and sufficient use of resources.

**Result:** A significant reduction of interruptions was achieved with this measure but monitoring and audit on going to reduce to a minimum. Sample of the results can be seen in Table 6.5 below.

<table>
<thead>
<tr>
<th>Quality &amp; Patient Safety</th>
<th>Target</th>
<th>Jul15</th>
<th>Aug15</th>
<th>Sep15</th>
<th>Oct15</th>
<th>Nov15</th>
<th>Dec15</th>
<th>YTD 14</th>
<th>YTD 15</th>
<th>TREND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inappropriate Interruptions during reporting sessions</td>
<td>&lt;10% of total interruptions</td>
<td>40%</td>
<td>38%</td>
<td>35%</td>
<td>30%</td>
<td>25%</td>
<td>23%</td>
<td>64%</td>
<td>20%</td>
<td>↓</td>
</tr>
</tbody>
</table>

**Table 6.5: Inappropriate Interruptions during reporting sessions**

*Number of patients not arriving for their appointments:*

**Problem:** An audit of the number of patients not arriving for their appointments showed unacceptably high numbers. It is important to allow appropriate interruptions i.e. when patient’s results must be discussed. Inappropriate refers to the radiology being interrupted while in the middle of reporting a complex scan and someone knocks on the door to ask for directions to another radiologist’s office.

**Root Cause Analysis:** On contacting the patients it was found that most patients just forgot about their appointments.

**QIP:** It was decided that a web texting system should be used to remind patients of their appointment. This initiative was cost neutral and relatively simple to implement.

**Result:** A reduction of 48% of the DNA rate was achieved over a six-month period.

*Voice Recognition Error Rate:*

**Problem:** Radiologist flagged the inaccuracy of the new voice recognition system. An audit was carried out and the error rate was found to be unacceptably high.

**Root Cause Analysis:** It transpired that the settings of the voice recognition system were not correct, and it was not accumulating “learning” over time.
QIP: The supplier was contacted, and the system was recalibrated and training to use the system was provided to radiologists. Reporting templates were developed and implemented which reduced the error rate dramatically. Monitoring and audit is on-going to verify the error rate is reduced to a minimum. A voice recording of the report was sent to a secretary for proof reading before the radiologist will sign off on the report. This was a solution in particular for one of the radiologists having trouble with the VR system.

Result: The average voice recognition error rate reduced from 8% to 5 % over a three-month period.

Number of Intra-Venous Extravasations in CT with the injector:

Problem: Following incident analysis extravasations in CT were found to have a significant increase when compared to the previous year.

Root Cause Analysis: On review of the equipment replacement log it was found the injector was near end of life and needed to be replaced.

QIP: A new CT injector pump were bought and installed. Training were provided to radiographers to use the new pump,

Result: Extravasations reduced by 35% over a nine-month period.

No of unexpected findings Communicated to the Referring Consultant:

Problem: On analysis of the significant unexpected finding log it came to light that these findings were not communicated, and the loop were not closed in a timely fashion.

Root Cause Analysis: The referrer provided incorrect contact details which in some cases made it impossible to contact the referrer.

QIP: A designated secretary was assigned the task to monitor the log and verify the findings were communicated by e-mailing from a central e-mail address clearly marked significant unexpected finding.

Result: This process was very effective in closing the quality cycle, but some of the referrers still neglected to acknowledge the e-mails they received. The aim was to communicate 100% of the unexpected findings to the referrer in the agreed turnaround time of 48 hours. The issue was raised at the consultant forum which improved the situation with on-going monitoring.
Demand and Capacity Alignment in Radiology:

**Problem:** On completing a resource analysis it came to light that the capacity in the number of radiologist available fell far short in terms of numbers of whole time equivalent (WTE’s) and number of hours available to service the demand. This created a backlog of unreported images that was not reported in a timely fashion.

**Root Cause Analysis:** The compliment of radiologists was not adequate to meet the demand on the service.

**QIP:** Capacity study was completed for each radiologist. Based on the available hours and the contract for the specific radiologist the work schedules were optimised to produce maximum output for each radiologist

**Result:** This QIP was found to produce 10% more output but the risk was still significant. Business cases were made for additional radiologist.

**Follow-up:** Recruiting an additional radiologist proved more difficult than expected and an interim solution had to be found. It was decided to outsource backlog of unreported images to a 3rd part via tele-radiology. NIMIS made this solution possible by clearing the backlog of 2000 unreported images over a two-month period.

**Number of critical findings not successfully communicated in the Target Turnaround Time:**

**Problem:** Radiologists found it next to impossible to communicate critical findings in a timely manner to the referrer. The responsibility lies with the radiologists to proof that the findings were communicated to the referrer. It was a risk the radiology department were exposed and needed to be addressed. Critical findings must be communicated within 24 hours.

**Root Cause Analysis:** Central e-mail NIMIS does not provide a solution to close the quality loop.

**QIP:** A central e-mail account for the communication of unexpected findings was set up with a designated secretary assigned to manage it. This led to the referring doctor being pursued until an e-mail receipt was sent to confirm the e-mail was read by the referrer. A phone call was also made to close the quality loop for effective communication.

**Result:** 100% compliance were achieved
Quality improvement is driven by the quality team leaders of each discipline in radiology. The team leader is responsible for recording the progress for the quality improvement plan in the template specifically developed for this purpose. The quality team leaders report directly onto the radiology quality committee. The Team leaders also interact across directorates with other disciplines outside of radiology. Radiology is demand led service and cross directorate quality initiatives are often necessary which require collaboration for a holistic approach. The QIPs (Quality Improvement Plans) are implemented using the Radiology structure, from the top down and from the bottom up to create a pro-active / reactive quality cycle. The Quality Improvement Mechanism is demonstrated in Figure 6.1.

During the first action cycle, the RQC decided that focus should be maintained on identified quality shortfalls. Consequently, KPIs were removed from the scorecard if the target was reached in six consecutive measurements. These KPIs were put into a “parking lot” for separate monitoring on a six-monthly basis. Apart from maintaining focus on quality shortfalls, this decision also helped to reduce the amount of data required for the scorecard on a monthly basis. On the other hand, in cases where the target was not being met, it was important that the RQC understood whether current resource should be able to meet the target. If the RQC identified that the current resource should be capable of meeting target, then once that target was not reached three times, an internal review was undertaken. Staff were interviewed to determine the reason for non-compliance and additional training was provided if necessary. If, using current resources, the process and structure change could not cause targets to be met, risk assessments justified business cases for additional resource to senior management.

The result of continuous monitoring of KPI measurement with resulting action where set targets were met indicated consistent and sustained continuous improvement. When compliance had been achieved for a KPI measurement quality assurance of the protocol went into maintenance mode and compliance was checked every six months to verify the level of compliance was maintained. There is 4 different levels of quality Improvement i.e. level 1=emerging improvement, level 2=continuous improvement, level3 = sustained improvement and level 4=excellent improvement according to the QA self-assessment tool that was applied in the research. An illustration of the different levels of quality can be seen in Figure 6.2.

Collaboration with radiologists to find solutions to non-compliant KPIs was prioritised. Radiologists were interviewed in a separate set of interviews when KPIs were not met. A list
of solutions and suggested quality improvement plans were collated following the interviews. The radiologists, as a collective, wanted an independent review of their work schedules and required that output be included. They suggested that an additional radiologist should be put on the reporting roster for CT to meet demand and turnaround time KPIs. The radiologists also agreed that reporting activity figures per radiologist could be circulated to support fairness and transparency. All these actions and engagement by the radiologist supported and strengthen the positive impact of RAD-QAP in radiology. Change management was an important element and needed a considerable amount of patience and skill.

6.2.2 Communication Strategy

The scorecard serves a communication and display tool for monthly KPI measurements. These were modified and made more user-friendly in the implementation and evaluation phase. The quality and patient safety section were put first on the scorecard as it was deemed the most important section of the scorecard. Finance was moved down on the scorecard for example.

IPEM records in the department now indicate a routine management and assurance that quality is high. There is now evidence of daily, weekly and monthly checks being carried out. Checks are carried out based on the qualifications of the auditor, and they may be undertaken by a physicist or radiologist. Frequency of checks is based on risks associated with non-compliance with standard.

6.2.3 Learning

A significant amount of time was intentionally invested in introducing staff to the concept of quality performance management and the researcher regularly provided advice and education on audit and quality assurance to help the programme remain on track and that audits complied with the clinical audit cycle (Figure 2.3).

**Staff training** sessions to educate staff regarding the benefits of KPI measurements, audit selection, design and the difference between audit and research. Staff were encouraged to contact the researcher as required if experiencing any difficulty or lack of understanding with the process. Involvement on different levels was encouraged by emphasising the continuous professional development (CPD) points allocation to audit activities. Information regarding sessions and audit topics were placed in high profile areas and staff were asked to pay
attention to the posters. CPD point allocation is explained in a publication by the Irish Institute of radiography and radiation therapy, “CPD, personal record booklet” and staff were encouraged to read this. The learning from the action research cycle benefited both the department and the broader scientific community. It is stated by [156] that “action inquiry is primarily orientated towards change but involves a conscious approach to action in which an organisation or community develops a collaborative and reflexive awareness”. To satisfy the action research requirement for specifying learning and to develop a collaborative and reflexive awareness, the researcher incorporated three types of learning into the action research programme:

**Internal learning to benefit the organisation.** The internal staff education programme was broadened to incorporate learning from this action research. This is evidenced by staff continuous professional development points (CPD), posters were (and continue to be) on display to continuously updated. This provides continuous learning to benefit the organisation.

**Learning from the research.** As discussed earlier action research involves collaboration between the researcher and the researched. During phases 1-4 in the programme the researcher would work with the researched to gain opinions and insight through meetings, interviews and evaluation of plans by the researched.
4 Levels of Quality Improvement  QA TOOL

Target reached x 6 moved on to next level

Bench mark against national/international standards in increments of 15% between different levels of quality compliance in 2 categories service delivered and service delivery. Service delivery depends on capacity of the structure i.e. Access vs. The outcome i.e. Service delivered

- Pre VS Post RAD-QAP : 75% of KPI's selected improved EI to SI
- Pre VS Post RAD-QAP : 15% of KPI's selected improved EI to EX
- Pre VS Post RAD-QAP : 10% of KPI's selected improved to CI (access to MRI and Ultrasound)
  but fell back into EI due to Structural issues

Figure 6.2: Four Levels of Quality adapted from HSE Q&A Tool [247]
6.3 **Contributions of Action Research in the Radiology Department**

The development and testing of RAD-QAP produced a version that was feasible for use and within the scope of practice of radiology staff, particularly the clinical staff that may not have a background in the management of quality data produced by software systems. The most significant development for RAD-QAP was the development of the components and requirements. The importance of implementation of the components in the correct order was identified through action research in the domain. Implementation of the compliance audits identified that knowledge and communication were not sufficient. There were significant differences in compliance throughout the department. At this stage the understanding of the requirement for governance and with this came the governance component of RAD-QAP. It was evident that a number of structures were required to be in place before KPI selection and audit implementation came into play. The KPIs for selection were developed with a view to providing a holistic quality assurance programme which avoided staff choosing KPIs that were of interest to them as opposed to benefit to the department. The programme integrated with the activities of the day to day running of an acute hospital.

Communication within the department has improved as the information sessions inform staff regarding the necessary changes required to improve performance and protocol compliance. The resulting higher quality diagnostic images facilitate the radiologists to deliver the best possible radiology reports.

Standards within the department benefit from regular review and update of imaging protocols. Compliance with the protocols is constantly monitored and root cause analysis provides an indicative guide as to the corrections necessary to achieve a quality service. Quality assurance means that the official departmental protocols are applied as prescribed by the radiologists.

The students in the department benefit as the protocols are standardised, reviewed and updated regularly. In the past students on practical placement had difficulties with inconsistent instructions from different qualified radiographers and this problem was solved through standardisation of protocols. Students training have further been enhanced by their presentations on the topics dictated by audit.
When the QA findings pointed to the negative a great deal had already been achieved as the weakness had been identified this facilitated the task of finding solutions to rectify the problem. QA is also seen within this department as a pro-active way to prepare for external audit. The Department has a set of updated standardised protocols.

Studies of rejected radiographs are conducted in the radiography department in order to identify the causes of rejected images. The reject analysis reports indicate that compliance with protocols has risen from an average of 82% to 96%.

Table 6.6: Sub-Optimal Image Analysis figures

Table 6.6 shows the number of images that were found to be sub-optimal or that fell in that category. Some of the images were flagged on NIMIS by the radiologist to recall the patient for a repeat image or just flagged it to encourage learning and no patient recall necessary. The files for sub-optimal images were created as a result of RAD-QAP. A QA tool for the radiologist were developed and incorporated into the NIMIS Reporting function and allowed radiologists to select image quality short falls from a pre-set list. A learning file for
radiographers was created on NIMIS and this created opportunity for learning and continuous professional development. Previously there was no data available on the sub-optimal images, let alone training to address the issue.

**Consequent outcomes include:**

- Student training has improved due to updated and standardised protocols,
- Radiographers have earned CPD points in the process,
- Audit presentation sessions are a learning opportunity for radiology staff involved,
- A programme for the management of information systems has been developed.

With RAD-QAP, staff know about the escalation process prior to audit and have an opportunity to correct practice prior to governance and consequence. System use is better, data is more accurate, and staff are more cooperative in working together toward a unified goal. Due to the simplicity and regular reviewing of small sample sizes, process issues come to light quickly and are fixed rapidly. When there is indication of high risk, the hospital can examine the issue in greater detail with larger sample sizes.

Dialogue between radiographers and radiologists is within a structured forum. Standards of care are scientifically measured instead of being based purely on the individual’s perception of standard. It fosters a culture of continuous quality improvement. This programme can be as contained or deployed depending on the logistics of the department in question. It can be implemented incrementally starting off, for example, in the Emergency Department, and then can be rolled out at a later stage to the specialist areas as staff members become familiar with the process. The Department will be compliant with EU Law SI 478/2002 by having a continuous quality assurance programme in place.

This QA programme assures compliance with best practice, ensuring prioritised KPIs are managed to achieve net benefits within the live clinical environment. This continuous programme further implies that areas producing non-compliant KPI data are revisited frequently by prioritising KPIs based on risk rating. This approach stipulates clinical/risk significance is built into the KPI framework. Governance relevant to the individual KPI is put in place in advance to facilitate changes to happen. Local governance and continuous review of KPI data against the target implies continuous focus on quality improvement plan development and implementation.
The development of formal implementation components and formal quality improvement plans that link into an escalation process and regular high-level performance reviews where the chief executive officer (CEO) is present considerably increased the effectiveness of RAD-QAP.

Radiology continues to use RAD-QAP and it is an essential tool in assuring departmental standards and implementing the RAD-QAP standards for better safer healthcare.

RAD-QAP is structured so that it works. It is simple to implement so that people involved know their roles and responsibilities clearly. RAD-QAP can bring people into the programme, but it cannot force their commitment. Therefore RAD-QAP is very reliant on commitment from the most senior manager. RAD-QAP can be implemented by disparate professions in the department but the full benefits are realised when the most senior manager takes control and is committed. It is however time consuming to implement and requires a large commitment to quality assurance. The benefits of implementation of RAD-QAP in the radiology department were appreciated in the department and a staff member was devoted to implementation of the QA programme.

6.3.1 Conclusion to Action Research

RAD-QAP developed throughout the course of the action research in the radiology Department. RAD-QAP was initially presented as a list of requirements that had been developed as a result of the first phase of the research. Implementation of RAD-QAP in radiology evolved RAD-QAP from a list of requirements to a programme consisting of seven steps, which staff could easily understand. The programme developed into a fully-fledged programme which was iteratively implemented. The difficulties and the success with implementation are explored, solutions were identified, and many problems were overcome. Realistic communication strategies were put in place, and these are now available for use in the next phase of RAD-QAP.

The seven components of RAD-QAP evolved throughout the course of the action research in the radiology department.

The authority component was developed to align with the leadership facet of clinical governance outlined by [68]. They identified need for a number of structures to be implemented to achieve clinical governance that led to the development of the structural component these included a radiology quality committee. Stakeholder analysis was included;
this includes the patient, internal and external stakeholders. Their requirements must be prioritised and taken into consideration, based on how critical the requirements are to the safe, effective running of the department, the organisation and ultimately the patients. Standards were developed, to achieve the highest quality of software management and adherence to legislation. A suite of policies, procedures, protocols and guidelines were developed and built into day to day management of the department. A communication policy was implemented to increase staff awareness of this quality assurance initiative.

The need for a holistic programme to achieve continuous quality improvement and provide quality led to the development of the quality profiling component. To facilitate a list of possible KPI is selected based on quality shortfalls within processes that were identified as areas of concern for the radiology department. The data component was developed to achieve the final list of KPIs selected by an expert group through consensus. The final list would include National KPIs and map to the national health care standards. This component also requires that data will be collected in a co-ordinated and standardised manner. This component instigates the agreement of statistical methods for data analysis. The quality improvement validation component tested the effectiveness of QIPs implemented. The quality improvement verification was put in place to assure that the QIP were effective to address the quality shortfall by means of KPI measurement against a set target. Non-compliance to the target was actioned swiftly. No of pro-active vs. reactive KPI quality improvement plans were added as a KPI to measure the shift from reactive incident management to proactive risk management to achieve excellent quality. Quality assurance and ultimately achieve clinical governance using a set of KPIs measured against a set target measured and reviewed periodically by senior management.

**Identification of Patient Benefits**

When the **Quality Profiling Component of RAD-QAP** was activated and it was noted that metrics measuring structure, process and outcomes to assure success was confirmed. The Delone and McLean Model for information system success was discussed as an appropriate model to base the metrics on. Patient benefits from RAD-QAP were identified and key performance indicators were also developed. These were measured prior to and post application of RAD-QAP (See Table 6.7, Table 6.8).

One of the patient benefits of RAD-QAP is **assurance that RAQ-QAP is efficient and effective at improving quality**. A monthly report outlining the KPI data measurements and trend
comparisons was produced and reviewed. The report was discussed in detail at senior meetings and actioned appropriately. There is now data available on quality management in the radiology department. The clinical director and directorate team make decisions based on this data.

*Quality shortfalls in quality management are flagged:* This is another patient benefit from the system, having been identified through the implementation of RAD-QAP. The report created by the system is set up to flag where outcomes deviate from the desired standard of outcome. It is accepted that outcomes will not remain static and that there can be spikes in the data. The report however provides an indication where they begin to deviate from the expected. This allows for system analyses to be performed where deviations occur so that poor outcomes do not become systemic or become the accepted norm.

RAD-QAP identified those data quality measurements *actioned in a pre-agreed timely manner*. The true benefit of a quality assurance programme is not realized until it initiates appropriate actions. Actions such as practice standardization and education programmes have been initiated based on KPI measurements from RAD-QAP. There is now evidence of clinical staff acting on these findings before the KPI data are reviewed by the quality committee and that practice has been shown to improve as a result. This indicates that staff are self-correcting and also pro-actively changing process to achieve the KPI targets.

The NIMIS system which has been in existence for four years, not providing benefit to its full potential to the organization, is now central to radiology management quality assurance. The Delone and McLean Model (see Figure 6.3) was modified so that the definition of information system yield for quality management was changed from net benefit to patient benefit bringing it in line with the national standards for better safer health care [19]. The implementation of RAD-QAP resulted in the inclusion of the risk management process in the rapid escalation process ensuring the efficient, effective management of risk.
Figure 6.3: De Lone and McLean model as adapted by Reid [23]

<table>
<thead>
<tr>
<th>Patient Benefits</th>
<th>Score Prior to Intervention</th>
<th>Score Following Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly/Annual report (25%)</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Assurance that over-all Radiology turnaround times is efficient (25%)</td>
<td>1%</td>
<td>25%</td>
</tr>
<tr>
<td>Quality shortfalls in Radiology management flagged (25%)</td>
<td>2%</td>
<td>25%</td>
</tr>
<tr>
<td>Information is actioned in a timely manner (25%)</td>
<td>3%</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>Patient Benefit Score</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 6.7: Patient Benefits Pre-and Post RAD-QAP Implementation, Adapted from Reid (2014)
<table>
<thead>
<tr>
<th>Performance Indicators</th>
<th>Score Prior to Intervention</th>
<th>Score Following Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPI 1</strong> Governance established for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data entry (5%)</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Data retrieval (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Technical management (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Data dissemination (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>KPI 2</strong> Supports in place for staff:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entering data (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Retrieving data (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Generating reports (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Disseminating reports (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>KPI 3</strong> Quality and accuracy of data:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% of data reviewed (10%)</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>&gt;95% accuracy (10%)</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td><strong>KPI 4</strong> Report availability:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All reports available within an acceptable predefined timeframe (20%)</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>KPI 5</strong> Information from reports is used:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action where data quality low (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Action where information quality low (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Action where user satisfaction indicates. (5%)</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>All reports actioned where clinical quality low (5%)</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong> Performance Indicator Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Table 6.8: Patient Benefits and Key Performance Indicators Pre-and Post RAD-QAP Implementation
Adapted from Reid (2014)
6.3.2 Interviews with Senior Managers

These interviews took place in the model 4 acute hospital radiology department. Clinical specialists in charge of each modality in radiology were interviewed as part of the evaluation process for RAD-QAP. The managers were chosen for interview as they were experienced in quality assurance. A total of five managers were interviewed. They managed CT, MRI, AE, nuclear medicine and general x-ray. The interviews provided valuable insight into the reality of implementing a quality assurance processes.

The interview questions used in the evaluation process were designed to query the individual Components of RAD-QAP in detail. Probes were also developed to gain further depth and insight where the researcher felt that the interviewee may have more to offer. The questions and probes can be found in Appendix VII.

Nine key themes came through strongly in the interviews. The breakdown of themes can be found in Appendix VIII, IX.

6.3.3 Discussion of Interview Findings

Interviews provided valuable information on the success factors and the barriers to implementing a quality assurance programme.

Leadership

The importance of a leader who can lead for the implementation of any project was a theme that surfaced continually throughout the course of the interviews. This leader must be passionate, convincing and more importantly convinced. Changing practice and maintaining good practice is core to achieving a successful outcome and the ability to do that is central to good leadership. Authority is a necessary requirement for the leader to change practice. The leader must be accountable and able to make unpopular decisions to bring about change.

The fact that persistence overcomes resistance also came across very strongly in the interviews. The persons in charge felt that implementing RAD-QAP would be time consuming and that there would be resistance but that with persistence and commitment it could be done. The persons in charge felt that it was important to be able to delegate and assign responsibilities for staff development purposes and to provide cover and support.
Education

The importance of continuous education for staff was found to be important. The theme was prevalent with education being considered to provide more than vital knowledge. Education was considered to empower staff, create champions, lift apathy and increase moral.

Patient –Centered Care

The patient must always be kept central and a customer driven service must be assured. A variety of methods for keeping the patient central were provided- patient stories, feedback, listening. These must be incorporated into every aspect of planning of the running of the organisation.

Goals/Priorities/Timeframes

Consistency and clarity of direction and desired outcome was a key driver of success. Goals, priorities and timeframes assisted in ensuring correct prioritisation so that ‘the energy was spent where the need was’. ‘Without goals people can get busy with other things’. Timeliness was required to get things done, ‘if not timely people can forget’

Reviews and Follow-up

The importance of and the need for robust review and follow up processes to achieve quality was a theme that surfaced throughout the course of the interviews. There were a number types of reviews mentioned. Routine internal reviews such as audits and routine external reviews such as those performed by the Health Information and Quality Authority provided a valuable overview of the quality status of the organisation. The findings from these routine reviews needed to be acted upon, worked on were the words that were used most often, to manage quality and to reduce risk. The other form of review that was important was those that were conducted following significant events or risks. These were particularly important and were conducted regularly in radiology. Things can and will go wrong “review can show you where things go wrong” and “persistent review will get you there”. The importance from learning from significant events was of vital importance to the safe management of radiology.
Support

The theme of support surfaced frequently, and it was found to be very beneficial, support from above and support from staff and peer support. Support and healthy competition from the other units was found to be particularly beneficial.

Measuring

Measuring practice was an important driver of quality to remove any preconceptions as “things are not always as you think they are”. It was found that there was greater need for measuring initially until high quality practices were bedded in. Spot checks were important in ensuring that quality remained high but were not always considered to be enough. Routine measurement needs to occur in association with the spot checks. Where practice is found to be weak the routine measurements are increased.

Structures

Structures require standardised practice and policies and have an important role to play in quality management. In a complex and busy environment, such as a radiology department “everyone can be all over the place you need to sit back and devise a plan”. Where there is a lack of policy it “can cause upset”. Policies provide clarity and empower management, but they require a lot of work to keep them up to date and accessible to staff. The PIC indicated that this is exhausting. It was felt that a small suite of user friendly protocols is very useful.

Communication and working as a Team

Working as a team and communicating could be considered as two separate themes. However, I have elected to discuss them together as they were so interconnected throughout the course of the interviews.

PICs felt that good communication and teamwork were key requirements to successful implementation of quality in their units. This should be seen in context with the previous themes of consistently, clearly and simply communicating the key messages that you want to get across. Communication of quality requirements must be concise and precise. A two-way communication process must be developed that involves receiving and communicating from the staff and back to the staff. Staff need to be kept up to date and aware of the priorities of the organisation and they in turn need to be empowered to communicate what is going on the ground. There is a lot to be learned from staff feedback as they know what is going on the
ground and can provide local solutions. Staff employed in the units need to ‘learn not to fear openness’. Communication processes need to be reviewed regularly to be effective. The person in charge must continually listen and try to correct problems.

A well-functioning interested team is vital to the successful running of radiology. Champions of quality must be fostered and encouraged. Staff must be educated to have the necessary knowledge skill around quality management. Staffs on the ground have gained a huge amount of knowledge through continuous professional development and experience. They are on the ground and are in a position to drive quality therefore they must be given ownership of the QA processes and must be empowered to lead change. They are more clued into front line things and can become disillusioned if they think their energies are being wasted. Nobody, however, can do everything or be an expert at everything, staff must work together to assure quality.

The pressures that staff are under was emphasised continually “staff have an awful lot coming at them.” Clarity of purpose and reducing information considered helpful in reducing the load on staff. If something is a priority this must be made clear and the information reduced to indicators rather than reams of information. Protected time was required in order to implement a quality assurance programme.

Remaining positive and celebrating victory was also seen as important. As discussed previously staff have a lot coming at them and can become demoralised. It is important not to continually stress the negative when auditing. Feedback particularly positive feedback is important.

6.3.4 Conclusion to Phase 4

An adaptable tool for the measurement and management of quality and risk has been developed and is leading to a measurable improvement in quality. The radiology department at the time of writing is the only department to have achieved success with the QMIS system. Healthcare audit is also seen within this department as a pro-active way to prepare for external audit. The department now has a suite of updated standardised protocols and compliance with protocols has risen from an average of 82% to 96% over a period of two years. Student training has improved due to updated and standardized protocols.

A previously unused data available on an information system is now being used in quality improvement. A QA programme for equipment (software and hardware) has been set up.
Monthly review meetings are set up and results outside of the allowed parameters are discussed and referred to the physicist. Quality improvement plans put in place and further tests conducted to verify equipment is functioning within the acceptable parameters. All these cases are referred to the radiation safety committee for discussion. Radiation safety officer was appointed as part of the quality improvement plan to manage equipment calibration as per IPEM guidelines [220].

Action research in the radiography department is administratively and clinically dependant on technology i.e. NIMIS. It is an acute inpatient environment that also serves out patients where medical devices and systems are as central to the functioning of the service. The effectiveness of RAD-QAP Version 3 was implemented to determine if any changes are necessary to achieve its success in the inpatient environment. Following phase 3 the quality verification component was added to allow for regular performance reviews to verify the quality data and provided a mechanism to follow up on actions from previous meetings. The quality assurance component with stipulated documentary evidence was added. They included official standardised documentation, service plans, list of duties and responsibilities, risk register, scorecard, quality improvement master list, quality improvement project tracker and audit forward plan to allow for official documentation of quality data and actions taken. These are kept in an excel book together with meeting attendance and minutes to avoid fragmented documentation.

The researcher carried out interviews with domain stakeholders. The researcher also observed at meetings and performed thematic analysis on the outputs. Data was collected, results analysed and changes were made to RAD-QAP throughout the action research phase in the department.

6.4 Chapter Conclusion

During the action research phase RAD-QAP identified problematic areas required that they were revisited quickly. The most senior staff in the department formed a strong knowledgeable team, the quality assurance team, put in place to regularly choose from the KPI component of RAD-QAP. Each time a KPI is chosen for review, they must engage people to provide a combination of authority and knowledge relevant to the topic, to verify standards are in place and adhered to and that required changes to structures or practice actually happen. This increased the likelihood of improving quality through KPI continuous
measurement improved outcomes for patients and staff. Each KPI measurement is reviewed regularly against a set target in a predefined framework that manages quality, risk and the quality improvement plan in the same framework.

The fact-finding step of the research provided us with an understanding of factors that could lead to risk and breaches of patient safety.

KPI measurements reviewed regularly against set targets were found to effectively highlight process failures. RAD-QAP developed into a fully-fledged programme which was iteratively implemented. The difficulties and the success with implementation were explored, solutions were identified, and many problems were overcome. Realistic communication strategies were put in place. Implementation of RAD-QAP in the radiology department led to measurable improvements in the management of quality in the acute radiology department.

RAD-QAP components and protocols provide a structured approach to assuring quality in a department. RAD-QAP includes drivers of a high-quality service to configure a holistic quality assurance programme. This must be applied to have the correct staff with the appropriate skills is driving the quality initiatives.

The implementation of RAD-QAP also resulted in the inclusion of the risk management process in the escalation process ensuring the efficient, effective management of risk. The implementation provided an understanding of how good structures lead to good processes which in turn lead to good outcomes. For example, implementation of RAD-QAP resulted in stakeholders working together to improve the service delivered to patients.

As a conclusion, it is important to reflect on what the implementation of RAD-QAP gave to the radiology department. We saw how good structures led to good processes which in turn led to good outcomes. For example, our implementation of RAD-QAP decreased the number of staff collecting data from NIMIS. There was now a designated person in place that used standard set of KPIs with agreed methods of data extraction. Increased focused on the quality shortfalls resulted in organisational benefits by creating valuable, quality assured information that clinicians are confident to use. RAD-QAP is fair as it gives staff an opportunity to correct their practice prior to governance and consequence as they are aware of the escalation process. Staff are also aware of the areas that are of high priority for quality assurance. Education provided to staff facilitates professional development.
Following this research, in the radiology department, RAD-QAP continues to be used and is considered to be an essential tool in assuring departmental standards and implementing the HIQA standards for better safer healthcare.

Official standardised documentation was developed as part of RAD-QAP Version 4 provided recorded evidence of quality improvement and risk assessments. This requirement was added to the quality assurance component. The documentation includes a governance organogram, radiology service plan, list of duties and responsibilities for radiology staff, quality assurance scorecard, risk register, quality improvement tracker, project tracker, audit forward plan.
Chapter 7  Description of RAD-QAP

7.1 Overview

This chapter presents the final version of RAD-QAP, radiology quality assurance programme. The programme is a useful tool to support co-ordinating the activities of the various stakeholders that make up the multidisciplinary team that surrounds the hospital patient. The collective objective of the multidisciplinary team is to improve patient outcomes. In some cases, this goal may be to cure, in other cases to alleviate symptoms and in other cases to assist towards a dignified death. Software systems and medical device software are tools that are integral in attaining that goal.

The programme comprises of a number of requirements and practices which must be in place to assure the quality of software in the clinical environment. The subsections of this chapter describe these requirements and practices and their significance. RAD-QAP components and protocols provide a structured approach to assuring quality in a department. When applied inwards from components 1 to 7, it dictates that the correct staff, with the correct skills, is driving a relevant, co-ordinated, holistic programme that achieves results in key areas the overall goal. The 7 components of RAD-QAP can be seen in Table 7.1 and the interdependent processes within RAD-QAP are illustrated in Figure 7.1.

7.1.1 Structure of RAD-QAP

RAD-QAP takes the form of seven implementation components which must be implemented in sequence, commencing with the authority component through to the quality assurance component, as Table 7.1 shows. These components must be implemented from the outside in to achieve the correct establishment of one component to the next. This is important as failure to follow the sequence in one component will lead to weakness in the next.

The programme’s 7 components from design to implementation and assurances are further subdivided into sub-requirements which again must be implemented in order, the exception to that being the quality Improvement that also involves quality shortfall identification process. Quality shortfalls can and will vary in type and each quality improvement plan must be implemented and managed as a project from beginning to end. Detailing the different quality shortfalls would be beyond the scope of this PhD. A number of relevant quality
improvement plans, and consequent improvements will however be detailed. A number of relevant quality improvements will be detailed in Chapter 7.

7.1.2 7 Components of RAD-QAP

Component 1 - Authority Component

This component superseded the original governance component as defined by Reid. It became clear through greater understanding of the concepts of governance and attempts to implement governance arrangements that this could not be established from the outset. A fully implemented, mature quality assurance programmes would indicate that governance arrangements were in place. Authority was found to be the key and this must be stressed from the outset. Where authority is not established and where the person with the most authority is not driving the programmes it will not progress (Literature Review, Inquiries Review, Action Research).

Component 2- Structure Component

The quality assurance team replaced the audit committee with the implementation as it was felt to be a more passive set up. The quality assurance team implements quality assurance, producing and providing evidence of acting on the findings. A further change at this point was the development of compliance levels for policies. This assured from the outset that high standards were identified and the staff strove to achieve them (Literature Review, Standards and Legislation Review, Inquiries Review, Action Research).

Component 3 - Quality Profiling Component

The quality profiling component is fundamental to RAD-QAP and this phase selects the set of KPIs and connects quality and risk in one framework. A complete service analysis that included complaints analysis, incident analysis, resource analysis and capacity and capability analysis to prioritise relevant aspects of the system necessary for delivery of a high-quality care (Literature Review, Action Research).

Component 4 – Quality Data Component

The quality data component defines the KPIs and sets compliance levels. This Phase maps the set of KPIs to health care standards to include the drivers responsible for achieving the dimension of quality as prescibed by health care standards. This phase defines the data to
be collected as well as the methods for analysis. It identifies an accountable person for this task. RAD-QAP Version 4. The data collection points at the different levels of the management structure are aligned in this phase. This also allowed the person in charge to delegate the work thus spreading the load. The person in charge working from feedback, made the programme more efficient and more balanced. This phase reduced the number of KPIs significantly by means of consensus study. KPIs were selected by the consensus group according to high priority and high risk. KPIs that reached the target with the first 6 measurements were removed and put in a parking lot (Literature Review, Action research)

**Component 5 – Quality Improvement Validation Component**

In this component the first measurement is taken to provide a baseline. In this Component Quality Improvement Plans are developed for KPI measurements falling below target. This is to remove any variance in the process to allow the set targets to be met. It starts from an initial measurement of the KPIs that leads to a more sophisticated systems analysis process when the set target is not achieved. QIP requires systems’ analysis as opposed to automatic education and consequence in the event of poor results. Education however remains the first action of the escalation programme in the event of poor or non-compliant practice. Following the root cause analysis quality improvement plans are developed implemented (Literature Review, Action Research)

**Component 6 – Quality Improvement Verification Component**

A second measurement is taken using the set of KPIs to determine the effectiveness of the quality improvement plans (QIP) plans. The purpose of this Component is to verify that actual quality improvement has been achieved. QIP are modified when the measurements do not meet the set target. KPI are measured for 6 consecutive months to until sustained compliance achieved. Six compliant measurements verify that the improvements are maintained (Legislation and Standards Review, Literature Review, Action Research)

**Component 7- Quality Assurance Component**

The four levels of quality emerging improvement (EI), continuous improvement (CI), sustained improvement (SI), excellence (E) are then determined to provide quality assurance of KPIs covering the relevant aspects of the service. The KPIs for Pro-active VS Reactive QIPs are added to this level to provide ultimate assurance that continuous quality improvement is indeed materializing with sustained efforts of quality improvement plan
implementation for KPIs falling below target. This component provides KPI measurements against a set target over time to provide evidence of quality improvement and thus assurance that quality processes are continuously reviewed and improved. (Literature Review, Inquiries Review, Legislation and Standards Review, Action Research) Table 7.1 shows the complete list of requirements for each component of RAD-QAP. The 7 components of RAD-QAP can be seen in Figure 7.1.
<table>
<thead>
<tr>
<th>1. Authority Component</th>
<th>9][7] [46][68] [70] [72] [175] [87] [225] (Literature Review, Inquiries Review, Action Research)</th>
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<td>R1.2 Define Accountable Person Drives</td>
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<td>R2.3 Establish QA Committee</td>
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<td>R2.4 Establish Quality Assurance Teams</td>
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<tr>
<th>3. Quality Profiling Component</th>
<th>55][19][129][111][14][256] (Literature Review, Action Research)</th>
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<td>R3.2 Standards Review</td>
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<td>R3.3 Service Plan Objective Analysis</td>
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<td>R4.6 Set Compliance Levels</td>
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<td>R4.7 Development of Scorecard</td>
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<td>R5.8 Six Sigma Principles Incorporated into Quality Improvement Plans-Training Programmes</td>
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<td>R6.1 Modify Scorecard If Necessary</td>
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<td>R6.2 Manage KPIs</td>
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<td>R6.3 Communicate Results through Quality Committee</td>
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<td>R7.5 Project Trackers</td>
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| R2.5 Develop Format for Performance Reviews |
| R2.6 Develop Policies, Procedures, Protocols and Guidelines |
| R2.7 Implement Integrated Quality and Risk Framework |
| R2.8 Develop communication strategy |

| R3.8 Risk Register Analysis |
| R3.9 Complaint Analysis |
| R3.10 Patient Employee Satisfaction Audit Analysis |
| R3.11 Inquiries Recommendations |
| R3.12 Image Reject Analysis |
| R3.13 WTE Analysis |
| R3.14 Absenteeism Analysis |
| R3.15 Accounts Analysis |

| R4.8 Data management |
| R4.9 Define methods of data collection |
| R4.10 Define sources for reliable measurements |
| R4.11 List monthly reports needed |
| R4.12 Agree Time frame and frequency of collecting data |
| R4.13 Define KPI data analysis methods |
| R4.14 Define Data collection points and align with management Structure |

| R5.9 Second Measurement Post Quality Improvement Plan Implementation |
| R5.10 Root Cause Analysis if KPI Target still not met. |
| R5.11 Structure and Process Review for KPIs falling below Target |
| R5.12 Third Measurement post process and structure Modification |
| R5.13 Escalation of Consistent Non-Compliant KPIs |
| R5.14 Acknowledge and Celebrate Success |

| R6.4 Accumulative Periodic Analysis/Trend Analysis |
| R6.5 Pro-Active Reactive QIP Ratio |
| R 6.6 Overall Quality Improvement Verification |

| R7.6 Audit Forward Plan |
| R7.7 Quality Assurance |
| R7.8 Accountability Framework |
| R7.9 Performance Framework |
| R7.10 Governance |
| R7.11 Quality Management Cycle |

Table 7.1: The 7 Components of RAD-QAP
Figure 7.1: Output from Phase 4 - The 7 Components of RAD-QAP with documentary evidence
The 7 components of RAD-QAP align with the 10 facets that are considered by [68] to provide clinical governance in a health care setting. (See mapping study in Table 7.2)

<table>
<thead>
<tr>
<th>10 Facets of Clinical Governance</th>
<th>7 Components of RAD-QAP</th>
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<tbody>
<tr>
<td>1. Leadership</td>
<td>Authority Component</td>
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<tr>
<td>2. Detection of adverse events</td>
<td>Structure Component</td>
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<tr>
<td>3. Clinical risk reduction</td>
<td>Quality Profiling Component/Quality Data Component</td>
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<tr>
<td>4. Learning lessons from complaints</td>
<td>Quality Profiling Component /Quality Improvement Component</td>
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<td>5. Evidence-based practice</td>
<td>Quality Profiling Component</td>
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<tr>
<td>6. Quality improvement (includes clinical audit)</td>
<td>Quality Improvement Component</td>
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<td>7. Dissemination of good practice and ideas and innovation</td>
<td>Quality Validation Improvement Component</td>
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<td>8. Professional development programmes</td>
<td>Quality Validation Improvement</td>
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<tr>
<td>9. Addressing poor clinical performance</td>
<td>Quality Improvement Component Quality/Verification Component</td>
</tr>
<tr>
<td>10. High-quality data and record keeping</td>
<td>Quality Data Component/Quality Assurance Component (Documentary Evidence)</td>
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</tbody>
</table>

Table 7.2: Mapping of RAD-QAP to Governance Principles [68]

7.1.3 **Significance of RAD-QAP**

Organisational goals are achieved through KPI data measurements when aligned with governance structures / duties and responsibilities. Periodic reviews provide a structured forum for discussion of quality KPI data and promote quality and risk management through QIP implementation and continuous feedback on achievement of the end goal.

RAD-QAP will increase the likelihood of desired health outcomes and are consistent with current professional knowledge [2]. Healthcare quality and risk are effectively managed
through the implementation of an integrated quality and risk management system that encourages continuous quality improvement [46].

These include:

- Validation and verification to confirm quality assurance (Literature Review, Action Research),
- Formal quality control and quality improvement processes must exist. Helps co-ordinate the activities of the department [174] (Inquiries Review, Standards and Legislation Review),
- Quality assurance process are measured by a set of KPIs that can be verified by subsequent measures (Literature Review, Expert Panel),
- KPI measurement is useful in controlling information overload. It focuses and helps to priorities issues based on risk (expert validation process),
- Simplicity must be maintained to allow quick understanding as managers are time poor and will have limited time to spend learning the new process. Reduces information overload (expert panel),
- Useful to standardize process to reduce variation in a complex environment. Department operates within a set of agreed principles, standards and rules [68],
- Considering clinicians concerns and resistance to technology and KPI measurements as well as their power in final decision making [48],
- Advice on involving them early in the process is worth considering [232],
- Facilitates that patients receive high quality care [67],
- Multi-disciplinary staff in the hospital particularly those who are not members of the QA team will be facilitated to work in a structured unified manner, providing a quality assured service with cohesive guidance (action research radiology department),
- Quality Assurance must be introduced in a structured, simple, manageable programme as part of daily hospital activity (action research radiology department),
- Quality assurance is only achieved if the validation and verification stages are carried appropriately with documentary evidence to assign accountability and continuous follow-up of quality initiatives to address risk (action research radiology department).
7.2 Requirement 1 - Authority Component

The authority component of RAD-QAP (component 1 in Figure 7.2) is required to have clarity around the leadership and management of quality in the radiology department. The complexity of radiology in an acute setting can cause confusion due to the conflicting demands on staff time and attention. The programme will be negatively affected if there is any ambiguity around leadership. The authority component defines authority in the department and stipulates that the relevant person with the overall authority is in control of the programme and drives it within a predefined time frame.

The authority component has three sub requirements. Define accountability structures; define accountable person drives and training needs analysis for the accountable drives must be carried out. The first is required for clarity around reporting structures and each individual’s duties and responsibilities. The person with ultimate accountability for the clinical as well as the administrative side must be defined and clearly communicated. If there is any uncertainty at this point it must be addressed so that there is one, clear line of authority. The person with authority in an organisation is the person with the power to make and execute decisions this person must drive the programme. Lack of interest or commitment from this person will have a detrimental effect on the programme. An organogram should be in place demonstrating the reporting lines as well as the different grades with their duties and responsibilities clearly defined (Literature Review, Inquiries Review, and Action Research).
Significance

The significance of having an authority component is as follows:

- Prioritise that the radiology department and many different stakeholders in the multidisciplinary environment of the acute hospital’s own personal or local priorities are kept in line with the goal of improving patient outcomes (inquiries review, literature review, action research),
- Put person in place to achieve decision making power to drive the programme (literature review, Action Research),
- Put authority in place to support maintenance of the programme (action research),
- Put authority in place to maintain direction (action research),
- Necessary to reduce ambiguity around priorities (literature review, action research),
- Helps prevent losing or weakening the overall goal by the pursuit of disconnected individual stakeholder goals (literature review, action research),
- Embed quality assurance programme in management approach as a priority of the department (action research),
• Identify and prioritize training needs and drive the agenda (Action Research).

The requirement for an authority component was mainly identified in the action research in the case hospital (Acute Hospital - Model 4)

7.2.1 Requirement R1.1 - Define Departmental Accountability Structures.

According to the WHO leadership is defined as follows “To direct the activity…to start, begin…front, foremost”. Leadership is defined as the willingness to initiate, convene, or lead an action [222].

Interviews with staff established the existence of parallel management with conflicting work practices. Lack of clarity around leadership and responsibility was evident in the findings from the inquiries. This lack of clarity was a main reason for failed uncompleted or abandoned projects. Lack of a named person that owned responsibility for quality improvement project completion was a main reason for failure. Clear accountability must be established with the most senior person in charge in the department. Reporting relationships should be clear. This step is very important as quality is every staff member’s duty, if there is no official accountability structure in place the programme won’t be maintained over the long term. See organogram of the reporting relationships and a list of duties and responsibilities in

Significance

• Strong leadership is the single biggest element that will encourage the success of the quality programme (external validation interviews)
• Required to eliminate parallel management (case study research).
• Imperative that staff understands and agrees with the duties and responsibilities assigned to them, many staff members has outdated contracts that is 20 years and older and does not reflect what the staff member does or what the organization needs anymore,
• The complexity of the environment and the conflicting demands on staffs’ time and attention mean that for successful quality assurance processes it is necessary to establish clear lines of authority (action research radiography department),
• Useful for decision making in the event of conflict (action research),
• Lack of leadership leads to lack of understanding and cohesiveness (case study research),
• Achieving success in a project requires the person in charge to lead and inspire the team to deliver (external validation interviews),
• Quick decisive action imperative for the programme to yield result in an acceptable timeframe and must be driven by set performance reviews,
• Necessary tools should be made available for staff to manage QIP project implementation. Tools that are available should be used and training provided.

**Practices**

• Develop an organogram of the department with clear reporting lines and management structures. No person in the department should report to two people (researcher experience),
• Eliminate parallel management by introducing a policy as to which manager overrides and is the final authority in decision making in the event of two professions working together in the department. In radiology, this will generally be the consultant radiologist in charge [49],
• Name the person in charge of each project and stipulate reporting frequency to the quality committee. Committees can’t be in charge on any aspect of quality assurance (researcher experience),
• The person in charge of implementing any aspect of quality assurance must have the authority to implement any required changes and must have authority to make decisions and give instructions to the staff that must implement processes or activities (action research radiography department),
• The person in charge may delegate work to another but this person is a coordinator on the project as opposed to being a person in charge and must report directly back to the person in charge (action research),
• This leader must have experience in quality management as well as expertise in the domain of radiology with background knowledge; they must be capable of assigning responsibilities and take leadership to assert and direct.

7.2.2  **Requirement R1.2 Accountable Person Drives**

It is not enough to identify the person with the authority to drive the programme. That person must take ownership and drive the programme. They must have the energy, enthusiasm to do that. The programme without the leadership will not achieve success.
The person identified to drive the programme must be the most senior person in the department, the person in charge, i.e. the manager. The manager set up and implements the other components. The manager informs staff of the importance of this programme and that there are consequences for non-compliance with the programme.

**Significance**

- The person in charge must take an interest and drive the project for a quality assurance project to succeed (validation interviews),
- This person must be meticulous from beginning to end to achieve the goal.
- Prioritises that the goal of patient care and outcomes is of highest priority in the department and is more dominant than the reactive issues that arise on a day to day basis (action research radiography department),
- It is required so that there is absolute clarity around the direction of management of quality in the department. Ambiguity will weaken the programme (action research),
- Helps that there is clarity around requirements (action research),
- A totally committed leader inspires a team (external validation interviews),
- Required to facilitate that the other components are set up and implemented,
- Helps to raise awareness of the importance of the programme to departmental staff (action research),
- Required to for staff awareness. They must be aware of the consequences of non-compliance with the programme (action research radiography department),
- Helpful in coordinating the disparate objectives of stakeholders in a very complex environment (action research model 2 hospital Nenagh),
- Required prevent collapse of projects due to low interest (action research model 2 hospital Ennis).

**Practices**

- The person in charge (PIC) chairs meetings to indicate responsibility for the programme (external validation interviews),
- The PIC sets up the subsequent components of RAD-QAP and assigns tasks and responsibilities for the implementation of subsequent components of RD-QAP (external validation interviews),
• The PIC communicates the importance of this programme and consequences of non-compliance with the programme to radiology staff (external validation interviews),

• The PIC requests regular feedback and progress reports from stakeholders. This indicates an interest to stakeholders and the programme stays central to practice (external validation interviews),

• The PIC must remain resilient, recognising and empowering champions. (external validation interviews),

• Programme results are presented and discussed at forums and meetings so that data informs practice and the programme remain central,

• Lead person supports standardization of practice (action research),

• The PIC accepts feedback from staff and this is incorporated into the programme as appropriate, informing topic selection and practice (action research),

• Monthly performance reviews at directorate level of quality performance measurement data produced by quality improvement projects must be reviewed to manage and maintain action the long term,

• Formal performance reviews also form part of the accountability framework.

7.2.3 Requirement R1.3 Training Needs Analysis for Lead Drivers

“A training needs analysis is the systemic investigation of training needs within an organisation. It is part of a process which integrates training with the business or development of plans”. “A professional, comprehensive training needs analysis (TNA) must be carried out to provide your new network with concrete data and information to make informed decisions on the direction and activities of the network” [215].

Significance

• It is very important to do training needs analysis at the very start in the authority component. The most accountable person and team leaders cannot lead in a quality assurance programme if they do not possess the necessary skill set and knowledge to lead and advice the teams competently (interviews),

• This analysis supports the leadership and arm them with the skills to co-ordinate and manage and guide on all levels, from the most accountable personable to the quality assurance committee and in turn the quality assurance teams (interviews),

• The central purpose of the network/team needs to be the focus of the training programme,
• Identify the gap between current knowledge and skill set and compare to the required levels,
• Aptitude of the different leaders needs to be assessed and considered when the training programme is developed (interviews).

Practices

• The most accountable brings the skill of strategic planning and vision to the project. She/he is also responsible to identify the direction the certain projects trough critical decision using previous experience as well as drawing from training provided,
• This person will collaborate with the identified leads and through the quality committee and instigate the training needs analysis and instruct for the appropriate syllabus to be developed to address the training needs of the specific group of people configured in the teams,
• These training needs might develop and change as the quality assurance programme matures through the different phases of implementation. The most accountable person will instigate and review the process and allow the quality committee to manage and coordinate this function through the team leaders that interacts directly with all staff.
7.3 **Requirement 2 - Structure Component**

Structure relates to the elements required to assure compliance (such as clinical and non-clinical policies, procedures, protocols pertaining to various enabling elements of the service). In a quality assurance programme, structures refer to the elements that need to be put in place to achieve quality improvement. The person in charge of the domain cannot achieve quality assurance working alone in an unstructured environment. The structure of quality measurement systems is important to the process and outcome. ‘Good structure increases the likelihood of good process, and good process increases the likelihood of a good outcome’ [21]. The structure component (component 2 in Figure 7.3) requires that a quality committee for oversight together with quality assurance teams consisting of key stakeholders be established for each individual quality improvement plan to oversee implementation and follow through. This team is led by the person in charge as established by RAD-QAP’s previous component. Quality committee responsibility is to identify the level of performance that the department must achieve in relation to patient outcomes and the standard of care that the patient must receive. Staff and tools are in place to achieve good patient outcomes and a good standard of care. They must establish, develop and maintain a prioritized suite of pertinent policies, procedures, protocols and guidelines whose function is to support achievement of the desired levels performance dictated by the performance indicators. The team must also agree compliance levels with the PPPGS.

The sub-requirements of the structural component are as follows: stakeholder analysis develops quality assurance team, develop policies, procedures, protocols and guidelines, agree compliance levels, and develop communication strategy. A radiology service plan must also be produced by the senior management team to align with the over-all hospital strategy and service plan (Literature Review, Legislation and Standards Review, Inquiries Review, Action Research).
For any team to function and be effective, they need to have direction and a clear plan for what the priorities of the organization are and plan the radiology service priorities around the goals of the organization.
7.3.1 Requirement R2.1 Stakeholder Analysis

Stakeholder analysis is a process of systematically gathering and analyzing qualitative information to determine whose interests should be considered when developing and/or implementing a policy or program. The world health organisation (WHO) stakeholder analysis involves systematically gathering information to identify the stakeholders required to implement the programme. A quality assurance team must be put in place and to correctly establish this team requires stakeholder analysis. The team should include staff members who bring knowledge and influence to the table. Membership can be identified using stakeholder analysis techniques [227] [19].

Clinical departments using medical device software and software systems must include software engineers and information technology staff if not already part of the team. Hospital staff work in teams, each team member has their own important role with their own set of priorities. RAD-QAP requires the clinical staff to work with non-clinical staff to attain a defined suite of departmental goals.

Hospitals provide an environment that is heavily dependent on information, where staff are expected to work on and in accordance with current available knowledge at all times. They are expected to work in line with evidence based best practice. Those with power must work with those with knowledge so that the knowledge filters through the components of staff.

The varied experiences of the stakeholders must also be taken into consideration with some, often those with greater seniority, having little involvement with technology and others having been brought up with it.

The radiology service plan must align with the hospital service plan so that all stakeholders are working towards the same goal and allow for resources to be pooled together to get maximum effect of all effort put in.

Significance

- Identify people whose interests must be considered, such as clinicians or patients, organizations, processes, and the external environment as products are not used in isolation. They are part of a larger socio-technical system [2],
- Identify the team to support the person in charge as no one person can do everything (external validation interviews),
• Identify the team to provide the knowledge required to run the department as no one person is an expert in everything (external validation interviews),
• Identify those with authority to implement standards in an area where many different professions with many different grades work together [20],
• There is a symbiosis between the software systems and the stakeholders, with stakeholders requiring the output from the systems and the systems requiring input from the stakeholders to assure the correct design, use and management [62].

**Practices**

• The person in charge of the department formulates the team as per the stakeholder analysis (Literature Review),
• Departmental stakeholders are listed (Literature Review),
• The patient must be kept central to any hospital quality assurance programme and must not be overlooked as a member of the quality assurance team. They bring a different perspective to the team [20],
• Stakeholder analysis must include external stakeholders [20],
• The requirements of external stakeholders must be identified though they will not necessarily become part of the team,
• Stakeholders are listed and are rated according to interest and power [241],
• Include clinicians as decisions are made by consensus and not through authority and in the clinical environment not all stakeholders are equal with few changes in healthcare delivery being achieved without the implicit, if not explicit approval of the medical staff. Be mindful of the fact that clinicians often have the final authority [62],
• Include software experts to advice clinicians as most of those doctors with final authority on how departments are run and how systems are managed does not have the skills to understand software management (action research radiology department).

**7.3.2 Requirement R2.2 Radiology Service Plan Development**

The radiology service plan must align with the hospital service plan so that all stakeholders are all working towards the same goal and allow for resources to be pooled together to get maximum effect of the effort put in.
Significance

- Most accountable person must prioritised radiology goals and clearly communicate it to the quality committee which will in turn base future planning on this direction (participant observer studies),
- This is a collaboration between the radiology department and administration,
- The success of the programme depends on alignment of KPIs with the institutional Strategy (literature review),
- The person in charge will consult with experts in the domain as well as outside of the domain to define goals and objectives correctly within the context and reality of competing agendas (action research),
- The person in charge will take care that internal stakeholders i.e. radiologists, radiographers, technical staff as well as support staff are consulted (action research),
- These goals will be kept central to decision making and strategic planning from this point forward (action research)

Practices

- Identify what the overall goals of the organization that must be considered, such as clinicians or patients—organizations, processes, and the external environment…. They are part of a larger socio-technical system [49],
- Identify the goals of the radiology department and align with the hospital service plan goals (external validation interviews),
- Apply prioritization of goals based on risk rating (external validation interviews),
- Will prioritise that the lead persons understand these goals and are clear on objective for the team.

7.3.3 Requirement R2.3 Establish Quality Committee

The quality committee will have structured communication in relation quality and risk management between the different levels and the designated lead for each of the levels. The quality committee in radiology will interact with relevant committees in other departments those impacts on the business in radiology. The quality committee acts as the central point for decision making, feedback as well as information dissemination with official recording of all
proceeding output on projects. The quality committee with appropriate terms of reference should be agreed in the authority component with input from relevant stakeholders.

**Significance**

- The quality committee is essential for the coordination of defining, prioritizing and monitoring of quality improvement,
- It plays a vital role in identifying issues and providing guidance and support in quality performance management as well as identification of areas for quality improvement on a continuous basis,
- The quality committee also pays a role in escalating consistent non-compliance with standards.

**Practice**

- The quality committee meets monthly chaired by the clinical director,
- Membership includes – clinical director, radiography service manager, quality and safety co-ordinator, nurse in charge, physicist, human resource manager, finance manager,
- Set Agenda for quality committee meetings
- Dissemination pathway of information – See Figure 6.1 for the quality improvement mechanism.

**7.3.4 Requirement R2.4 Establish Quality Assurance Teams**

A team is a Group of people working together toward a common goal. The common goal for the quality assurance team is to improve the care and outcomes for patients. This team’s responsibility is to identify a suite of key performance indicators and to develop and maintain a prioritised suite of quality protocols. It is also the responsibility of the team to verify that performance is at an acceptable level and that standards are maintained.

**Significance**

- The literature indicated that the most critical issues identified were in relation to non-inadequate capacity in the structures to service the demand. It is therefore helpful to configure a holistic programme recognizing the needs of the stakeholders [65],
• Useful to encourage stakeholders to understand the others point of view and to address issues that may arise as the programme is implemented (action research radiology department),

• Useful to encourage a strong skill set in the development of departmental goals. Develop, monitor and maintain a prioritized suite of quality protocols designed to attain those goals (action research),

• Required to disseminate knowledge across the diverse professional Groups that combine to make up the multidisciplinary team of a hospital department (action research Ennis),

• Using the healthcare staff’s clinical knowledge as well technical staff’s knowledge, the team can prioritise the maintenance of QA programme, to facilitate risks of noncompliance are properly assessed and addressed and that staff are aware of any changes that are required of them. If issues arise beyond team or departmental control, they can be escalated to more senior hospital management,

• Provides the skill to develop the standards and to agree the level of compliance required to reduce risk (action research).

**Practice**

• Contact the team as identified by the stakeholder analysis and establish suitable times to meet (action research radiology),

• Person in charge (PIC) outlines the requirements and contribution of each team member (action research),

• The PIC represents stakeholders and will engage with the process (action research),

• This team is apprised of its responsibility to develop and maintain a prioritized suite of performance indicators and PPPGs (action research),

• Identify a patient to be a member of the quality assurance team as they are the key stakeholder. The patient may be a current patient if their condition is chronic. A patient in the acute phase of illness would be unlikely to be able to have the energy to contribute. A former patient would also be appropriate [20],

• Identify requirements of the team,

• Empower non-clinical staff such as software engineers to work in partnership with healthcare staff to assure quality and safety within the domain (action research),

• Direct the team to empower the staff on the ground as this will lead to success (external validation interviews).
7.3.5 Requirement R2.5 Develop Format for Performance Reviews

Monthly performance reviews where all quality data is discussed regularly must be established. These reviews are imperative to maintain the survival of the RAD-QAP. The reviews focus the quality assurance team as they must present to the Executive Council of the Hospital. This activity brings urgency around quality monitoring and the actions and input that might be required from the higher levels in the organisation to address certain issues.

Significance

- The research has identified that if there is no regular review of quality data it leads to disintegration of quality initiatives (action research),
- The research also identified that these reviews must happen at the highest levels with the CEO present to embed the importance of quality management in the organization (action research),
- It was also highlighted that there was a need to present red risks to a person that was in a position of authority and could decide to facilitate the resolve of the problem (action research),
- It also became clear that these meetings must be focused and based on fact backed up with data as evidence (action research),
- The research identified that each QIP must have an accountable person name with actions assigned and dated with time frames agreed (action research).

Practice

- The most accountable person, the clinical director, will lead the review on behalf of the team,
- Each manager will present their own KPI data and focus on the KPIs falling below target
- QIPs will be discussed and approval for funding sought if the structure needed expansion to maintain adequate capacity (participant observer studies),
- These reviews will enforce the profile of RAD-QAP and embed it in the management structure as a vital element for the management of quality and risk in a large acute hospital (participant observer studies),
7.3.6 Requirement R2.6 Develop Policies, Procedures, Protocols and Guidelines

The QA team must verify that a relevant suite of policies, procedures, protocols and guidelines (PPPGs) are in place. Policies, procedures, protocols and guidelines are required to guide decision making and reduce variability of process.

Process measures, the focus of the largest proportion of quality improvement efforts, assess specific transaction in clinical-patient encounters, such as the use of appropriate surgical antibiotic prophylaxis, which are expected to improve outcomes [50]

This team’s responsibility is the development, monitoring and maintenance of a prioritized suite of policies, procedures, protocols and guidelines designed to attain those goals.

Significance

- When processes are mapped, procedures are done (external validation interviews),
- People are getting more accepting of policies there is nothing too exciting in them (external validation interviews).

Practices

- Identify areas where practice must be strong and that there is no room for variation. A policy, procedure, protocol or guideline must be in place where variation is not acceptable (action research radiology),
- Establish whether national policies already exist. Where a national policy exists, it must be utilised. It may, however, be adjusted for local use (action research radiology)
- Where national policy does not exist review whether an existing international policy already exists (action research radiology),
- PPPGs must be based on best available evidence and they must be up to date. If the PPPG is up to date and had been developed in line with evidence based best practice include it in your suite, if not a literature review must be conducted and the PPPG updated,
- It can be wearying and tiring to get policies signed off, so a lot of encouragement and support must be given to staff involved in this endeavor (external validation interviews),
- Send draft protocols around to the relevant stakeholders for review and feedback (researcher experience),
- Make necessary changes in indicated by feedback (researcher experience),
- Most senior person signs the policy into effect (researcher experience),
- Distribute the new policy to relevant stakeholders (researcher experience),
- A record of staff having read the policy must be maintained (researcher experience),
- Staff must have the ability to raise change requests to the policy if they have any reason to do so at a later date (researcher experience).

7.3.7 **Requirement R2.7 Embedment of Quality and Risk Management Standard Framework**

The Quality and risk standard must be implemented at this stage as data will be capture by the different logs as prescribed by the standard. Incident logs, risk assessment logs, risk registers, HIQA self-assessment tool data, complaints analysis, audit results that include audits of clinical process and outcome. Patient satisfaction audits and inquiries recommendations are also included in this framework. Patient satisfaction audits and inquiries recommendations are also included in this framework. See Figure 4.9 for illustration of the QRMS.

**Significance**

- The research highlighted that the QRMS was implemented hap hazardly and data were recorded and logged but not regularly reviewed (site visits, hospital observation case studies, researcher experience),
- In instances where the QRMS were implemented and well managed the data were reviewed but not always acted upon (research experience, action research),
- Quality and risk data did produce QIP plans in certain instances; most overall trend confirmed that the RAD-QAP was not always fully implemented (researcher experience),
- QRMS – These analyses will facilitate the identification of KPIs (researcher experience, action research).
- Should be fully implemented and data logged and fully analyse quality data to provide information that will identify quality shortfalls based on risk rating (action research, standards review),

**Practices**

- Distribute the QRMS policy to relevant stakeholders (Researcher Experience),
- Identify areas where in Radiology where the QRMS is not fully implemented and implement fully (action research radiology),
• Establish whether all the quality and risk management processes are being followed in the areas of radiology. (action research radiology),
• Establish that team leaders understand the value and rationale for maintaining the logs (action research radiology),
• Verify incidents are recorded as per policy (researcher experience),
• Verify risks are assessed and logged with necessary impact scoring as well as additional controls identified (researcher experience),
• Verify complaints are logged analysed and followed up on (researcher experience),
• Verify recommendations from Inquiries from reviews are listed and implementation tracked and managed (researcher experience).

7.3.8 Requirement R2.8 Develop Communication Strategy

The final important structure to be put in place is a communication strategy to relay necessary information between the quality assurance committee and the QA team to the staff on the. A robust communication strategy is required to be in place so that stakeholders are aware of any changes that are required of them.

To support the most accountable as well as the QIP drivers’ clear communication strategy must be agreed. It is critical that stakeholders are kept in the loop and up to date all the time. Frequency of communication and the format of information dissemination should be agreed right from outset.

Significance

• Senior managers do not always meet staff (external validation interviews),
• Listen to staff as they will have solutions to issues that senior staff may not even know exists (external validation interviews),
• Listening to staff can result in local solutions try to continually listen to staff and correct problems (external validation interviews),
• Useful in the storming phase of a project or during change management negotiation and communication with stakeholders to overcome barriers and to sustain the project (action research radiology),
• Staffs engage if they know exactly what to do and who to go to and who is in charge (external validation interviews),
• Need correct information flow as information can be distorted and may not achieve the stakeholders in question,
• The quality programme must be supported by a communication strategy to support its survival (external validation interviews),
• Communication strategy should make use of technology as well as more simple methods to communicate to the team as well as other staff members. (action research radiology),
• Communication strategy must disseminate information in a timely manner to relevant stakeholder and be the monthly calendar to allow for proper planning and project management (action research),
• It is required so that there is clarity around the next steps in projects and to encourage feedback and suggestions from relevant stakeholders in a timely manner to enhance and improve the outcome of projects (action research),
• Improvement efforts can be communicated through the various methods. Communication can be documented using activity logs, issue identification logs, meeting minutes. (action research).

Practices

• Improvement efforts can be communicated through the various methods. Communication can be documented using activity logs, issue identification logs, meeting minutes. (action research),
• The person in charge (manager) must nominate a suitable person assign responsibility for communication strategy to be carried out as agreed (external validation interviews),
• The PIC must stipulate requirement that the designated person is appropriately trained in minute taking to allow for information to be recorded accurately recorded and disseminated to stakeholders (external validation interviews),
• Communication must flow in several directions from the top down via the team leader to the team and from there to the various levels of staff [19],
• The communication must flow from the frontline staff to the team and to the team leader (external validation interviews),
The patients must be kept in the loop. Their concerns must be identified and communicated to the relevant stakeholders among the staff. There must be an appropriate communication process to the patients to inform them of the hospital activities that are in place to improve quality of care, quality of life and outcomes.

They must also be communicated with in relation to how their issues or complaints are being addressed for example:

- News letter,
- Notice boards indicating – You asked for we gave…. You asked for ……we couldn’t provide because ……,
- Individual letters,
- Electronic communication,
- Booklets and Leaflets,
- Materials such as posters can provide essential education to staff members (Action Research Radiology Department),
- Information must be reduced to very lean formats as “you cannot bombard people with information, they will shut down, and there are ‘lots of things coming at staff” (External Validation Interviews),
- Text messages can be an effective method of communication (Case Study Research).
7.4 Requirement 3 - Quality Profiling Component

The quality committee must co-ordinate the identification of possible indicators that are relevant to the department through a service analysis, literature review, capacity and capability studies as well as training needs analysis. A depth review of the service plans for radiology must be carried so that the stakeholders involved are all on the same page and working towards achieving the same goals.

Quality profiling component (component 3 in Figure 7.4) facilitates that the QA programme is holistic and based on patient requirements. Implementation of this Component requires the quality assurance team to 6 monthly complete service analysis incidents, complaints, HIQA recommendations etc. prioritized based on the risk posed by non-compliance. Each KPI increases in priority if it hasn’t been reviewed in the previous six months (Literature Review, Action Research).
Figure 7. 4 Quality Profiling Component Requirements

Undertake a full review of available literature to provide guidelines for evidence based best practice to establish and define quality in radiology. The literature review will identify a list
of relevant KPIs that is widely used in radiology to measure and manage radiology. Clinical professionals should stay involved in research to stay current and informed on the newest techniques available as well as trends in quality and risk management.

**Significance**

- Research highlighted that staff tend to stagnate and don’t see as quality and risk management as their job or responsibility (hospital observational case studies, interviews).
- Research also pointed out that staff felt that did not have enough hours in the day for these additional duties (interviews).
- Clinical staff needs CPD activities to proof clinical competence to allow then to register with their professional regulatory bodies and the literature reviews will provide opportunity to add this activity to their CPD portfolio while gaining CPD sessions (standards review).
- The literature review will involve staff right from the start in compiling the first list of possible KPIs (interviews).
- This will educate the staff in quality management and instill RAD-QAP as an integral part of the management strategy in the radiology department (researcher experience).
- Literature reviews introduce as a regular activity in the department and is not just associated with official research projects (action research).

**Practices**

- The researcher did an extensive literature review for the purpose of this project, but in real terms when RAD-QAP is implemented in a radiology department the quality committee is required to carry out a literature review at least once a year to stay aligned with evidenced based standards and techniques.
- The extraction of possible KPIs following the review of relevant articles (action research radiology).
- Most radiology Department has set up journal clubs to comply with the CPD requirements.
- Selected articles must be listed for discussion and KPIs could be extracted in this way providing CPD activity as well as selecting KPIs (action research radiology).
- The staff can make a list of possible KPIs identified in the literature review.
- Radiology staff can take part in this process (action research radiology).
7.4.1 Requirement R3.1 Identify Relevant Legislation

*Legislation* consists of a law or laws passed by a government. Many aspects of healthcare are covered by legislation. Complying with law and regulations can present a difficult challenge for hospital managers. For example, hospital workers demand more and easier access to patient information to provide the best care to their patients. Also, vendors of healthcare software use words like flexible, easy-to-use, accessible, streamlined, and multidisciplinary to promote their products. This is at odds with principles of data security which talk about privacy and confidentiality [236].

Legislation must be identified in relation to a given topic so that it can be complied with while still attempting to achieve the desired outcome from the system and for the patient.

**Significance**

- Consequences and penalties of non-compliance with legislation can be high (expert group),
- Legislation can change so it is important to remain up to date in relation to legislation (legislation review),
- It is seen as a priority by the legislators (legislation review).

**Practices**

- The most expert stakeholder in the domain reviews the legislation that exists in relation to the topic that was selected (action research radiology),
- Identify the governing body in relation to the topic and any direction provided by that body (action research radiology),
- Utilise national policies, procedures, protocols and guidelines as they often cover required legislation (action research radiology),
- Review international guidelines if national guidelines do not exist (action research radiology),
- Persist with legislation identification; this can be difficult the first time it is conducted but it becomes easier as the stakeholders become familiar with where the legislation is to be found (action research radiology).
7.4.2 Requirement R3.2 Standards Review

Radiology is governed by standards that prescribed the responsible justified use of radiation as well as standards for each Radiology examination. These standards are international standards and are enforced by legislation. There RAD-QAP would be incomplete without this vital review to verify compliance with standards.

Significance

- The research highlighted that standards have not been reviewed, in some cases it was not looked at for many years (literature review, inquiries review),
- Staff tend to accept the protocols as the gold standard without questioning them (action research),
- Most staff felt they did not have time to review standards as the daily workload did not allow such activities (interviews).

Practices

- Radiation charts must be updated and reflect these standards (researcher experience),
- Clinical technique protocols must be reviewed and align with standards (researcher experience),
- Referral guidelines must be reviewed and in place and align with these standards (researcher experience),
- All the above is available and accessible on a central data base for the relevant stakeholders to access (researcher experience).

7.4.3 Requirement R3.3 Service Plan Objective Analysis

The hospital service plan identifies goals and objectives for the organisation based on the previous performance and patient feedback to maintain its continuous growth to improve the service delivered to the patient and employees alike. These goals and objectives are invaluable for the selection of relevant KPIs. Areas of concern must be prioritized for KPI measurement to achieve end goal.

The goals and objectives identified in the hospital service plan and radiology service plan should be reviewed and KPIs must be identified for projects and QIPs support the achievement of the overall goals and objectives of the organization.
Significance

- The research identified that often the goals and objectives in the service plans of the hospital are not clearly communicated to radiology staff (interviews),
- It was felt that radiology staff did not always understand the rationale behind the goals and objectives that was set for the department (interviews, action research)
- There was a lack of understanding as to the importance of the alignment of the goals and objectives between to overall hospital service plan and the radiology service plan (interviews),
- The discussions with staff identified that lack of communication to the staff to explain the goals and objectives led to poor or no buy-in of project and initiatives to achieve same (interviews, inquiries reviews).

Practices

- The quality committee must undertake a review of the goals and objectives of the hospital and radiology service plan (action research),
- KPIs must be prioritized and selected to aligned and reflect these goals and objectives (literature review),
- The KPIs identified in this review must be prioritized to reach the final set of KPIs (literature review),
- The different elements that are responsible for delivering a high-quality service to patients must all give their input into this review i.e. the finance manager must explain the budget constraints and human resource manager must outline the available staffing resources for the year (literature review).

7.4.4 Requirement R3.4 Overall Service Analysis

A complete service analysis covering the different elements included the quality and risk framework is invaluable to determine patient satisfaction and give an overview of the current state of the service. This analysis requires that data captured by the QRMS be analysed to identify KPIs based on risk, priority, volume, and cost. This step will provide vital information pointing to quality shortfalls within the Radiology service at this specific point in time. This exercise will guide the selection of relevant KPIs that is most in need of improvement.
Significance

- The research confirmed that this type of complete service analysis is only possible if the elements of the Quality and Risk Management Standard are in place and in fact being used as prescribed (standard reviews, inquiries review, action research),
- The different logs from the complaint analysis, risk registers, resource analysis, capacity/capability and demand studies, incident logs, patient satisfaction audits, staff satisfaction audits, recommendations from inquiries, technology capability study, external audit results, and internal audit results will identify quality shortfalls and areas of concern within the radiology service based on evidence, (standard reviews, inquiries review, action research),
- This information is most valuable for the selection of KPIs that will measure quality in the areas that is in most need of improvement (standard reviews, inquiries review, action research),

Practices

- The Quality Committee must co-ordinate the service analysis by requesting all the logs from the relevant personal,
- Resource Analysis – Human Resource Manager,
- Capacity/ Capability /Demand studies – Radiography Service Manager/ Clinical Director
- Technology Capability Analysis – IT Manager,
- Training Needs Analysis-Learning and Development officer,
- Complaints Analysis – Complaints Officer
- Incident Analysis – Quality and Patient Safety Manager
- Risk Register Review– Radiography Service Manager
- Patient Satisfaction audit results – Clinical Audit Officer,
- Staff satisfaction audit results – Clinical Audit Officer,
- Gap Analysis of HIQA /Inquiries recommendations- Quality Manager Image Reject Analysis- Radiologist in charge (See Figure 6.6),
- WTE Analysis- Human Resources
- Absenteeism Reports- Radiography Service Manager
- Waiting list Validation –Radiography Service Manager,
- Equipment Breakdown and replacement Log - Analysis-Engineer,
• Discrepancy Report - Radiologist in Charge,
• Accounts Analysis

Figure 7.5 shows the information feeding into the scorecard.

**Information to feed into BSC**

1. Service Plan Update
2. Accounts Analysis
3. WTE Census
4. Absenteeism Report
5. Complaints Analysis
6. Complaints Log
7. Master Quality Improvement Plans Log with real time tracking
8. Risk Register
9. Incident log
10. Risk Assessment Log
11. Audit forward Plan
12. Audit Results
13. HIQA recommendations gap analysis progress report
14. Cost Containment Plan

**Consensus group made decisions re process of use**

Figure 7.5: Information feeding into the Scorecard

7.4.5 **Requirement R3.5 Resource Analysis**

This resource analysis is a strategic planning tool which considers (a) the resources required supporting strategies, and those needed to gain 'competitive' advantage; and (b) the required competencies to effectively use those resources. The resources that an organisation has are important, as important is its ability to effectively use and manage those resources [159].

“Organisations do not operate in a vacuum and they need to respond to an ever-changing landscape. Therefore, threshold capabilities, will also change and organisations need to continuously review the required resources” [227].

“A resource analysis needs to consider how resources are managed, deployed and utilised. For example, there no merit in an organisation having a good reputation & brand if it is not exploited effectively”.
Significance

- The research identified that the Radiology Department was significantly under resourced with radiologists and hence there was a backlog of unreported images. The risk posed by inadequate resources as reported by many inquiries [7] [8] [16] [94] as patent diagnosis or treatment can be delayed and impact on the ultimate outcome of the episode. Innovative solutions must be found to address these issues. Tele-Radiology has been found to be very effective in addressing back logs of unreported plain films. It is also a cost-effective solution when it is found to be impossible to recruit radiologists,

- The research identified that resource analysis of staff, equipment, technology, finances and training must be carried. The resource analysis must determine the available capacity in the system; next demand must be calculated looking at previous patterns. Once completed a study must be carried out to evaluate output from staff maximise capacity based on international guidelines to improve patient safety. Next the output of the individual radiologist must be compared, and uneven distribution of work load should be addressed. A lot of change management, conflict management is needed to achieve this step. In this research the inconsistency self-corrected when the figures were distributed. The Radiologists decided to buy a software packages to evenly assign and distribute the work load.

- The unreported images that remained were outsourced to a tele-radiology company which becomes part of the resource compliment to align capacity and demand. This managed the risk posed by unreported images effectively.

Practices

- Radiologists must keep a log of their daily activities and record amount times spend on each,
- Radiologists work schedules must be reviewed,
- The annual leaves rules must be reviewed and must be aligned with the peaks and troughs within the department,
- Patterns must be identified, and any undone tasks must be recorded to identify risks,
- These lists must be reviewed and WTE must be calculated,
- WTE must be calculated and manage so there are never unreported images and that all reporting turn- around KPIs were met,
• Incomplete tasks and unreported images must be identified,
• The unreported images must be outsourced,
• A tender must be put out for tele-radiology contract,
• Once secured a robust quality assurance and governance must be agreed around the tele-radiology reporting.

7.4.6 Requirement R3.6 Demand/Capacity and Capability Analysis

According to the institute for innovation and improvement [227] demand is comprised of all referrals vetted and not vetted, scheduled and unscheduled. The SDU maintains that demand and capacity is an imported element for patient experience.

“If the demand for care is greater than the capacity of the system, there will be a delay in providing care. If the capacity is greater than demand, then resources are being wasted. When capacity and demand are matched, delays in care are reduced. Whenever a quantitative analysis indicates that the system has the capacity to meet the demand during normal functioning, then specific change concepts can be implemented relatively quickly to help align capacity and demand during predicted or unpredicted periods of high demand” [95] [96].

“The mismatch between, and variation in, capacity and demand is one of the main reasons why waiting lists or backlogs develop and waiting lists and waiting times increase. The undertaking and understanding of the outputs of robust demand and capacity modeling are a fundamental requirement for the planning and delivery of healthcare services in a modern health and social care system” [95] [96].

“The benefits of such an approach are no longer questioned yet, despite the body of evidence available, such an approach is not universally understood, adopted, nor acted upon”.

Capabilities are viewed at two levels, namely the threshold and competitive advantage level. The threshold level is the survival and competitive advantage level is indicative of the organisations ability to compete.

Resources are those that are required to operate at level, competencies are those requisite skills, experiences and abilities to use those resources.
Significance

- “Realistic capacity planning in terms of demand is critical to quality” [93],
- “Demand is predictable, and capacity is measurable” [95],
- A main finding of the service analysis was that a clear understanding of demand, capacity, bottlenecks and constraints will help to address many common problems in Radiology that reduce quality and create risk,
- Clarity of purpose, predictability and accountability enhances when there is a good understanding of demand in Radiology which will allow for planning to align capacity with demand,
- The research identified that processes are not always optimum. Process changes can enhance optimum utilisation of resources and increase output,
- The research identified that the status of quality in radiology should be visible to display the bottlenecks expressed in data. It should also display where positive contributions were made,
- The research highlighted that staff are more willing to buy into process improvement if they can see where the improvements were made, and it’s backed up by data that is on display,
- It was clear from the research that organisational intelligence must be developed by means of data that measures and informs management and staff on an ongoing basis about the level of quality in the radiology department. Waiting lists are not necessarily because of a lack of capacity in the system but rather a misalignment between demand and capacity with delays in the process,
- The research showed that capacity planning must align with the seasonal peaks and troughs in the radiology department. Annual leave and other absence i.e. conference attendance had to planned sensible around the demand to optimize available resources on the day.

The research identified the following important concepts that must be grasped by managers:

- Understand the reasons why waiting lists grow,
- Model the requisite level of supply required to keep pace with demand,
• Understand the gap between the required level of supply and the current capacity of a service,
• Calculate the maximum waiting list sizes that are consistent with the clinical pathway milestones,
• Model the impact of clearing excess waiting list sizes down to ideal maximum levels;
• Identify any potential inefficiencies,
• Support better decision making around service changes,
• Reduce waiting times for patients,
• Adopt more flexible working arrangement to manage peaks and troughs are addressed
• Extended working hours must be considered – work differently-work smarter,
• Quality data provided by NIMIS and other information systems must have a clear forum for discussion and governance around it.

Practices

• The quality committee must undertake capacity studies of each individual radiologist to determine maximum capacity achieved [218],
• Current output for the resources available must be calculated-include specified activities,
• National and international guidelines must be consulted to set universally accepted targets for radiologist workload. The RCSI and RCR have very clear guidelines in this regard [228] [50],
• Duties and responsibilities aligned with tasks measured in hours expressed in whole time equivalents to allow correct calculation of man power needed,
• Work load distribution studies must be carried out to balance the work load fairly amongst the radiologists,
• Interviews with radiologists to identify their duties and responsibilities
• Radiographer output should also be calculated and work load per radiographer should be compared across the sites,
• Demand must be calculated by adding the waiting lists as well as scheduled but not completed studies, unvetted requests plus rejected requests to calculate the total demand for each modality,
• Waiting lists must be evaluated. This is very important as some patients might have had their scans done elsewhere and valuable slots will go to waste if an appointment will be assigned in such cases. (Waiting lists validation exercise),

• A review of unreported images must also be carried out and solution must be found to reduce the risk,

• Audits should be carried out on processes that was identified as quality shortfalls with the view to modify and improve,

• Validation of waiting lists,

• Demands need to be measured in the same units.

7.4.7 Requirement R3.7 Technology Capability Analysis

Lack of appropriate structures and processes around the management of quality data produced by information systems in Radiology can result in almost opportunity to improve the quality. It makes the goal of patient safety much more difficult to achieve if available data are not extracted and used to improve the quality of the service for the patient. To achieve information quality, the data must be valid, accurate, distributed and used.

To support RAD-QAP is maintained over the long term all technological capability and capacity in terms of available quality data as well as appropriately quality staff to extract, analyse and report the data.

Implementing a structured quality assurance programme will provide a predefined standardised framework for exacting data and reporting of quality data within set time frames.

Processes must be managed to attain objectives. It is important to review quality data use, and the successful implementation of RAD-QAP can result in efficient processes and good clinical outcomes when the available quality measurement data provided by the technological ability of NIMIS is applied to quality improvement in a co-ordinated manner with in a predefined framework.

Equipment break down log must be analysed to take all issues into consideration.

Equipment replacement programme must also be included and the effect on service should be considered.
Significance

- “Better information can lead to better care, as demonstrated by improved health outcomes, such as creating the ability to diagnose patients more accurately, as well as sooner; to comply with patients’ wishes; to reduce the number or severity of errors; and to support care delivery through better access to information” [119],
- Clinicians need to be able to compare studies and cannot do so without accurate information and must have quality software in place to do so [118],
- Healthcare staff are reluctant to extract quality data from information systems where predefined reporting, reviewing and follow-up actions are not structured and co-ordinated with a lead person in place. (case study research),
- Lack of quality measures can lead to difficulty in retrieval and loss of required information [252],
- Use of existing information systems must be optimized as their use significantly improve outcomes and minimize the effects when things go wrong [173],
- When systems information isn’t used, data quality deteriorates. (case study research),
- Increasing use of fourth generation databases by staff with little expertise of data quality techniques. Software such as Microsoft Excel gives healthcare staff members (who aren’t qualified in software engineering and don’t understand compliance) the capability to implement systems (case study research),
- “In evidence-based service delivery setting, reliance on information systems can be dangerous, especially when the systems source information is suspect [189],
- Formal plans to utilize the data to produce meaningful information. Implementation of a quality assurance programme highlights quality data currently available on NIMIS that is not used for quality improvement. (action research radiology). There appears to be in certain areas an emphasis on collecting rather than reporting data (case study research).

Practice

- Quality committee will co-ordinate the identifications of a list of information systems in radiology,
- Quality Committee will identify useful quality data available on information systems,
- A list of relevant logs and reports already being produced by information systems will be reviewed,
• Develop a list of software systems and medical devices and software systems. (Case Study Research),
• Develop and document defined outputs for each system [119],
• Develop a suite of performance indicators for each system [119],
• Perform a risk assessment to determine the likelihood and impact of sub optimal performance of the system [235],
• Identify legislation governing each KPI selected,
• Add each software system to the topic selection list for RAD-QAP (case study research).

7.4.8  Requirement R3.8 Risk Register / Incidents Analysis

One of the foundation principles of medicine is first do no harm. Risk management must be an integral part quality management processes and include proactive risk assessment and reactive incident management to avoid incidents. Risk management is an integral part of a quality plan, but should part of the overall risk management plan for the services which hospitals provide. There are three main aspects of risk management - defining a risk management strategy, identify and analysing potential risks and managing and mitigating risks which do take place. Even with the most proactive risk management process incidents will regularly occur and these must be managed in a proactive manner to reduce their occurrence.

Significance

• The risks involved in a radiology department is well recognized in the literature [19],
• Systems can fail acts of nature, hardware failures, human error, vandalism and software [208],
• Useful to proactively identify and manage risk prior to incidents [134].

Practice

• Identify incidents with high risk rating and impact score and incidents of highest volume (literature review),
• Risks assess the impact and the likelihood of possible serious harm caused to patient or employee (action research),
• Where risk is moderate or high. Identify and implement controls to lessen the risk (action research),
• Select KPIs to reflect and measure the identified risks based on high frequency of occurrence.

7.4.9 Requirement R3.9 Complaints Analysis

“We learn from complaints that are documented and reported. This organisational learning begins with evaluating the incident which caused the complaint through to embedding the necessary changes into practice” [200].

“Complaints data can become part of the whole data system for quality and safety management. We can feed information about errors, mistakes, system failures and near misses into processes that can best act upon it. Complaints constitute a significant consumer input into this process” [200].

It is useful to analyse the type of complaints received to identify patterns and frequency of types of complaints that can identify system errors within in the organisation.

Significance

• The research identified KPIs through the complaints analysis by looking at the root cause of complaints. It makes more sense to address the root cause of an event and address it in the system to prevent a repeat,

• The risk impact scoring of complaints is very useful in this exercise and will prioritise certain type of the complaints for KPI selection.

Practice

• The quality committee should designate a team leader to undertake this task,

• Reoccurring complaints should be identified and then risk rated,

• The complaints with the highest volume should be identified and listed,

• Complaints with the highest risk impact score should be identified and listed,

• Complaints should be mapped to the HIQA standards to identify which theme occurs most frequently to determine which standards are being breached.

7.4.10 Requirement R3.10 Patient and Employee Audit Satisfaction Results Analysis

Audit is a well-recognised toll to access quality in the clinical environment [15].
“If quality is to be at the heart of everything we do, it must be understood from the perspective of patients.”

The first step is to find out what patients and service users think by asking about their experiences.

Examining feedback will give a direct insight into what is working well – and not so well – in the way your organisation delivers care. You will discover examples of good practice where lessons can be learnt, and, areas of concern where improvements can be made.

**Significance**

- By asking patients in a rigorous, systematic fashion about their experiences of care and treatment healthcare services can be accurately measured and improvements made,
- The research identified that patients were mostly very satisfied with the service once they entered the radiology department. Compliments were recorded in these audits and surveys,
- The patient dissatisfaction was recorded when the audit was carried out on the cohort of patients that are on waiting lists for 6 months and longer. It is important to measure and reflect out patient’s dissatisfaction with ling waiting times to access MRI and Ultrasound,
- Possible KPIs should record total patient satisfaction as well as turnaround times from request received to report complete must also be measured to show and record the synergy between patient satisfaction and access times.

**Practices**

- Quality committee should develop patient satisfaction questionnaires to serve as the audit tool in the different modalities in radiology,
- Data should be gathered to determine patient satisfaction with the service they receive from entering the radiology department until they leave with the report,
- Information on the service received by the radiologist as well as the radiographer, nursing and support staff,
- Questionnaires should ask questions in relation to cleanliness to dignity and professionalism,
- Patient satisfaction audits should also be carried out on the patients waiting on long waiting lists. It is important that results are published, and quality improvement plans are
implemented, and another audit carried out to ascertain the effectiveness. Compliments should also be taken on board and communicated to the staff to acknowledge practices that works well,

- Quality improvement plans should be developed to address these issues and progress should be communicated to patients,
- Patient satisfaction audit with radiologist interaction must be conducted,
- Patient satisfaction audit with radiographer interaction satisfaction must be carried out.

7.4.11 Requirement R3.11 Inquiries Recommendations Gap Analysis

“In reviewing the recommendations from national reports, service providers should look at the national standard or standards connected with each recommendation to ultimately determine if their service meets the requirements of the national standard for safer better healthcare. In this context, implementing recommendations can be at a microsystem level (department or directorate level), mesosystem level (hospital or specific service) or macrosystem level (hospital Group or national healthcare service level”). Linking learning to national standards: How recommendations from previous HIQA investigation, statutory inquiry and review reports (2009–2015) relate to specific national standards for safer better healthcare

Learning from these reports and recommendations are the most valuable as it could prevent the repeat of such incidents in the future. Understanding the root cause of the error empower and inform us to address the weaknesses in the system.

Significance

It is recognised that individuals working in healthcare can improve patient safety by engaging with patients and their families, learning from errors, sharing the learning across the service and communicating effectively within and across the healthcare team” HIQA

The research identified recommendations made by HIQA were as follows

- Delayed cancer diagnoses because of delayed reporting,
- Turnaround times for pediatric patients for emergency CT scans,
- Turnaround times for breast cancer staging,
- Turnaround times for prostate staging,
- Protocols and procedures,
- Waiting times CT,
Waiting times Ultrasound,
Radiation protection,
Open disclosure,
Patient satisfaction audits,
Clinical audit,
Complaints analysis,
Facilitate radiologists and radiographers are properly qualified,
Policies and procedures,
Intra-departmental consultation/peer review,
Multidisciplinary case discussion,
Incident reporting,
Vertical case review/audit,
Demand and capacity planning,
Documentation around patients,
Governance should be in place with accountability and responsibilities.

Practices

- Reports must be reviewed and applicable KPIs formulated to measure the quality shortfalls in implantation of the recommendations,
- KPIs to measure each of the recommendations that that was not implemented was to be selected,
- KPIs to be listed on possible KPI list.

7.4.12 Requirement R3.12 Image Reject Analysis

“Reject analysis should be undertaken on a regular basis and action undertaken as appropriate. It is important in a digital department to perform reject analysis. There should be a simple procedure in place for rejecting images to that does not result in the image from disappearing from the system, ideally the image should be categorized and stored” [220].

Significance

The aim of a reject analysis is to:

- Measure the reject rate and monitor over time,
• To find major reasons for rejects and address problems to reduce the rejected rate,
• To compare reject rates between different departments,
• It is paramount to have a positive approach to outcomes. Reject analysis can be used to identify the protocols for audit. Reject analysis should not be used for identifying individuals but rather to identify the reason behind any high reject rate with the aim of reducing the reject rate,
• IPEM Report 91 of 2005 recommends that: reject analysis should be performed on a regular basis and actions undertaken as appropriate. It is important in a digital department to perform reject analysis. There should be a simple procedure for rejecting images that does not result in the image disappearing from the system. Ideally the image rejected should instead be categorised and stored [220].

Practice

The PACS manager should create a reject file on PACS

Criteria should be set up on PACS for

• Centering point,
• Density,
• Penetration,
• Positioning.

This will allow radiologists to reject any images and justify the rejection

A similar and reject analysis tool must be set up for radiographers to allow for selection for a reason for repeat.

All the rejected images will be stored in a QA file to be analysed analyzed for

• Type of images rejected,
• Reason for rejection,
• Recall rates,
• Suboptimal images rejected by radiologists,
• These files are kept as teaching files,
• Number of images rejected.
Quality Improvement Plans should then be developed.

The rejected images are kept for six weeks before disappearing from the system in the Case Hospital. The images are accessed within the six-week period for the purposes of reject analysis. Radiographers do not have authorisation to delete any rejected images and a password is needed to delete images.

7.4.13 Requirement R3.13 WTE Analysis

Significance

A radiology department needs to be adequately resourced at all times. All staff grades should be recruited in a timely manner. The Radiography Service Manager needs to work closely with the human resource liaison to verify information on posts is accurate. No of WTEs should align with the demand on the service.

Practice

Human Resource liaison should be tasked to extract and provide the following verified information.

- Approved and unapproved posts,
- Match the position numbers,
- Approved WTE ceilings for radiology modalities,
  - Radiologists
  - Radiographers,
  - Nurses,
  - Administrative Staff,
  - Health Care Assistants.

7.4.14 Requirement R3.14 Absenteeism Analysis

Significance

The absence of staff should be tracked. Back to work interview analysis should be used to reduce any long-term sick leave for example. Tracks and trends must be identified, and solutions must be found.
Practice

Radiography Service Manager should be tasked to extract and provide the following verified information.

- Approved leave,
- Unapproved leave,
- Maternity leave,
- Parental leave,
- Long term sick leave,
- Stress Leave,
- Critical illness,
  - Radiologists,
  - Radiographers
  - Nurse,
  - Administration staff,
  - Health care assistants.

7.4.15 Requirement R3.15 Accounts Analysis

Significance

Radiology Managers must receive the account analysis in timely manner to allow them to plan effectively within the allocated budget. The accounts must be presented in a simple format that is easy to interpret. Information must be accurate and up to date.

The Finance liaison should be tasked to extract and provide the following verified information:

- Pay,
- Non-pay,
- Overtime pay,
  - Radiologists,
  - Radiographers,
  - Nurses,
  - Health Care Assistants.
The significance and practices of the Quality Profiling Component is as follows:

Significance

This research has established an inclination of staff to focus on themes that they know will measure compliant, but this has limited benefit for the patient and the organisation. Therefore, a suite of topics must be agreed based on priority, high risk, high cost, and high volume, area of concern, patient outcomes and unplanned outcomes.

- They must therefore be included in the possible KPI selection list,
- The quality assurance team must regularly choose KPIs for review from the quality profiling Component of RAD-QAP,
- Reduce possibility for KPI to be overlooked. Each time a KPI is chosen for review, they must apply Component five and Six of RAD-QAP to the KPI,
- Useful for a holistic approach to quality assurance, research indicates that quality measurement is ad hoc with some areas receiving more attention than others [234],
- Reduces the tendency to select pet topics (action research),
- Prioritise high risk KPIs are identified based on risk (action research),
- Reduce possibility that high priority KPIs can be overlooked for review (action research),
- Promotes relevant KPIs identify quality shortfalls and will measure and address the real issues as highlighted by the service analysis.

Practice

- Quality committee will co-ordinate the identifications of a list of possible KPIs for continual measurement and review until set target has been reached with six consecutive measurements. The final list of KPIs will be selected by the expert consensus group in the next component – the quality data component of RAD-QAP. This group consists of consultant radiologists, human resource manager, radiography service manager, finance manager, quality and safety manager,
- Identification of possible KPIs is carried out by doing a complete service analysis that includes incident analysis, complaints analysis, and risk analysis, recommendation from inquiries, demand and capacity analysis, resources analysis [83],
- Identify KPIs for inclusion on the list based on national priority, high risk, high cost, high volume, area of concern, patient’s outcomes and unplanned outcomes [14] [15] [16] [77],
• Include management of quality data produced by information systems [70],
• Potential KPIs for inclusion on the list are as follows: Human Resources, Finance, clinical outcomes both planned and unplanned, Quality and Patient Safety, Clinical Outcome, patient and staff experience- satisfaction surveys, demand and capacity KPIs, Timeliness and equity of care, national KPs [139],
• The potential risks associated with each possible KPI must be identified and rated according to severity and likelihood [83],
• KPIs must be listed for review. Each KPI increases in priority if it hasn’t been reviewed in the previous six months (Action Research Radiography Department).

7.5 **Requirement 4 - Quality Data Component**

Following identification of possible KPIs in quality profiling component (component 4 in Figure 7.6) a final list of the KPIs is selected by the consensus by the expert group. The quality assurance component of RAD-QAP recognizes that “good structure increases the likelihood of good process, and good process increases the likelihood of a good outcome” [21] [76]. The sub-requirements of the components must be implemented in absolute order as failure of the order of implementation will weaken the resulting outcome for the KPI selection (Literature Review, Action Research).
7.5.1 Requirement R4.1 Establish Consensus Group to Select Departmental KPIs

Expert consensus group consisting of 10 consultant radiologists with 10-15 years’ experience, human resource manager, radiography service manager, physicists, quality and patient safety manager must be established. This group must meet 6 monthly to discuss the relevant KPIs on the scorecard. This group will work closely with the quality committee. The consensus
group was established for the Delphi consensus study during the research after which a decision was made that the group will have an on-going role to review and identify relevant KPIs in collaboration with the quality committee.

Performance represents the extent to which set objectives are accomplished [240]. Key Performance Indicators are specific and measurable elements of health and social care that can be used to assess quality of care [40].

The research has indicated that diverse goals such as cost, access, and quality produce confusion as to which goal is most important or which goals are to be achieved. Usually, a concentration on one outcome, such as reducing delay in patient flow, leaves open concerns with quality and cost. Since different health care stakeholders have different frames of reference and different points of view, this can lead to the loss of the overall goal. A set of performance indicators must be agreed based on identified quality shortfalls and identified risks that exist in the radiology department to promote safe and effective running of the department with high quality patient care. The expert consensus group was thought to be the most qualified to take on this role. The quality programme evaluates quality shortfalls in the enabling elements that supports a high-quality radiology service i.e. patient safety, human resources, finance, patient satisfaction, employee satisfaction and clinical accuracy. The members on the expert group were selected to have expertise in one of or more of these areas.

**Significance**

Diverse goals such as cost, access, and quality produce confusion as to which goal is most important or which goals are to be achieved. Usually, a concentration on one outcome, such as reducing delay in patient flow, leaves open concerns with quality and cost. Because view, can lead to the loss of the overall goal [48].

- Without measures things that require improvement can be missed (external validation interviews),
- Different health care stakeholders have different frames of reference,
- KPIs measuring identified quality shortfalls are designed to improve current weaknesses in the system and will therefore drive the agenda for continuous quality improvement.
Practices

- KPI score matrix must be used for this purpose,
- A process of three rounds of illumination of the list of possible KPIs identified by the quality profiling component should eliminate KPIs to produce a final list of KPIs that would be manageable to start off with (Delphi study),
- Identify outcome measures, which measures quality shortfalls in the system that is of high risk rating or high volume of life endpoints as well as morbidity and mortality [50],
- Identify measures of performance, based on standards determined through evidence-based academic literature [19].
- Agree and sign off on the performance indicators by consensus.

7.5.2 Requirement R4.2 Define KPI Definitions

RAD-QAP dictates that when a KPI has been chosen for review outcomes or set targets are the most important element and should be defined first.

Significance

- The mere action of identifying metrics, doing the calculations, and making the comparisons has a positive impact on effective on outcome [119],
- Useful to clarify the desired outcome. If there is lack of clarity as to the desired outcome or set target staff will not be empowered to achieve it (external validation interviews),
- Required to assess whether performance on the ground in relation to the topic is acceptable (external validation interviews).

Practices

- Review national policies, procedures, protocols and guidelines to assess whether standards nationally acceptable outcomes have been established (action research),
- Where national policies do not exist review international literature (action research),
- In the event of there being no available set local standards, based on literature review and stakeholder expertise in the subject (action research),
- Document the desired outcomes (action research).
• Establish Key Performance Indicators. Significant metrics indicating performance. For example, the number of rejected x-rays. The down time of a system. Percentage of use of a system (action research).

7.5.3 Requirement R4.3 Final list of KPIs selected by Consensus Group

Developing a scorecard with selected headings and set targets with KPIs to be measured within set time frames which reflect performance of the main enabling elements of a quality health care i.e. governance and leadership, governance and management, workforce, use of resources and use of Information. The following headings were selected: quality and patient safety, national KPI’s and clinical programmes, hand hygiene, waiting times, turnaroud times, patient satisfaction, employee satisfaction, Output vs. capacity, productivity, human resources, finance. A subset of indicators is included in each section for the different modalities and different staff in radiology [93].

Risk is also recorded on the scorecard that gives visibility in a two-way format where the radiology department performance is measured as well as the response from senior management in relation to vacancy approvals or business plan applications. See Table 7.3.

<table>
<thead>
<tr>
<th>Quality and Patient Safety</th>
<th>Target</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of SRE</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>Total No. of incidents</td>
<td>&lt;5</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of High priority Radiology risks</td>
<td>0</td>
<td>Per month</td>
</tr>
<tr>
<td>No. risk assessments</td>
<td>1</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of New Risks</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No. of suboptimal images</td>
<td>&lt;5%</td>
<td>Total Reports</td>
</tr>
<tr>
<td>VR error rate</td>
<td>&lt;5%</td>
<td>Total Reports</td>
</tr>
<tr>
<td>No. of Unscheduled down time of equipment</td>
<td>0</td>
<td>Hrs.</td>
</tr>
<tr>
<td>Complication rate for invasive procedures</td>
<td>0</td>
<td>No.</td>
</tr>
<tr>
<td>No. of Proactive QIP’s</td>
<td>1</td>
<td>No.</td>
</tr>
<tr>
<td>No. of Reactive QIP’s</td>
<td>1</td>
<td>No.</td>
</tr>
<tr>
<td>National KPI’s MRI to prevent delayed staging and treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>&lt;10</td>
<td>Days</td>
</tr>
<tr>
<td>Rectum</td>
<td>&lt;10</td>
<td>Days</td>
</tr>
<tr>
<td>Hand Hygiene Compliance</td>
<td>&gt;95%</td>
<td>Random Audits</td>
</tr>
<tr>
<td>CT out-patients</td>
<td>&lt;15%</td>
<td>Waiting &gt;3m</td>
</tr>
<tr>
<td>CT in-patients</td>
<td>&gt;85%</td>
<td>In 24hrs</td>
</tr>
<tr>
<td>MRI out – patients</td>
<td>&lt;30%</td>
<td>Waiting &gt; 6m</td>
</tr>
<tr>
<td>MRI in-patients</td>
<td>&gt;80%</td>
<td>In 24hrs</td>
</tr>
<tr>
<td>Ultrasound out-patients</td>
<td>&lt;30%</td>
<td>Waiting &gt; 6 months</td>
</tr>
<tr>
<td>Ultrasound in-patients</td>
<td>&gt;95%</td>
<td>In 24 Hrs.</td>
</tr>
</tbody>
</table>
### Turn Around Times to prevent delayed diagnosis and treatment

<table>
<thead>
<tr>
<th>GP pts. - time to next app</th>
<th>&gt;95%</th>
<th>In 2 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report - Urgent Paediatric</td>
<td>35-60</td>
<td>Time (Min)</td>
</tr>
<tr>
<td>Median - Urgent Adult CT</td>
<td>1-2</td>
<td>Time (Hrs.)</td>
</tr>
<tr>
<td>No. of Unreported Images</td>
<td>0-400</td>
<td>Per month</td>
</tr>
<tr>
<td>Turnaround time for GP</td>
<td>&gt;95%</td>
<td>Per month</td>
</tr>
<tr>
<td>Report turnaround time</td>
<td>3-7</td>
<td>Days</td>
</tr>
</tbody>
</table>

### Patient Satisfaction to measure quality of care

<table>
<thead>
<tr>
<th>Patient satisfaction %</th>
<th>&gt;95%</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff satisfaction</td>
<td>&gt;95%</td>
<td>Satisfaction</td>
</tr>
</tbody>
</table>

### Productivity

<table>
<thead>
<tr>
<th>No. of MRI Scans</th>
<th>360</th>
<th>P/M/Scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Risky Activity</td>
<td>0</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of CT scans</td>
<td>700</td>
<td>Per month</td>
</tr>
<tr>
<td>% Risky Activity</td>
<td>0</td>
<td>Sty</td>
</tr>
</tbody>
</table>

### Human Resources

<table>
<thead>
<tr>
<th>No. of Full time Radiographers</th>
<th>48</th>
<th>Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of WTE Radiologists</td>
<td>13</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of WTE Nurses</td>
<td>6</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of Agency Staff</td>
<td>0</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of Support Staff</td>
<td>4.6</td>
<td>Sty</td>
</tr>
<tr>
<td>Total Absence Coefficient</td>
<td>0.3</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of Long- term Absences Radiographers</td>
<td>0</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of locum staff</td>
<td>2</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of administrative staff</td>
<td>19</td>
<td>Sty</td>
</tr>
<tr>
<td>No. of Long-term Absences Admin</td>
<td>0</td>
<td>Sty</td>
</tr>
</tbody>
</table>

Table 7.3: KPIs selection

#### 7.5.4 Requirement R4.4 Mapping to HIQA Standards

Quality and Patient Safety = Safe Effective Patient Care

- Clinical accuracy,
- Capacity/capability/demand,
- Access,
- Productivity,
- Patient Satisfaction,
- Hygiene,
- Human Resources,
- Finances.
7.5.5  Requirement R4.5 Include National KPIs

National clinical programmes dictate the national KPIs. Compliance is compulsory and thus these KPIs are prioritized in RAD-QAP. Table 7.4 shows the national KPIs.

<table>
<thead>
<tr>
<th>National KPIs for MRI Staging</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast Cancer</td>
<td>&lt;10</td>
<td>Days</td>
</tr>
<tr>
<td>Rectum Cancer</td>
<td>&lt;10</td>
<td>Days</td>
</tr>
<tr>
<td>Prostate Cancer</td>
<td>&lt;6 weeks</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.4: National KPIs Inclusion

7.5.6  Requirement R4.6 Set Expected Compliance Levels

In this component, the QI team must identify the compliance levels that must be achieved. Standards can vary throughout the course of the implementation of RAD-QAP. If departmental standards are low interim standards can be set to encourage achievement of an overall goal.

The team will set the expected standards and desired outcomes, relevant to the KPI. They will define the structures, required to be in place and the processes that must be adhered to achieve a good outcome for the topic selected.

Expected standards must also be documented. It is not always possible to achieve 100% success in the clinical setting. Resources may be wasted in the pursuit of unattainable or unnecessarily high goals. Risk assessment can identify where the standard should lie.

HIQA requires routine measurement against standard and provision of evidence of meeting standard on an on-going basis. HIQA requires that information is held securely and confidentially, obtained fairly an efficiently, recorded accurately and reliably, used effectively and ethically, shared appropriately and lawfully.

Where standards do not exist or where legislation has not been found to have not kept pace with advance in technology, the hospital must set its own standards.

Significance

- Legislation does not always keep pace with technology therefore the hospital must set its own standards based on risk assessment [232],
• There may be cases where the risk of non-compliance with legislation outweighs risks of compliance with legislation. Formal and rigorous risk assessment should accompany any deviations from risk assessment,

• Review of legislation indicated that FDA legislation is ahead of E.U. Legislation; therefore, it would be acceptable to abide by E.U. Legislation but set standards higher and conform to FDA legislation.

**Practices**

• Review the literature in relation to the topic in question to identify whether the literature provides the standard required. [14] [15] [16] [77],

• Review practice in peer hospitals to identify the levels of compliance (action research),

• Review practice in non-peer hospitals to identify standards there (action research),

• On completion of literature and practice reviews, set standards based on the findings. The level of compliance should be achievable in the department in question. The level of compliance should also be in line with peer hospitals. Where the standard of non-peer hospitals, such as large teaching hospital versus small private hospital, identify whether it is in control of hospital in question to achieve the standard of the non-peer hospital [77],

• Reassure team members and staff that setting levels of compliance will improve the standards of care by identifying areas of weakness and thus allowing staff to address the problems. Areas of weakness that are within the control of the staff will be addressed locally and areas outside of their control will be escalated to those with the capacity to address the issues in question (researcher experience).

**7.5.7 Requirement R4.7 Design Customised Scorecards**

Scorecards must be developed by designed by grouping the headings together to reflect the dimensions of quality aligned with the HIQA standards to include the enabling elements that contributes to the delivery of a high-quality Radiology service.

A scorecard [24] [25] in Table 6.2 was constructed to serve as a frame work for recording and communicating KPI measurements and progress against targets for radiologists and management. The categories selected for the scorecard included: quality and patient safety, national KPIs and clinical programmes, hand hygiene, waiting times, turnaround times, patient satisfaction, employee satisfaction, productivity, human resources and finance [103].
This supported that the context and reality of the specific radiology department was accounted for.

7.5.8 Requirement R4.8 Data Management

Data must be collected monthly by the RIS/PACS Manager by accessing the NIMIS system. Data was collated by the quality coordinator and recorded on the scorecard. Data had to be verified by the radiologist in charge. Data was collected per the HIQA guidelines for KPI collection [19]. The scorecard was successfully implemented in three other departments unrelated to radiology.

7.5.9 Requirement R4.9 Define and agree methods for data collections

The process for data extraction must be standardized and the data must be verified to assure accuracy. Quantitative and empirical data collection methods are the chosen method of data extraction for simplicity. Standard procedure for data collection must be written up and be available at all times. Reporting templates must be designed using the reporting function available on the information systems to extract data in a template format to achieve standardization and accuracy.

- A wide variety of data collection methods are necessary to measure the different KPIs,
- Audit was used as collection method for most KPI data to populate the scorecard.

7.5.10 Requirement R4.10 Define data sources for reliable measurements

Data sources to be accessed to obtain KPI Data reports should be identified and listed.

**The following information systems are used in Radiology:**

- NIMIS - National Integrated Medical Imaging System,
- NIMS – National Incident Management System,
- Q-GENDA – Radiology On-Call Scheduling Software System,
- IPIMS - Integrated Patient Management System,
- CISWEB – Clinical Indemnity Scheme,
- Q-PULSE- Quality Management Software,
- MEDONC –Medical Oncology Information System,
- MOCIS - Medical Oncology Clinical Information System,
- PPARS –Personnel Payroll and Other Related Systems,
7.5.11 Requirement R4.11 List monthly reports required

The reports necessary for the scorecard population must be listed and a person designated for being responsible to collate the lists within agreed timeframes. Activity reports from the different systems

- Waiting Lists analysis – NIMIS- Radiography Service Manager,
- Incident analysis – NIMS- Risk Manager,
- Complaint analysis – Q-Pulse – Complaints Officer,
- Image Reject analysis – NIMIS- PACS Radiographer,
- Recall Rates – NIMIS- Radiography Service Manager,
- Number of Suboptimal images – NIMIS- Radiography Service Manager,
- Number of significant findings communicated – NIMIS- Radiology Secretary,
- Risk assessments – Q Pulse - Radiography Service Manager,
- Risk Register- Quality and Safety Manager,
- Audit results of pro-active and re-active – NIMIS- Quality Manager,
- National Recommendations – HIQA – Quality Manager,
- Self-assessment against the Heath care quality standards. QA Tool- Clinical Specialists,
- WTE Analysis – PPARS- Human Resources,
- Accounts Analysis - PPARS- Finance,
- Absenteeism Report – PPARS- Radiography Service Manager,
- Discrepancy Analysis – NIQAS (PeerVue)- Radiologist in Charge,
- Equipment Log - EXEL sheet –Physicist,
- QA Logs - EXEL sheet Clinical Engineer.

7.5.12 Requirement R4.12 Agree time frame and frequency of data collection

Follow-up measurements were taken at agreed intervals post quality improvement plan implementation to assess the effect. Monthly reporting of data with the data collection managed within the four-week cycle. Identified person should extract and collate data within the set timeframes and recorded on scorecards in a timely fashion. The data should be presented in a standardized report format.
7.5.13 Requirement R4.13 Define KPI analysis methods

Very simple methods for analysis of KPI data are used. Empirical counting of data method mostly utilized. A variety of other statistical methods including dispersion, analysis of variances, correlation and regression, t-distribution and t–test were used if applicable in analysis of KPI data.

7.5.14 Requirement R4.14 Define data collection points and align with governance structure

Radiology scorecards should be developed for each radiologist and each modality i.e. MRI, CT, nuclear medicine, interventional radiology, mammography, ultrasound and Theatre that feeds into the overall scorecards. These different scorecards align with the level of management and the appropriate set of KPIs measuring relevant KPI output of the activities at that level.

7.6 Requirement 5 – Quality Improvement Validation Component

The validation component (component 5 in Figure 7.7) of the programme. In this phase the process of use for the scorecard is refined. KPIs help us to learn and improve report and demonstrate compliance as well as control and monitor output. The phase also includes reviewing structures, processes and outcomes, acting quickly where standards have not been achieved by developing appropriate quality improvement plans. Where correct processes exist, it must be established that staff are adhering to them. The component requires good management structures, good control and good feedback.

Clinical audit is “a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change” processes [14] [15] [16] [77]. It involves examining work practices, comparing them against an agreed standard then making the necessary changes to the work practice to achieve the agreed standard (Literature Review, Action Research).
7.6.1 Requirement R5.1 Define Accountable Person

Once a KPI is chosen an accountable person with the authority to address issues in relation to that topic is placed in charge. This may or may not be the departmental PIC. If the topic under review is relevant to only a subsection of the departmental staff, the manager of those
staff will be placed in charge. It is important to bear in mind that the accountable person for the topic is a person with authority to implement change and not necessarily the person with the requisite knowledge.

The quality committee must co-ordinate the selection of indicators that are relevant to the department and agree acceptable levels of performance through establishing a consensus group consisting of consultant radiologists.

The leader may differ from the original person in charge as the KPI may be local to an area or a unit. Some software systems, for example, may be used throughout a hospital whereas some will be used only in one department or part of a department. The scope of the topic will dictate who manages it. The KPIs selected will dictate whether this is a consultant, midwife/nurse manager or an administrator. This person must be supported by the correct stakeholders and experts relevant to the topic.

**Significance**

- Helps the person in overall charge of the department to delegate responsibility (action research),
- Places accountability and responsibility with the most relevant party (action research),
- Encourage responsibility for management that is disseminated more locally (action research).

**Practices**

- Define the scope of the topic for review (action research),
- When a topic has been scoped a quick stakeholder, analysis will identify the person in charge of the KPI, other members of the review team can be put in place at that time. This will again include those with knowledge and power to implement the changes required to achieve goals in relation to the KPI (action research),
- Topic owner is informed of their responsibilities in relation to the KPI and most importantly their responsibility in relation to the overall goals of the department (action research).
7.6.2 Requirement R5.2 Appoint Accountable Person Leads

For a successful outcome the KPIs must be reviewed by a person with the necessary authority or power must again take control. As with the departmental leader the KPI leader must drive the QIP to achieve the KPI. The significance and the practice mirror those outlined in the authority Component (but relevant to the KPI).

Significance

- Required so that ownership and responsibility is taken locally for the subject (action research),
- It is not enough that the topic owner is identified they must also take an active part in bringing assuring successful bringing about change where it is required (action research),
- Necessary so that the topic is given its due importance (action research).

Practices

- The departmental person in charge must empower the topic leader to manage the KPI (action research),
- The departmental leader must support and encourage the KPI leader to manage any change required (action research),
- Where the KPI leader is not engaging the departmental person in charge must use recognized change management techniques (action research).

7.6.3 Requirement R5.3 Engage Correct Stakeholders

A quick stakeholder analysis will identify other members of the KPI review team. This will again include those with knowledge and power to implement the changes required to achieve goals in relation to the KPI. The significance and practice again are similar to those of the structural component but relative to the KPI as opposed to the department. See an example of Stakeholder Analysis in Table 4.2.

7.6.4 Requirement R5.4 Define Process for Quality Improvement Implementation

Process measures are the focus of the largest proportion of quality improvement efforts, assessing specific transaction in clinical-patient encounters, such as the use of appropriate surgical antibiotic prophylaxis, are expected to improve outcomes [50].
Achieving good outcomes in the heterogeneous hospital environment requires standardisation of process. The QA team as part of the structural component of RAD-QAP will have developed a suite of policies, procedures, protocols and guidelines (PPPGs). In this Component, relevant stakeholders must identify the process to be followed in radiology activities make sure that the process remains up to date and in line with best practice and documented in an official approved departmental policy that is accessible to radiology relevant staff. Quality improvement plans were developed and implemented under guidance of the quality committee. Staff were given training around agile thinking to facilitate the development of appropriate and effective Quality Improvement Plans [221].

**Significance**

- Good processes lead to good outcomes [21] [76],
- Necessary to achieve a state where policies remain up to date and based on evidence based best practice (action research),
- Must be defined so that staff are aware of them (action research),
- Necessary to reduce variation of practice due to the hospitals variety of professions and even within those professions, variety of qualifications, experiences and viewpoints (action Research),
- Necessary to support staff are clear on the process to be followed (action research),
- Policies are in place healthcare to inform staff which processes are required from them (action research).

**Practices**

- A policy, procedure, protocol or guideline must be in place in relation to a topic where variation is not acceptable (action research),
- Establish whether national policies already exist. Where a national policy exists, it must be utilized. It may however be adjusted for local use (action research),
- Where national policy does not exist review whether an existing international policy already exists (action research),
- PPPGs must be based on best available evidence and they must be up to date. If the PPPG is up to date and had been developed in line with evidence based best practice include it may be audited against, if not a literature review must be conducted and the PPPG updated,
• Send draft PPPGs around to the relevant experts and stakeholders for review and feedback (researcher experience),
• Make necessary changes in indicated by feedback. (researcher experience),
• Most senior person signs the policy into effect (researcher experience),
• Distribute the new policy to relevant stakeholders (researcher experience),
• A record of staff having read the policy must be maintained (researcher experience),
• Staff must have the ability to raise change requests to the policy if they have any reason to do so at a later date (researcher experience).

7.6.5  Requirement R5.5 Process of use for the Scorecard

An official document for the process of use of scorecard as part of the quality programme must be written up and signed off by the quality committee. This document must stipulate details of the KPIs, data collection methods, data analyzing methods, quality improvement plans, responsible persons for the duties and responsibilities, display and communication methods, escalation of non-compliant KPIs.

7.6.6  Requirement R5.6 First Measurement to establish a Baseline

Audit was used mostly to collect the relevant data to calculate the KPIs. The logs and reports identified in the data component were employed at this stage to provide the necessary KPI data. It is necessary to establish a baseline to measure against to show if the Quality Improvement Plans are producing a measurable improvement against the baseline. Record the data on the scorecards in the appropriate section.

7.6.7  Requirement R5.7 Quality Improvement Plans developed for KPIs falling below set target

Quality improvement plans are developed following a root cause analysis:

The responsibilities of the Committee include:

• Developing and approving the quality improvement plan,
• As part of the Plan, establishing measurable objectives based upon priorities identified using established criteria for improving the quality and safety of clinic services,
• Developing indicators of quality on a priority basis,
• Periodically assessing information based on the indicators, taking action as evidenced through quality improvement initiatives to solve problems and pursue opportunities to improve quality,
• Establishing and supporting specific quality improvement initiatives,
• Reporting to the Board of Directors on quality improvement activities of the clinic on a regular basis,
• Formally adopting a specific approach to Continuous Quality Improvement (such as Plan-Do-Check-Act: PDCA).

7.6.8 Requirement R5.8 Six Sigma Lean principles apply in quality improvement management

Lean process re-engineering is used with great success in healthcare (De Souza, 2009 and Young and Mac Clean) the basic principle of reducing “waste” by removing delays and duplication from the system and standardize all processes. Official policies must be drawn up to reflect this. Every process must be divided up into metrics to measure each step to identify bottlenecks and inefficiencies.

Patient flow audit must be carried out to identify quality shortfalls in the process to develop Quality Improvement Plans. RAD-QAP provides the opportunity to establish training programmes that runs concurrently with the quality improvement cycles of RAD-QAP. These programmes are based on learning generated from the root causes for non-compliant KPIs.

Significance

• Requirement for statutory registration with professional bodies for radiologists and radiographers (literature review)
• Professional competence must be maintained through continuous learning (literature review)
• Audit activity and quality improvement initiatives is a recognized CPD activity and earn CPD points for radiologists and radiographers
• Teaching sessions re audit and quality improvement are recognized CPD activities
• A symbiosis is created between continuous quality improvement and continuous learning as a result of RAD-QAP
• It is advisable to have an academic institution approve and accredit the CPD programme
The benefit of earning CPD points incentivises staff to engage and maintain RAD-QAP.

Pro-active learning based on risks identified by RAD-QAP (issues identified and addressed before events occur)

Reactive learning based non-compliant KPIs (issues addressed after event occurred)

Practice

- Structure for in-house lunch time meetings must be put in place and driven by radiographers and radiologist
- The learning from the root cause analysis and quality improvement cycles must be utilized to select relevant topics for continuous in-house CPD programmes for radiologists, radiographers, nurses (action research)
- The selection of CPD topics will be focused on quality shortfalls identified through non-compliant KPI measurements (action research)
- Poster and scorecards should be displayed at workstations with KPI measurements flagged with red, amber and green to communicate the non-compliant KPIs to staff (action research)
- Other topics can be combined with these programmes to include evidenced based practice techniques
- Every member of staff should engage in the teaching, audit and quality improvement plan development on a rotational basis to earn cpd points

7.6.9 Requirement R5.9 2nd measurement post quality improvement plan implementation

Following the implementation of the quality improvement plan a second measurement must be taken and recorded on the scorecard in the appropriate section. Compare to target and if compliant for 5 consecutive measurements the KPI can be parked to replace with other more urgent KPIs. If not compliant a root cause analysis must be carried out.

7.6.10 Requirement R5.10 Root Cause Analysis

Root cause analysis implies considerable organisational work. It is based on the models used by the airline industries that regularly perform RCA on issues identified during maintenance (Canadian Patient Safety Institute, 2006) [205].

A root cause analysis should be carried out to determine the reason for not reaching the set target. This technique was imported from the manufacturing industry in 1996 as mandated by
the joint commission for sentinel events. The main questions that a root cause analysis is based on are “What happened?”, “Why did it happen?” and “How can the likelihood of reoccurrence be reduced?” By design a root cause analysis is performed on uncontrolled case studies (Joint Commission for Sentinel Events, 1996) [204].

A thorough root cause analysis requires the following (Canadian Patient Safety Institute, 2006):

- An Understanding of how radiographers interact with their environment,
- Identification of potential problems related to processes and systems,
- An analysis of underlying cause and effect systems through a series of “why” questions,
- Identification of risks and their potential contributions to the event,
- Development of actions to improve processes and systems,
- Design of measures to evaluate implementations of actions,
- Adequate documentation.

For the root cause analysis process to be credible there should be participation by the leadership of the organisation and those most closely involved in processes and systems.

7.6.11 Requirement R5.11 Structure and process review for KPIs falling below target

When a KPI falls below target repeatedly the process must be reviewed to identify methods of improvement, if the process is optimized the structure needs to be reviewed to verify if it supports the process. The research identified that an additional MRI scanner was needed once the waiting lists were evaluated as the resources in place were at maximum capacity. In some instances, were functioning in the risk area were staffed were pushed to do scans in the risky area. Where patient care might be comprised as the workload is just too heavy for the structure to cope. Donabedian Model implies that the process cannot be effective if the structure does not support the process.

7.6.12 Requirement R5.12 3rd measurement post process modification or structure modification

A measurement must be taken post QIP implementation i.e. in this research extended working days were introduced to address the long waiting lists. This was a short-term solution as staff fatigue led to the quality committee to reassess the situation. These measurements should preferably be taken on pre-agreed time intervals of 4 weeks. Following
the implementation of RAD-QAP, we identified the specific KPIs that had not reached their target we undertook a review of the process and structure that supports the specific KPI. The process and/or structure were then modified to address the quality shortfall. In the event where additional staff were required risk assessments were carried out to highlight and justify the business cases to senior hospital management.

7.6.13 Requirement R5.13 Business Plans for non-compliant KPIs

If the measurement is still not meeting the set target, business plans must be developed to address these issues. As in this research in specific the outsourcing of MRI waiting lists or the employment of a tele-radiology company to deal with the unreported images backlog. The data will be provided by the scorecards will support the business plan and high light the risk providing data as evidence. RAD-QAP includes capacity and demand planning as a vital step in the process to achieving quality within the optimisation of available resources. For example - the radiologists’ capacity were increased by making use of outsourcing plain film image reporting to a 3rd party utilising tele-radiology to allow the structure to breathe and cope with the peaks and troughs of patient flow. This measure addressed the large number of unreported plain film images and reduced the risk of patients of delay in possible cancer diagnosis. The addition of a 3rd party in the structure stimulated a quality programme with the 3rd party to quality assure the images reported via this route. This solution was applied to CT on-call out of hours. This relieves pressure off the radiologist that was working under strain due to inadequate resources as demand and capacity was not aligned.

7.6.14 Requirement R5.14 Escalation Levels for consistent non-compliance

The national performance oversight group has developed a four-point escalation framework from level 1 (yellow) to level 4 (black) which is used to escalate issues and incidents as required. (Escalation levels in Figure 7.8) The characteristics of divisions or services at each level of escalation and the nature of likely supports, interventions and sanctions available to divisions to help them to improve performance have also been developed for implementation during 2016.
It is important to note that escalation and de-escalation through the levels outlined may not be sequential and, in the case of financial underperformance, is differentiated per performance rating. The initial level of intervention and the level of escalation are based on the seriousness of the performance issue, the likelihood of deterioration in performance and the magnitude of the issue. There may be circumstances where the issue is so serious that it merits red or black escalation in the first instance or where the level of intervention moves directly from Level 2 to Level 4. There may be circumstances where the issue is so serious or performance so poor within a service that it merits a formal performance escalation meeting with the Director General and the national performance oversight group at which a number of remedial actions are agreed.

The rate of de-escalation is determined by an assessment of the complexity of the underlying issues and of the likelihood that recovery will be sustained over time.

The escalation process involves the KPI to be escalated to the next level for resolve if the measures were non-compliant for more than 6 consecutive measurements and all routes for quality improvement has been exhausted. Achieve a predefined standard. There are four cycles of the audit process with each failure to achieve the standard resulting in a stronger consequence. If the noncompliance presents a moderate to severe risk this is managed...
appropriately and escalated up the risk register if deemed appropriate. If the non-compliance does not present a risk there is an escalation through communication of findings- compulsory education, sanction up to and including disciplinary process and escalation beyond local management if standards cannot be raised locally.

**Significance**

- True quality assurance requires continuous monitoring with action where non-compliance or poor quality is established (site visit),
- A folder full of policies and bad practice can still exist in certain areas (external validation interviews),
- Studies can have unexpected findings. Staff may genuinely consider that a practice is of a high standard, but this may not be the reality. The reverse may also be true (action research),
- Monitoring and standards will prevent people taking shortcuts (external validation interviews),
- Quality may not be good because the process has not been monitored (external validation interviews),
- Necessary to continually review as poor practice can become systemic [7] [173],
- Inadequate recording systems compromise communication of clinical activity, stifle the opportunity for quality improvement and disempowered practitioners [7] [173],
- A lack of proactive management relating to compliance has resulted in a lack of compliance with standards (action research),
- Continual tweaking improves databases (case study research).

**Practices**

- Establish a routine of continuous quality assurance audits are put in place (site visit),
- Schedule protected time for these programmes, this can be difficult, but the attempt must be made (external Validation Interviews),
- Use recognized audit processes as they are both understood and mandatory for clinicians [12],
- Data is collected and measured against the standard, changes in practice (if indicated) are implemented, and re-audits take place to assess whether improvements have occurred [14] [15] [16],
• The rapid escalation component requires the auditing of current outcome in relation to desired outcome for the chosen topic. Where standards are not achieved, actions are rapidly put in place and the status is audited again. If compliance is not achieved quickly the matter is escalated to a higher level of authority (site visit),
• Due to the complexity of the environment smaller sample sizes are more manageable, which facilitates faster turnaround of audits (action research),
• Small sample sizes, particularly when reviewed regularly, can be very effective in highlighting process failures (action research),
• Staff are overloaded with information so reduce the information to the bare minimum (external validation interviews),
• Quality issues identified by the process are divided into those within and outside of the scope of the department (action research),
• Quality issues within the scope of the department are addressed rapidly with an escalation of education through to disciplinary process where persistent non-compliance is a problem. Software engineers, internal I.T. staff or clinical staff must take responsibility to follow up and resolve issues relative to their own field (action research),
• As change management is part of the process of RAD-QAP and this is often the most difficult part of the programme. Use of a recognized change management process is recommended. Kotter’s model was found to be effective during the action research [150],
• Create a supportive environment for best practice to flourish [14] [15] [16] [77],
• When the desired standard has been achieved, select another more urgent KPI (action research),
• Revisit KPIs regularly to re-evaluate standards are maintained (action research).

7.6.15 Requirement R5.15 Acknowledge and Celebrate success [250]

In-house CPD programme providing training and lectures to address the identified quality shortfalls (non-compliant KPI measurements) within Radiology to allow staff to earn CPD points for compulsory professional registration with the Radiography and Radiology Professional Bodies.

If the KPIs are consistently met or exceeded the radiology quality committee should acknowledge and celebrate the success by designing a method of rewarding staff for excellent service and continuous quality improvement, for example, in the case hospital the CEO hosts a “CEO rewards ceremony” where certificate of excellence is handed to staff for excellent
performance at an official awards ceremony [249]. This research was recognized in the quality improvement division and received an award for improving the service delivered to patients in radiology.

7.7 Requirement 6 – Quality Verification Component

The quality verification component (component 6 in Figure 7.9) is the 6th component of RAD-QAP (Literature Review, Legislation and Standards Review, Action Research).

![Diagram of Quality Verification Component]

Figure 7.9: Quality Improvement Verification Component

7.7.1 Requirement R6.1 Modify Scorecard if necessary

It is important that scorecard is reviewed by the quality committee and the expert group to design a scorecard that stays focused on the quality shortfalls and high-risk areas of concern.
Once risks are addressed successfully other more urgent KPIs should be selected for measurement.

7.7.2 Requirement R6.2 Manage KPIs

Add and delete KPIs according to compliance achieved to keep the KPIs relevant to the areas that urgently needs attention.

KPIs were removed from the scorecard if the target was reached in six consecutive measurements. These KPIs were put into a “parking lot” for separate monitoring on a six-monthly basis. Apart from maintaining focus on quality shortfalls, this decision also helped to reduce the amount of data required for the scorecard on a monthly basis.

It became apparent after first quality improvement cycle that RAD-QAP needed continuous monitoring to maintain the relevant KPIs live on the scorecard in the context of a demand driven radiology department with waiting lists growing as soon as they have been cleared. Therefore, the KPIs achieved needs to be deleted to make way for new more relevant KPIs to measure continuous improvement; deleted KPIs can from be reviewed every 6 months to measure the quality improvements were maintained. The value of a scorecard that reflected the KPIs that were reflecting the current quality shortfalls in the radiology department expressed in KPI measurements against the set targets. Once continuous quality improvement is achieved consideration could be given to setting higher targets and essentially raising the baseline to create a dynamic environment around quality management.

7.7.3 Requirement R6.3 Communicate results through Quality Committee

Appropriate and effective mechanisms are in place for communication and consultation on quality and risk matters with key stakeholders within and outside the organisation. Scorecards must be displayed in different areas in the interest of transparency of the process.

“A stakeholder analysis should be conducted to support, firstly that appropriate stakeholders have been identified and, secondly, that appropriate mechanisms have been defined for communicating and consulting with the various stakeholders or stakeholder groups. The test of an ‘effective’ communication and consultation mechanism is ‘does it work and, as such, services should aim to provide clear evidence of effectiveness?’ [46].

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7.7.4 Requirement R6.4 Accumulative Periodic Analysis/Trend analysis

Hospital activity tends to follow natural pattern of increased and decreased demands. Trend analyses are useful in providing this data. It will add to the intelligence data of the Radiology Department.

**Significance**

- Repetitive use of the scorecard will identify patterns over times and will provide valuable data to allow informed decision making,
- The managers using these scorecards will be educated using these figures and learn its context and reality as well as relation and interaction with other KPIs that it might impact on.

**Practices**

- 6 monthly trend analyses must be carried out to learn about the natural trends that exist within the Radiology Department,
- Managers should use this data and match the resource deployment with these trends to determine if capacity meets demand all year round.

7.7.5 Requirement R6.5 Pro-active: Reactive QIPs Ratio

Pro-active quality management as oppose to reactive risk management is the aim of this quality programme. The baseline of this study is determined by quality shortfalls stimulating quality improvements. Repeated cycles of continuous measuring against the set targets until compliance achieved will cause a shift from reactive to pro-active risk management. This shift will allow for risk assessments to be carried out and issues to be addressed pro-actively before incidents occur. The ultimate KPI to measure the success and effectiveness of the programme is expressed by the ratio of - no of pro-active QIPs: no of reactive QIPs.

The main key performance Indicator “Pro-active QIP’s: Reactive QIP’s “under the quality and patient safety heading on the SC evaluated RAD-QAP by expressing the effectiveness of the quality improvement initiatives for the sum of all the activities in the radiology department and confirmed after 12 months that more pro-active QIP were implemented hence the ratio of QIP’s implemented were in favour of pro-active quality improvement. R: P =10:1 Vs. R: P =3:12 year on year.
RAD-QAP was also evaluated for effectiveness against the organisational service plan goals that was set at the beginning of the research. There was a clear improvement in quality management through the stimulation of corrective actions because of periodic review of the scorecards of the specific KPI’s selected for reporting.

7.7.6  Requirement R6.6 Overall Quality Improvement Verification

The overall verification was based on the QA self-assessment tool based on the 4 levels of quality that can be achieved. With continuous assessment and implementation of quality improvement plans the level of quality for each KPI will progress according to the number of consecutive target complaint measurements. The four levels of quality being as follow EI=Emerging Improvement, CI=Continuous Improvement, SI=Sustained Improvement and E=Excellence. Emerging Improvement was set as the baseline for the research. Six consecutive compliance measurements allow the KPI to move on to the next level of quality and equally if the KPI are non-compliant for three consecutive measurements in the new quality level it will move back to the previous level. It is a dynamic process with constant monitoring review and quality improvement implementation. The levels are shown in Figure 7.10)
4 Levels of Quality Improvement

QA TOOL

- Target reached x 6 moved on to next level
- Benchmark against national/international standards in increments of 15% between different levels of quality compliance in 2 categories service delivered and service delivery. Service delivery depends on capacity of the structure i.e. Access vs. The outcome i.e. Service delivered
- If Target not reached x 3 move back to previous level

Figure 7.10: Levels of Quality adapted from HSE Q&A Tool [247]
7.8 **Requirement 7 – Quality Assurance Component**

Quality assurance and improvement is the responsibility of all stakeholders and these must be involved in all iterations of the quality cycle. “Quality Assurance is the process of managing quality” [256]. The quality assurance component is the 7th component of RAD-QAP (component 7 in Figure 7.11) (Literature Review, Inquiries Review, Legislation and Standards Review, Action Research).

![Figure 7.11: Quality Assurance Component](image-url)
7.8.1 Requirement R7.1 Documentary Evidence

Evidence of quality improvement initiatives measured from the baseline against a set target to proof quality control, quality verification and quality assurance. The scorecard displays and communicated this evidence in a structured pre-defined format that is customized for the specific quality profile of the radiology department in question.

The **scorecard** will identify quality shortfalls by means of KPI data that fall short of the set target; a risk rating will then follow with a root cause analysis that will lead to quality improvement plan development and implementation. The KPI data will also identify long-term quality improvement projects that will facilitate achievement of organisational goals. The entire list is needed to achieve effective clinical governance. The listed documentation form part of the accountability framework. HIQA the Healthcare Watchdog requires separate documentation as is set out below.

7.8.2 Requirement R7.2 Scorecards

A scorecard with KPI measurements including set targets and timeframes was developed. The scorecards serve as a communication, display recording, track and trending tool. The evaluation of RAD-QAP as a holistic quality assurance programme was evaluated at departmental level as well as at high level performance reviews and the effectiveness of RAD-QAP to manage quality improvement plans were implemented within agreed timeframes.

A scorecard [25] [26] was constructed to serve as a frame work for recording and communicating KPIs and our progress against these indicators. In addition, it provided a management and display tool for collected measurement data. The scorecard is based on the inclusion of the necessary elements that will promote a quality service was modified the scorecard that was appropriately for health care, the national standards for better safe health care, were selected as most suitable for providing a baseline for this study as it maps almost intuitively to the categories that needs to be included in the scorecard. The RAD-QAP puts the patient at the center of the all activity with the patient recognised as the biggest stakeholder in the clinical environment.
7.8.3 Requirement R7.3 Risk Registers

**Primary Goals of a risk register: The Risk Register aims to do the following:**

- Identify and record all risks related to a project,
- Gather relevant information on each of the risks,
- Capture derived information based on analysis and prioritization of the risks,
- Capture mitigation strategies planned for the risks,
- Track the status of each of the risks.

7.8.4 Requirement R7.4 Master Quality Improvement Plan Lists

A master list of all quality improvement plans must be compiled with all quality improvement plans and related implementation framework. This list will be useful for external audits.

7.8.5 Requirement R7.5 Project Trackers

The purpose of the project management plan (PMP) is a document that can be used by everyone involved with the project to help communicate and detail information and describe processes that the project will undertake. It will detail the scope, deliverables, timescales and roles and responsibilities of persons involved and be derived in form from the business case created by the Sponsor. It also forms part or can be used in the contract between the project manager and sponsor, and if not used in the contract, it represents an agreement.

7.8.6 Requirement R7.6 Audit Forward Plan

A comprehensive programme of clinical and healthcare audit must be in place that involves staff in multi-disciplinary audits.

“Clinical and healthcare audit involves comparing current practice to evidence based best practice in the form of standards, identifying areas for quality improvement and implementing changes to practice to meet the standards. It is the duty of healthcare professionals, so they deliver the highest possible standard of care to their patients/clients so by definition radiology staff should be auditing their work. Clinical and Healthcare audit ideally should be multidisciplinary but unit-disciplinary audits may also be conducted.” [46].

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The set of KPIs will also identify a list of audits that must be completed periodically on a six-monthly basis depending on compliance rates.

7.8.7 Requirement R7.7 Quality Assurance

Senior management receives independent assurance(s) that an integrated quality and risk management system is in place that meets the requirements of this standard.

“To be considered ‘independent’ the assurance (or assurances) should come from a source(s) independent of the department, directorate or organisation receiving the assurances. This does not necessarily mean that assurance providers need to be wholly independent of the organisation. For example, internal audit and the quality and risk office may well have the requisite independence necessary to provide adequate assurances to senior management depending on the area requiring assurance” [46].

7.8.8 Requirement R7.8 Accountability Framework

The ability of the RAD-QAP to identify a responsible person and assign accountability were evaluated in the KPI measurements that indicated an improvement or otherwise against the set target. Individual responsibility for quality and risk management is clearly defined and there are clear lines of accountability for quality and risk management leading up to the most senior manager or director.

“Quality and risk management is everybody’s business. Consequently, individuals should be clear about their responsibilities for managing quality and risk. Responsibilities should be stated in individual job descriptions, or in relevant policy and procedural documents. There should be an overall accountability framework for risk management within the organisation or department that leads to the most senior manager or director. At National level, the accountability framework for quality and risk management will extend to individual national directors, the CEO and the Board of the Health Service Executive (HSE)” [46].

7.8.9 Requirement R7.9 Performance Reviews

Monthly Performance Reviews were held to assess over-all departmental performance using the scorecard as framework for the review. Performance reviews were held at Departmental, Directorate and Executive level. Reviews tend to focus on the red flags on the scorecard and hence action was prioritised for the KPIs that were not achieving the target. The monthly reviews created urgency around the resolution of the red flags. The relevant stakeholders with
authority to affect decisions should be present at the performance reviews. The decisions taken by senior management and promised actions should also be recorded to create a two-way communication of assigned responsibilities to have recorded evidence of performance of all parties involved. This approach establishes clear accountability [46].

**Goals Setting**

Goal setting is an important part of the review process. Using SMART goal criteria will help you in setting effective goals for the future.

\[
S = \text{Specific} \quad M = \text{Measurable} \quad A = \text{Attainable} \quad R = \text{Realistic} \quad T = \text{Time-bound} \quad [214]
\]

**Specific:** Goals must be clear and unambiguous. When goals are specific, they tell employees exactly what is expected, when, and how much. Because the goals are specific, the supervisor can easily measure an employees' progress toward their completion.

**Measurable:** What good is a goal that can't be measured? If goals are not measurable, supervisors never know whether their employees are making progress toward their successful completion. Not only that, but it's tough for employees to stay motivated to complete their goals when they have no milestones to indicate their progress.

**Attainable:** Goals must be realistic and attainable by average employees. The best goals require employees to stretch a bit to achieve them, but they aren't extreme. That is, the goals are neither out of reach nor below standard performance. Goals that are set too high or too low become meaningless, and employees naturally come to ignore them.

**Realistic:** Realistic, in this case, means "do-able." It means that the learning curve is not a vertical slope; that the skills needed to do the work are available; that the project fits with the overall strategy and goals of the university. A realistic project may push the skills and knowledge of the people working on it but it shouldn't break them. Devise a plan or a way of getting there which makes the goal realistic. The goal needs to be realistic for where the employee is at the moment.

**Time-bound:** Goals must have starting points, ending points, and fixed durations. Commitment to deadlines helps employees to focus their efforts on completion of the goal on or before the due date. Goals without deadlines or schedules for completion tend to be overtaken by the day-to-day crises that invariably arise [214].
7.8.10 Requirement R7.10 Governance

Clinical governance is achieved through the selection of relative KPIs to allow measurements against a set target to produce data that will ultimately identify risks and will facilitate quality improvement plan development and implementation. The risks that cannot be resolved will be identified and escalated to the next level. The risk register will also identify long term projects that will be monitored on the project tracker. The departmental organogram of the management structure with clear reporting lines, duties and responsibilities are aligned with the KPI data collection points. As the programme matures each level should have a set of KPIs that would cascade from the one level to the next. In short, the above steps form the inputs for the achievement of governance with measurements that provides data is evidence of the processes and actions put in place.

7.8.11 Requirement R7.11 Quality Management Cycle

The quality cycle should be managed and monitored continuously to maintain the programme in radiology.

Measurable goals,

- Policies, Procedures, Protocols and Guidelines,
- Reporting lines, duties and responsibilities,
- Selection of set of relevant KPIs,
- Variations or non-compliance identified,
- Effective team meetings and performance reviews,
- Quality improvement plans and development and implementation,
- Training where needed.

7.9 Conclusion

This chapter describes the structures and requirements of RAD-QAP which answer the research questions. During this research, many problem areas within hospitals were identified which must be addressed to enhance the quality of service. The root causes of many problems lie in the absence or lack of enforcement of standards, legislation and management processes. Implementation of RAD-QAP addresses these issues.
Chapter 8  Summary and Conclusions

8.1  Introduction

This chapter concludes the thesis, providing a summary of how the research questions were developed and answered through application of the research methodology. The success factors in the research are outlined. The contributions of research area presented and discussed, as are the limitations. Recommendations and suggestions for further research are proposed.

8.2  Research Question 1

What aspects of radiology need to be measured in a quality assurance programme for continuous quality improvement?

Norton and Kaplan’s balanced scorecard principles [25] [26] and concepts of quality models presented in [84] were configured and used as the foundation as RAD-QAP. The Norton and Kaplan approach dictates the inclusion of finance, stakeholder’s interests, internal processes, capacity to deliver and customer satisfaction. These translated into finance, human resources, quality and patient safety, hygiene, patient /employee satisfaction, clinical accuracy and staff development for a radiology department. These were aligned to national health care standards to achieve the quality dimensions of person-centred care, effective care, safe care and support, better health and wellbeing. The structure or enablers of care must be included to provide a high-quality care. The enablers are the main drivers of the outcome KPIs or quality dimensions as specified by health care standards. KPIs measure the patient pathway from referral to the point where the referring doctor receives an accurate report in a timely manner.

KPIs are divided in 2 groups: KPIs measuring access to the radiology service and KPIs measuring the quality of the care delivered once the patient are in the health care system and enter radiology. Research Question 1 has been answered.
8.3 Research Question 2

What are the measures associated with those aspects?

A set of key performance indicators relevant to radiology was selected mainly guided by the service analysis, which included incident analysis, complaints analysis, HIQA recommendations, audits and resource analysis. Using this approach combined with the expert group’s input, a set of KPIs derived were designed to measure the high-risk areas in radiology, these were grouped under headings that aligned with the health care standard themes. This research identified access to the service as a KPI with reporting turnaround time as a metric. Therefore, KPI measurements in line with the risk identified by the service analysis are selected. KPIs measuring access to care was selected in the case hospital as it was a high priority risk. Once KPI compliance achieved it will be “parked” and replaced with another KPI in need of improvement.

Table 8.1 shows the KPIs as selected for the case hospital utilizing RAD-QAP. It is expected that list be different for every hospital depending on their specific issues and quality shortfalls. These KPIs were used in the case hospital with results that indicates measurable quality improvement. Evidence based standards were set for each KPI. Research Question 2 has been answered.

<table>
<thead>
<tr>
<th>Quality and Patient Safety</th>
<th>Target</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of SRE</td>
<td>0</td>
<td>No.</td>
</tr>
<tr>
<td>Total No. of incidents</td>
<td>&lt;5</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of High priority Radiology risks</td>
<td>0</td>
<td>Per month</td>
</tr>
<tr>
<td>No. risk assessments</td>
<td>1</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of New Risks</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No. of suboptimal images</td>
<td>&lt;5%</td>
<td>Total Reports</td>
</tr>
<tr>
<td>VR error rate</td>
<td>&lt;5%</td>
<td>Total Reports</td>
</tr>
<tr>
<td>No. of Unscheduled down time of equipment</td>
<td>0</td>
<td>Hrs.</td>
</tr>
<tr>
<td>Complication rate for invasive procedures</td>
<td>0</td>
<td>No.</td>
</tr>
<tr>
<td>No. of Proactive QIP’s</td>
<td>1</td>
<td>No.</td>
</tr>
<tr>
<td>No. of Reactive QIP’s</td>
<td>1</td>
<td>No.</td>
</tr>
</tbody>
</table>

National KPI’s MRI to prevent delayed staging and treatment

| Hand Hygiene Compliance                     | >95%   | Random Audits |

Hygiene Target to prevent infection outbreaks

Clinical Accuracy

| No of patients discussed in discrepancy meeting | <2% of the total | Per month |
| % Discrepancies                               | <2% of the total | Per month |
| No of multi-disciplinary meetings             | <2% of the total | Per month |
% critical findings communicated in 24hrs  Per month
% significant findings communicated in 48 hrs  Per month

**Timely Access to prevent delayed diagnosis**

<table>
<thead>
<tr>
<th></th>
<th>&lt;15%</th>
<th>&gt;85%</th>
<th>&lt;30%</th>
<th>&gt;80%</th>
<th>&lt;30%</th>
<th>&gt;95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT out-patients</td>
<td></td>
<td>&lt;15%</td>
<td>&lt;15%</td>
<td>&gt;85%</td>
<td>&gt;85%</td>
<td>&lt;15%</td>
</tr>
<tr>
<td>CT in-patients</td>
<td></td>
<td>&gt;85%</td>
<td>&gt;85%</td>
<td>&lt;15%</td>
<td>&gt;85%</td>
<td>&gt;85%</td>
</tr>
<tr>
<td>MRI out – patients</td>
<td></td>
<td>&gt;85%</td>
<td>&gt;85%</td>
<td>&lt;15%</td>
<td>&gt;85%</td>
<td>&gt;85%</td>
</tr>
<tr>
<td>MRI in-patients</td>
<td></td>
<td>&gt;85%</td>
<td>&gt;85%</td>
<td>&lt;15%</td>
<td>&gt;85%</td>
<td>&gt;85%</td>
</tr>
<tr>
<td>Ultrasound out-patients</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>&lt;30%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>Ultrasound in-patients</td>
<td>&lt;30%</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>GP pts. - time to next app</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
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**Turn Around Times to prevent delayed diagnosis and treatment**

<table>
<thead>
<tr>
<th></th>
<th>35-60</th>
<th>1-2</th>
<th>0-400</th>
<th>&gt;95%</th>
<th>3-7</th>
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<tbody>
<tr>
<td>Report - Urgent Paediatric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median - Urgent Adult CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Unreported Images</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnaround time for GP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report turnaround time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Patient Satisfaction to measure quality of care**

<table>
<thead>
<tr>
<th></th>
<th>&gt;95%</th>
<th>&gt;95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient satisfaction %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff satisfaction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Productivity**

<table>
<thead>
<tr>
<th></th>
<th>360</th>
<th>P/M/Scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of MRI Scans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Risky Activity</td>
<td>0</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of CT scans</td>
<td>700</td>
<td>Per month</td>
</tr>
<tr>
<td>% Risky Activity</td>
<td>0</td>
<td>Per month</td>
</tr>
</tbody>
</table>

**Human Resources**

<table>
<thead>
<tr>
<th></th>
<th>48</th>
<th>Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Full time Radiographers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of WTE Radiologists</td>
<td>13</td>
<td>Per Week</td>
</tr>
<tr>
<td>No. of WTE Nurses</td>
<td>6</td>
<td>Per Week</td>
</tr>
<tr>
<td>No. of Agency Staff</td>
<td>0</td>
<td>Per Week</td>
</tr>
<tr>
<td>No. of Support Staff</td>
<td>4.6</td>
<td>Per month</td>
</tr>
<tr>
<td>Total Absence Coefficient</td>
<td>0.3</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of Long- term Absences Radiographers</td>
<td>0</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of locum staff</td>
<td>2</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of administrative staff</td>
<td>19</td>
<td>Per month</td>
</tr>
<tr>
<td>No. of Long-term Absences Admin</td>
<td>0</td>
<td>Per month</td>
</tr>
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</table>

**Finance**

<table>
<thead>
<tr>
<th></th>
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<th>Overspend</th>
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<tbody>
<tr>
<td>Non-Pay</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pay</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medical Pay</td>
<td>xxxxx</td>
<td>Max Target</td>
</tr>
<tr>
<td>Paramedical Pay</td>
<td>xxxxx</td>
<td>Max Target</td>
</tr>
<tr>
<td>Nursing Pay</td>
<td>xxxxx</td>
<td>Max Target</td>
</tr>
<tr>
<td>Budget overspend</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Medical Overtime</td>
<td>0</td>
<td>€0.00</td>
</tr>
<tr>
<td>Paramedical Overtime</td>
<td>xxxxx</td>
<td>Max Target</td>
</tr>
</tbody>
</table>

Table 8.1: List of Headings with corresponding KPIs selected
8.4 Research Question 3

*How should the process of measurement be structured in conjunction with continuous improvement?*

RAD-QAP consists of 7 components, each requirement vital to quality management in radiology. The 7 components must be implemented in sequence, starting with the authority component, followed by the, structure component, quality profiling component, quality data component, quality validation component, quality verification component and finally the quality assurance component. The 7 components of RAD-QAP are discussed in detail in Chapter 7. **Research Question 3 has been answered.**

8.5 Research Question 4

*What is the impact of such a programme?*

RAD-QAP identifies risks effectively and supports pro-active risk management in radiology. The longer the programme was in place and the more data was collected the more useful RAD-QAP became as a quality management tool. Business cases could easily be made and backed up with KPI data as evidence where capacity within the current structure needed capital input for expansion to meet the demand on the system. Mandatory use of the scorecard lead to a change in culture as it states the accountable person and reporting structure (Authority component and Structure component).

The scorecard as part of the quality assurance programme led to focussed development, implementation and tracking of quality improvement plans against a set target which facilitated and directed decisions based on KPI measurements (Quality profiling and Data component). The tracking and trending of KPI data does not improve despite several attempts to implement a quality improvement plan i.e. waiting lists in MRI. Despite several initiatives to increase the through put of patients in MRI, a reduction in the waiting lists could not be achieved. This lead to the indisputable fact that capacity did not align with the demand on the system (quality validation and verification components). It showed that the structure was inadequate to accommodate the demand on the system. The fixed structure had to be expanded by adding additional equipment i.e. a second MRI scanner and additional radiographers. Data collected provided evidence for this conclusion. Data was presented as evidence and included in the business plan that led to the decision to prioritise the purchase of
a second MRI scanner to meet the huge demand on the system. The different KPIs expressed and articulated the context and reality of the situation we were dealing with in radiology.

KPI data was proven useful when other directorates made decisions to expand current services or add new services that would generate a higher demand in radiology. The data was used to evaluate additional resources based on figures. The periodic collection of data led to standardisation of data extraction methods as well as statistical analysis that in turn stimulated training for staff in these areas.

The quality assurance programme was implemented and adapted through action research to bring it in line with the hospital objectives, the HSE standard for better safer healthcare and staff requirement for professional development. The quality data were reported and reviewed at monthly performance reviews with senior management and the CEO present who has accountability and responsibility that can facilitate decision making and follow through on quality improvement projects (quality data, validation and verification components).

Staff were trained in quality assurance processes and made aware of their responsibilities in relation to their required performance. As a result of the implementation of RAD-QAP 75% of the KPIs selected improved from Emerging Improvement (EI) to sustained Improvement (SI), 15% of the KPI’s selected improved from EI to Excellent (EX) and 15% of the KPIs selected improved from EI to EX using data collected over a twelve-month period. Figure 6.2 demonstrates the level of quality and the % of KPIs that showed a measurable improvement. Quality assurance achieved through KPI measuring Pro-active: Reactive risk management ratio.

As discussed in Chapter 6, there is statistical evidence of measurable continuous quality improvements achieved with documentary evidence as a result of developing and implementing RAP-QAP in the radiography department (quality assurance component). 

**Research Question 4 has been answered**

### 8.6 Validity of the Research

The research methods chapter (Chapter 3) provides an overview of how the researcher investigated the various types of research methodologies and used them to develop a research method with which to approach the research questions (see Figure 3.1). The research method used recognised, validated research techniques that were suitable to answer the research
questions and appropriate to support validity of the research. Breuer and Broth (2003) use a variety of methods of knowledge productions such as positioning of various points of view, different frames of reference, perceptions based on experience, interaction with the social context – understanding that any interaction changes the observed object. Likewise, the use of multi-methods of research here raised confidence and trust in the research and offsets the recognised weaknesses in qualitative research such as the difficulties in providing conclusions with statistical significance. At all stages of the research validation was raised and credibility strengthened by engaging with experts both internal and external to the domain.

**Internal Validity**

Internal validity refers to the degree to which a researcher is justified in concluding that an observed relationship is causal [259]. The researcher as a participant observer in the study could threaten internal validity due to possible researcher bias [258]. [259] states that” There are many factors that can affect internal validity and therefore must be controlled as much as possible by robust research design to reduce their impact on validity. The consideration of self as a researcher and self in relation to the topic of research is a precondition for coping with bias”. Hence the author has declared her role in the practice context explicitly, to allow readers to more clearly identify the potential/lack of potential for bias (see section 3.1.8). According to [258] data reviewed by others and their judgments can be used to improve and strengthen methodology. Internal validity is quantitative in nature, where there are controlled experiments, and would be of a lesser concern in the qualitative sphere [259]. Focus groups and expert opinion from multi-disciplinary teams were utilised to strengthen the credibility of the work. The researcher engaged with and provided feedback to research participants at each stage on a regular basis to engender long term trust and increase the validity of the research as recommended by [161]. Participants had no reporting line to the researcher. Triangulation of data from several sources provided confidence that changes in dependant variable are caused by the independent variable.

**External Validity**

While the basis for RAD-QAP was derived from the literature and site visits in several Irish hospitals of varying nature (sub-acute, acute), it has been implemented in the radiology setting in one acute Irish hospital, and thus must be contextualized (as yet) as an Irish-hospital orientated solution. Future research is recommended to analyse the applicability of
the programme to other health care domains such as non-acute hospitals and to primary care. It is further recommended that RAD-QAP be implemented in other countries both within and outside the European Union to test its international applicability.

Construct Validity

According to [260] construct validity is considered an overarching term to assess the measurement procedure used to measure a given construct because it incorporates a number of other forms of validity such as content validity, convergent and divergent validity, and criterion validity. Messick (1988) states that “It is for this reason that construct validity is viewed as a process that you go through to assess the validity of a measurement procedure, whilst a number of other forms of validity are procedures (or tools) that you use to more practically assess whether the measurement procedure measures a given construct”.

Given the complex nature of an acute hospital setting and the multiple factors that can influence a given measurement there was awareness that “even if a measurement procedure is shown to have strong construct validity, it is something that develops gradually over time and it cannot be assumed that a measurement procedure has permanently or absolutely established construct validity” [260]. During the implementation of RAD-QAP this was an ideal to strive for rather than an absolute. Each additional study that showed a measurement procedure to have strong construct validity, especially in a wide range of contexts/situations, the claim of strong construct validity became greater. Maintenance and measurement over time is considered very important to the construct validity of this research.

8.7 Success Factors of the Research

This body of research commenced with concerns from the management surrounding quality assurance within radiology. The findings from the research indicated limited research in the field and did not yield a standard approach to quality management in radiology.

Following this project, there is now a well-structured quality assurance programme running in radiology that can be attributed directly to this PhD research. A QA programme for all the equipment (software and hardware) has been implemented. Monthly review meetings to discuss and action quality deficits has been established. Appropriate stakeholders, both internal and external to the department attend these meetings. The staff in the radiology are
now aware that quality is a priority for the department. Lines of authority have been established and responsibilities are now assigned appropriately for the development, implementation and compliance with policy.

Implementation of RAD-QAP in the radiology provided further successes. Action research resulted in better use of information produced by the clinical information systems. The information system for document management and control provides access for radiology staff to standardised protocols. This promotes the regular review of policies, protocols, procedures and guidelines (PPPG’s) and requires it to be updated in a co-ordinated way.

Learning from the study has benefited the radiology department. One of the most significant aspects for the safe running of the radiology department is managed in line with evidence based best practice. Quality measurements are provided in a timely manner to those who require it and there is evidence that this is now acted upon.

This body of research has successfully provided a quality assurance programme for radiology. Following development and implementation of RAD-QAP in the radiology, use of RAD-QAP has been implemented in other departments of the acute hospitals services. The directorate managers for the peri-operative directorate, the medicine directorate has adopted RAD-QAP as a programme to management quality assurance within their areas. These directorates did not participate in the action research cycles contributing to the development of RAD-QAP but, recognising the value of RAD-QAP, have commenced utilising it. They have indicated that they find it to be user friendly and it provides clear direction. It does not create “reams of unmanageable data” and it produces measurable results.

8.8 Discussion

The research was undertaken in a large hospital group catering for many patients. Radiology consists of many professions working together to deliver a high quality to service. Management changes frequently both in terms of structure and personnel. This had consequences for the project in terms of continuity in the implementation of RAD-QAP. It was noted that new managers did not prioritise quality assurance processes until their second year in post. This affected the implementation of RAD-QAP as a project. The decision was made to implement RAD-QAP at departmental level as opposed to hospital level. This was
due to the stability of the departmental managers. It was noted that once a department had implemented RAD-QAP it continued to be used there.

RAD-QAP structures, requirement components and protocols which were developed to provide a structured approach to assuring quality in a department, were found to be effective. When applied in totality in the correct order they achieved quality through allowing experts to work together to address the quality agenda. Implementation of RAD-QAP addressed many of the problems which lay in the absence or lack of enforcement of standards, legislation and management processes. Multidimensional KPI measurements on the scorecard aligned with organisational goals providing effective and powerful information about the quality of the service. Quality improvement in one area will stimulate improvement in another as RAD-QAP provides a balanced overview of operations in radiology. The KPI measurements taken against a set target provide validation when compliance is achieved and maintained over time. Periodic review of the measurements provides verification of the quality improvements against a baseline. During this research, many problem areas within radiology were identified and addressed enhancing the quality of service.

8.9 Research Contributions

The development of RAD-QAP contributed to research in establishing a working model with a template to guide implementation (chapter7) consisting of the following:

- A radiology quality assurance programme, consisting of 7 components and requirements with a step by step template to guide implantation,
- A method to select a set of appropriate radiology specific KPIs,
- An example of a quality assurance scorecard as central data collection tool,
- An illustration of how the resultant programme can be assessed.

RAD-QAP can be used to identify quality shortfalls through measurement that can instigate change with the appropriate remedial action. The 7 components of RAD-QAP (Chapter 7) with requirements provide quality assurance to a radiology department. The quality profiling component provides a method to select high risk KPIs that will target areas where it is needed most. Non-compliant KPIs identify quality shortfalls and instigate quality improvement quality improvement plans accordingly. The quality profiling component of RAD-QAP requires a service analysis to identify areas that needs urgent improvement in radiology.
Incident, complaints and risk assessments form part of these analyses. This component of RAD-QAP provides a standardised method for selecting the relevant radiology KPIs based on highest risk, thus providing a baseline measuring against set standards and addressing quality shortfalls with focused quality improvement initiatives.

RAD-QAP is not only a management but also a measurement system that enables radiology to clarify their vision and strategy and translate them into action. RAD-QAP uses quality assurance scorecards to display, track and trend quality data at one central point. KPI data is displayed year on year and month on month and provide an overview of the state of quality at a glance. KPIs more than 20% below the set target is flagged in red, measurements within 20% of set target, is flagged with yellow and compliant KPIs are flagged in green. Corresponding quality improvement plans to remedy situation and responsible person are also recorded. The scorecard gives oversight of which areas needs to be managed urgently. RAD-QAP provides quality assurance to radiology department with measurable quality improvements against the baseline. The scorecard became a prominent and useful tool used for performance reviews. The quality assurance scorecard for radiology aligns activities to the vision and strategy of the organisation; it improves internal and external communications, and monitors organisation performance against strategic goals. RAD-QAP verifies quality improvement through measurable KPI data and provides quality assurance to a radiology department.

Monthly performance reviews to discuss non-compliant KPIs provide verification that actual quality improvement is taking place and is sustained over time. The results achieved post implementation of RAD-QAP would suggest that the programme is effective in identifying and addressing quality shortfalls with sustained appropriate remedial action. RAD-QAP achieved quality assurance through repeated cycles of continuous measuring against the set targets until compliance and gradually a shift from re-active to pro-active risk management is achieved. This shift then allows for risk assessments to be carried out and issues to be addressed pro-actively before incidents occur. The programme’s effectiveness is assessed by the ratio of pro-active versus re-active quality improvement initiatives (Pro-active QIP’s: Reactive QIP’s). The initial ratio of 10:1 in favour of reactive risk management improved to 3:12 in favour of pro-active risk management following the implementation of RAD-QAP (R: P =10:1 Vs. R: P =3:12). The ultimate goal of RAD-QAP is to achieve pro-active risk management to enhance patient safety and the quality of the service delivered in radiology.
8.10 **Benefits of RAD-QAP**

This research has benefited the hospitals, service users of the hospitals, the researcher and the broader Radiology community.

8.10.1 *Case hospital*

The learning from the research has been shared with the case hospital. Radiology is now compliant with SI 125 of 2000 and SI 478 of 2002. Learning has led to improvement of the management of software systems in the hospital. Quality checks were set up for equipment. Audits are regularly performed to verify the accuracy of the data entry.

A defined set of goals and a prioritised set of KPIs have been developed in the directorates where the action research took place. Focus is on a monthly review of quality data and focusing primarily on achieving a defined suite of goals. A quality assurance scorecard was developed for the Radiology as part of RAD-QAP and results suggested improvement against the baseline.

This research has contributed a practical and useful escalation process that can be used where agreed standards have not been attained. Implementation of RAD-QAP in the organisation has led to successful utilisation of a previously underutilised document management system. Successful use of this system facilitates greater visibility of the status of policies and audits within the organisation which in turn has led to the management of policies within the organisation being overhauled.

Implementation of RAD-QAP has provided clarity in relation to the status of quality and safety within the domain. Implementation of RAD-QAP has facilitated multi-disciplinary staff working together to achieve common goals. Working with smaller sample sizes allowed rapid turnaround of audit and quality improvement practices.

8.10.2 *Patients / service users*

Through the implementation of RAD-QAP in radiology quality shortfalls were indentified and addressed. Improvements in the management of vital components in radiology produced modifications and quality improvement plans leading to measurable improvements in the service received by patients. Protocols were developed and implemented as a result of RAD-QAP.
Protocols were developed for the communication of critical findings and significant findings. The communication of significant findings is now managed in line with evidence-based best practice. Sentinel information is provided in a timely manner to those who require it and there is evidence that this is now acted upon. Restricted access to the department was implemented by radiology specific swipe cards to reduce inappropriate interruptions during radiology reporting sessions to facilitate optimal reporting environment to support accuracy of reports. A Vetting protocol for radiology request was developed to allow for a numbering system based on clinical criteria to assure patients with highest clinical need are prioritized. Structured reporting template was adopted to manage and reduce errors with the voice recognition further. Continuous audit for grammatical errors and any impact on clinical diagnosis are audited weekly, the rate reduced from 8% to 5% for a specific radiologist that had issues with VR. Sub-optimal and repeat images are reduced as a result of a QA programmed that added an image reject analysis on NIMIS for root cause analysis, focused learning and training reduced the number of sub-optimal images. Balancing the radiologist’s workload yielded a 10% increase in reporting activity that facilitated the clearing of a backlog of 2000 general images addressing a high risk of delayed diagnosis and treatment. A Web based text system to remind patients of their appointments reduced the number of patients with 20% and intravenous extravasations reduced by 35% over a 9-month period through equipment replacement and training of staff.

8.10.3 Health Care Quality Management

An extensive literature review was undertaken, and this highlighted a gap in the literature in relation to definitions of quality in radiology. The research points out that the data provided by RAD-QAP is objective and form a solid foundation that serves as a reference for all quality improvement initiatives. The combination of the objective data and the subjective human element with related processes combines to allow for a holistic and balanced approach to quality improvement in the acute Radiology setting.

8.10.4 Learning

RAD-QAP was implemented across the group and transferred into other departments other than radiology. Directorate meetings are structured around KPI review using the scorecards designed for RAD-QAP [25] [26].
RAD-QAP highlights the importance of pro-active versus reactive management and stimulated the design of governance structure to capture and promote these principles. The KPIs in the quality profiling component of RAD-QAP selected focus on the urgent high-risk issues that needs attention, while the structure component of RAD-QAP require the development of evidenced based policies, procedures, protocols and guidelines which are scheduled for protocol compliance audits.

The results of the audits stimulate training session to address the shortfalls pro-actively. The protocols are audited weekly as per the audit forward plan any non-compliance is then addressed by communicating the audit results and listing the root case for non-compliance, training is then provided if needed. This process has improved protocol compliance from 82% to 96%. The quality data component requires that evidence-based protocols be developed, and this brings current knowledge and enhances continuous learning for staff. Student training has improved due to updated and standardized protocols. Radiographers have earned continuous professional development (CPD) points in the process,

A high-level representation of the programme can be observed in Figure 7.1. The programme is described in detail in Chapter 7.

8.11 Limitations of the Research

[161] points out that “a case study will never provide conclusions with statistical significance. On the contrary, many kinds of evidence, figures, statements, documents are linked together to support a strong and relevant conclusion.” This lack of statistical significance may be a weakness in this research [161].

As discussed in Chapter 2 radiology departments face challenges in managing resistance to change. Implementation of change created difficulties. Initial apprehension of staff towards quality management posed a barrier that required patience and creative approach to overcome obstacles. Radiologists have time constraints and find it difficult to allocate time to audit and quality initiatives. Releasing staff to attend information sessions is an obstacle due to resource issues. The implementation and monitoring of the changes generated by KPI review meetings took further time and resources which were not always available. In the early stages it took time and energy from the domain leads to establish RAD-QAP as a daily activity as opposed to a once off exercise. It will take time and determination and resource allocation to
support that periodic data collection for population of the scorecard to be maintained in the department in the long term. Quality management requires dedicated staff to manage and coordinate the output from RAD-QAP to yield full benefits to radiology. It does, however, mean capital investment in additional resources. Inclusion of KPIs for national clinical care programme has prioritised MRI scans for cancer staging patients, and as a result, the department are compliant with these KPIs to manage the risk of delayed diagnose and treatment. This has a fall out that other types of patients are then deprioritised which is evident in the long waiting lists in MRI and ultrasound for other types of diseases. These remain a challenge.

8.12 Recommendations for Further Research

RAD-QAP has been implemented in the domain radiology setting in an Irish acute hospital. Future research is recommended to analyse the applicability of the programme to other health care domains such as primary care. It is further recommended that RAD-QAP be tested for implementation in other countries both within and outside the European Union to test its international applicability.

In this research, overall quality issues have been addressed in hospitals by focusing on the identification and remedy of quality shortfalls. RAD-QAP has been implemented at departmental level. Future research should explore the use of RAD-QAP at a higher level to provide quality assurance for more than just a radiology department. Work on developing a composite data basis for storing the quality measurements over time will be useful. Calculating proactive versus the reactive risk management ratio, develop a risk matrix to complement and strengthen the programme.

8.13 Conclusion

As a conclusion, it is important to reflect on what the development of RAD-QAP gives to radiology. The researcher has seen that good structures lead to good processes which in turn lead to good outcomes. For example, implementation of RAD-QAP within the radiology has decreased the number of repeat x-rays, reducing patient exposure to radiation and increasing efficiencies in the department. Root cause analysis of repeats led to focused training and
refresher courses in technique were given to address the problem as part of the in-house structured CPD programme that resulted from RAD-QAP.

RAD-QAP is a fair and transparent system as it gives staff an opportunity to correct their practice prior to governance and consequence as they are aware, prior to audit, of the standards that are of high priority and of the escalation process that will follow in the event of non-compliance. Education provided to staff provided opportunity professional development. There is a legal requirement for doctors to engage in audit and RAD-QAP assures that this occurs. The development of a scorecard reduces information overload and measures and displays prioritised safety issues that needs to be addressed urgently.

Radiology continues to use RAD-QAP an essential tool in assuring departmental standards as well as implementing the HIQA Standards for Better Safer Healthcare. KPI data provides objective evidence of measurable quality that provides evidence of real improvement.

Developments in the field of radiology and in other medical departments will advance. Definitions, requirements and standards for quality will change. Robust implementation of quality assurance processes must be central to the running of an organization. Quality and patient safety will however always be the goal of a quality programme. This is the way to confirm continuous quality improvement based on objective evidence provided at any point in time by a set of KPIs that reflects the state of quality in radiology that takes the context reality of the specific environment into account. This is an objective method to measure that management decisions are made based on KPI Data measurements that reflects quality performance against a set target. We can manage what we can measure.
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Appendix I. **Complete list of Radiology KPIs identified in the literature.**

This list was reduced by the Delphi consensus study to provide a manageable number of KPIs for the first iteration of RAD-QAP.

<table>
<thead>
<tr>
<th>Comprehensive list of KPIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of radiographers per scanner capacity [2] [27] [29] [31]</td>
</tr>
<tr>
<td>2. Appropriateness of modality [1] [29] [187] [34]</td>
</tr>
<tr>
<td>3. Time to next available Frequency with which patients are screened for pregnancy [24]</td>
</tr>
<tr>
<td>4. Percentage of radiographers registered with the national statutory body [24] [103]</td>
</tr>
<tr>
<td>5. MRI frequency for screening patients for ferro magnetic objects [24]</td>
</tr>
<tr>
<td>6. Percentage of studies that has standardised protocol in place [24] [29]</td>
</tr>
<tr>
<td>7. Compliance % with protocols [1] [24]</td>
</tr>
<tr>
<td>8. Dose Area Product (DAP) for pts not within guidelines of dose reference levels article 1 [103]</td>
</tr>
<tr>
<td>9. Frequency with which the wrong examination is performed on the correct patient [24]</td>
</tr>
<tr>
<td>10. Frequency of three-point id check used [24] [187]</td>
</tr>
<tr>
<td>11. Examination repeat rate due to incomplete or inadequate imaging [24] [103]</td>
</tr>
<tr>
<td>12. Frequency of adverse safety events in MRI [24] [29] [103]</td>
</tr>
<tr>
<td>13. Frequency of obtaining informed consent [24] [29]</td>
</tr>
<tr>
<td>14. Frequency of obtaining adequate tissue with biopsy [24] [29] [24]</td>
</tr>
<tr>
<td>15. Number of slips trips and falls reported [24] [31]</td>
</tr>
<tr>
<td>16. Frequency of interpretation errors [24] [58] [16]</td>
</tr>
<tr>
<td>17. Number of amendments to reports after it was sends out to the referrer [103]</td>
</tr>
<tr>
<td>18. Number of unreported images in x no of days [29] [27]</td>
</tr>
<tr>
<td>19. Number of additional investigations recommended by the radiologist [1] [31]</td>
</tr>
<tr>
<td>20. Frequency of patient satisfaction surveys and number of QIPs implemented [16] [103] [31]</td>
</tr>
<tr>
<td>21. Number of incidents [1] [58] [29]</td>
</tr>
<tr>
<td>22. Number of complications intravenous extravasations, pneumothoraxs rates, post</td>
</tr>
</tbody>
</table>
procedure hematomas, contrast media reactions, adverse drug reactions [24] [34][1]

23. Number of complaints [1] [24] [103] [16] [24] [29] [31] [58] [103]

24. Access to next available appointment outpatient per modality [187] [24]

25. Length of waiting lists [34] [16] [58]


27. % of cancellations [29] [31]

28. Did not arrive (DNA) rate [29] [31]

29. Patient total turnaround time per modality/in patients and out patients [187]

30. Report turnaround time per modality /in pts and out pts [187] [58] [29] [31][1]

31. Justification of referrals [197] [1] [29] [103]

32. Effective vetting system in place to achieve equitable fair access based on clinical details [187] [1] [24]

33. Number of radiographers per scanner capacity [29] [103]

33. Appropriateness of modality [1] [29] [16]

34. Time to next available appointment [24]

35. Examinations completed but not reported [24][1]

36. Picture Archiving Communication System (PACS) related issues network issues

37. Critical events sentinel events, near misses [58] [103] [58]

38. Radiation issues patient exposure, staff exposure, referral guidelines in place [103] [34]

39. Image quality issues no of sub optimal images [29] [103] [1] [187]

40. Number of patients recalled for repeat imaging [24]

41. Number of equipment included in the Quality Assurance Programme [29] [27] [31]

42. Number of equipment failures [103]

43. Equipment utilisation Ratio of number of hours available and number of hours in use [29]

44. Equipment staffing level ratio of number of imaging staff to number of machines [29]

45. Examination ordered but not performed [29]

46. Radiology/pathology correlation -Radiology/ultrasound correlation [34]

47. Peer review [58] [16][1] [34] [29]
48 Patient misidentifications [34] [29] [103]
49. Reading errors misinterpretation of findings [58] [16] [1] [34] [29]
50. Environment: environmental errors such as patient accident after sedation [31] [58] [29] [1]
51. Test: performing the wrong procedure or procedural compilations [24] [29] [31]
52. Allergy: allergic reaction [24] [1] [187]
53. Injection: wrong material or dose injection [24]
54. Side: Performing procedure on wrong side [24]
55. Correlation of radiological findings with pathological findings per modality [58]
56. False negative [24] [58] [29] [1] [187] [34]
57. False positive rates [24] [58] [29] [1] [187] [34]
58. Peer review agreement rate [58] [29] [1] [187] [34]
59. Percentage of examinations with unnecessary recommendations [24]
60. Rate of compliance with standardised protocols [102] [34] [58]
61. Error rate of VR software system [58]
62. Patient Satisfaction [24] [29] [103] [58]
63. Radiography staff number of examinations performed per staff whole time [29] [187]
64. No of physician surveys yearly to test satisfaction [24]
65. Number of new installations hardware software [31] [34]
66. Number of upgrades [29] [34]
67. % of total department budget spent on informatics improvements and upgrades [29]
68. Success rate of new informatics initiatives [29] [31] [27]
60. Number of new referrers [29]
70. Total number of referrer’s total number of referrals from all physicians [29]
71. Total Demand [29]
72. Total Capacity [31]
73. Number of new referrers [31]
74. Total number of requests [24]
75. Number of patients done [24]
76. Number of patients cancelled [24] [103]  
78. Total number of examinations [24]  
79. Compliance with directives [187]  
80. Policy formulation number of new ad updated policies [103]  
81. Harassment free work environment [29] [103] [187]  
82. Number of complaints from staff [103] [31]  
83. Vacation utilization [29] [31]  
84. Workload unsocial hrs. worked per WTE [29] [103]  
85. Commute average hours spent commuting [29] [103]  
86. Variety of work rostering number of different types of examination performed by radiographer [29] [31] [103]  
87. Continuity of staff [1]  
88. Number Full WTE [16]  
89. Number of vacant posts [103] [29]  
90. % Staff turn over [24]  
91. Staff satisfaction rate [1] [29] [10] [187] [24] [29] [31]  
92. Total % of pts getting info by post before scans [103]  
93. Total % spend on overtime [29]  
94. Percentage of patients scheduled within x minutes from initiating phone call [24]  
95. Intra departmental review of image interpretation by staff [29][58]  
96. Percentage of phone calls answered within x minutes [24]  
97. Number of risk assessments [24]  
98. Number of QIP Implemented as a result of risk assessments [24][1]  
99. No of QIP’S Not implemented [29]  
100. Number of conferences attended by Radiologists [103]  
101 % of Radiologists compliant with CPD requirements [24]  
102. % of Radiographers complying with CPD requirements [24] [29] [21] [103]  
103% of Radiographers attending training courses [24]  
104. % of Radiographers complying with CPD requirements [24]
<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>105.</td>
<td>% of Administrative staff attending courses [29] [31]</td>
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<tr>
<td>106.</td>
<td>Number of Research Projects [103]</td>
<td></td>
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<tr>
<td>108.</td>
<td>Number of Multi-Disciplinary Meetings [58] [16]</td>
<td></td>
</tr>
<tr>
<td>109.</td>
<td>Ratio of Radiologists/Radiographers/ Attendants/ nurses per machine [29]</td>
<td></td>
</tr>
<tr>
<td>110.</td>
<td>Number of full time Radiographers per week [103]</td>
<td></td>
</tr>
<tr>
<td>111.</td>
<td>Number of WTE Radiologists [29]</td>
<td></td>
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<tr>
<td>109.</td>
<td>Number of locum staff [29]</td>
<td></td>
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<tr>
<td>110.</td>
<td>Number of support staff [29]</td>
<td></td>
</tr>
<tr>
<td>111.</td>
<td>Total No of Absences [1] [58]</td>
<td></td>
</tr>
<tr>
<td>112.</td>
<td>Long-term Absences Radiographers [29]</td>
<td></td>
</tr>
<tr>
<td>113.</td>
<td>No of positions not filled by permanent full-time staff [103]</td>
<td></td>
</tr>
<tr>
<td>114.</td>
<td>Number of locum staff [29]</td>
<td></td>
</tr>
<tr>
<td>115.</td>
<td>Number of administrative staff [187] [103]</td>
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</tr>
<tr>
<td>116.</td>
<td>Number of vacation days available: versus no of days taken [29]</td>
<td></td>
</tr>
<tr>
<td>117.</td>
<td>Non-Pay (Stock Consumables) [29]</td>
<td></td>
</tr>
<tr>
<td>118.</td>
<td>Over all Pay [103]</td>
<td></td>
</tr>
<tr>
<td>119.</td>
<td>Medical Pay [103]</td>
<td></td>
</tr>
<tr>
<td>120.</td>
<td>Medical Overtime [1] [16] [24] [29] [31] [58] [103]</td>
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</tr>
<tr>
<td>121.</td>
<td>Number. of MDM’S [58] [24]</td>
<td></td>
</tr>
<tr>
<td>122.</td>
<td>Number of patients discussed [58]</td>
<td></td>
</tr>
<tr>
<td>123.</td>
<td>Number of patients discussed [58] [103]</td>
<td></td>
</tr>
<tr>
<td>124.</td>
<td>Peer Review Performance [58]</td>
<td></td>
</tr>
<tr>
<td>125.</td>
<td>Number. of Discrepancy meetings [58]</td>
<td></td>
</tr>
<tr>
<td>126.</td>
<td>Number of Patients discussed [58]</td>
<td></td>
</tr>
<tr>
<td>127.</td>
<td>Total Number of Urgent findings communicated and acknowledged [58] [187]</td>
<td></td>
</tr>
<tr>
<td>128.</td>
<td>Total Number of Unexpected significant findings communicated [58]</td>
<td></td>
</tr>
</tbody>
</table>

This list serves as a “parking lot” for KPIs to be added or deleted according to compliance.
Appendix II. Inquiry Themes

The inquiries findings were mapped to health care standards and governance principles to facilitate thematic analysis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td>Proactive risk assessments</td>
<td>Hayes</td>
</tr>
<tr>
<td></td>
<td>Proactive risk assessments</td>
<td>Hayes</td>
</tr>
<tr>
<td></td>
<td>Proactive risk assessments</td>
<td>Look Back review</td>
</tr>
<tr>
<td></td>
<td>Reactive risk management</td>
<td>To Err is Human</td>
</tr>
<tr>
<td></td>
<td>Adequate investigation and follow up</td>
<td>Francis Report</td>
</tr>
<tr>
<td>System</td>
<td>Identify System</td>
<td>Therac</td>
</tr>
<tr>
<td></td>
<td>Identify required output from system</td>
<td>Bristol/Lourdes/Therac/ IOM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building safer systems for better care</td>
</tr>
<tr>
<td></td>
<td>Get outcome</td>
<td>Bristol/Lourdes/Therac</td>
</tr>
<tr>
<td></td>
<td>Use outcome</td>
<td>Bristol/Lourdes/Therac</td>
</tr>
<tr>
<td></td>
<td>Identify safety requirements for software</td>
<td>Therac</td>
</tr>
<tr>
<td></td>
<td>Do not be overconfident in software</td>
<td>Therac</td>
</tr>
<tr>
<td></td>
<td>Do not confuse safety with reliability</td>
<td>Therac</td>
</tr>
<tr>
<td></td>
<td>Independent checks required so that the machine is working properly</td>
<td>Therac/Hayes</td>
</tr>
<tr>
<td></td>
<td>Verification of data input on systems</td>
<td>Therac/Hayes/ IOM</td>
</tr>
<tr>
<td>Governance</td>
<td>Critical component that must be in place</td>
<td>Bristol/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>Lourdes/ Look back</td>
</tr>
<tr>
<td>QA System</td>
<td>Co-ordinated approach</td>
<td>Bristol/Lourdes</td>
</tr>
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</tr>
<tr>
<td></td>
<td>Robust Quality Assurance Programmes</td>
<td>Bristol/Lourdes/Therac</td>
</tr>
<tr>
<td></td>
<td>Protected time for quality assurance processes</td>
<td>Bristol/Lourdes</td>
</tr>
<tr>
<td></td>
<td>Dangerous to rely solely on dedication, loyalty and integrity. Safe independent quality assessment processes and assurance must be put in place.</td>
<td>Lourdes</td>
</tr>
<tr>
<td>Change</td>
<td>Capital Investment in required</td>
<td>Bristol/Port Laois</td>
</tr>
<tr>
<td></td>
<td>There are no short cuts</td>
<td>Bristol/Port Laois/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Change can only be brought about by the willing participation of all stakeholders</td>
<td>Bristol/Hayes/Savita/IOM</td>
</tr>
<tr>
<td>Culture</td>
<td>Openness and transparency required</td>
<td>Bristol/ Look Back/IOM/Tallaght</td>
</tr>
<tr>
<td></td>
<td>Cultural change takes time</td>
<td>Lourdes/ St Francis/ Freedom to speak up</td>
</tr>
<tr>
<td></td>
<td>Safety of patients is important</td>
<td>Bristol/ Savita</td>
</tr>
<tr>
<td></td>
<td>Learn from sentinel events</td>
<td>Bristol/ Savita/ Port Loais</td>
</tr>
<tr>
<td></td>
<td>Culture of quality must be maintained</td>
<td>Bristol</td>
</tr>
<tr>
<td></td>
<td>Accept responsibility when things go wrong</td>
<td>Bristol/ Hayes</td>
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<tr>
<td></td>
<td>Supportive and flexible promoting continued improvement in the quality of care</td>
<td>Bristol/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Truthful and honest</td>
<td>Bristol/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Standards of ethical behaviour</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td>Teamwork</td>
<td>Not too much private practice</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td>----------</td>
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</tr>
<tr>
<td></td>
<td>Multi-disciplinary review</td>
<td>Lourdes/ Barrington’s/ Port Laois/ Savita</td>
</tr>
<tr>
<td></td>
<td>Multidisciplinary team approaches</td>
<td>Lourdes/Hayes</td>
</tr>
<tr>
<td></td>
<td>All should assist preparing annual reports</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Teamwork is vital</td>
<td>Bristol/ IOM/Savita</td>
</tr>
<tr>
<td></td>
<td>Professions should shadow each other</td>
<td>Bristol/Savita</td>
</tr>
<tr>
<td></td>
<td>No sense of a cohesive team, between clinical and administrative staff</td>
<td>Tallaght/Hayes/ Savita/ Freedom to speak up</td>
</tr>
<tr>
<td></td>
<td>Teamwork with appropriate discussion before and after events</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Multi-disciplinary liaison</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td>Leadership</td>
<td>Leadership skill should be developed in all profession with training</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td></td>
<td>Disciplinary processes in place deal with at a local level</td>
<td>Bristol/ Look back Review</td>
</tr>
<tr>
<td></td>
<td>Management and leadership vital</td>
<td>Lourdes/ Francis/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Problems where possible should be sorted at hospital level, this is not costly but requires support</td>
<td>Lourdes/Savita/ Radiology Survey</td>
</tr>
<tr>
<td></td>
<td>Revolving leadership</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Guided by agreed standards</td>
<td>Lourdes/ Hayes/Look back Review</td>
</tr>
<tr>
<td></td>
<td>Independent mechanisms of regulation</td>
<td>Look back/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Leadership</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td>Management</td>
<td>Lead clinician must have authority to manage staff</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td>------------</td>
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<td>----------------</td>
</tr>
<tr>
<td></td>
<td>Lead clinician must have authority to delegate</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Inefficiency of management structure with too many reporting to CEO</td>
<td>Tallaght</td>
</tr>
<tr>
<td></td>
<td>Lead clinician needs to be in place for 5 years</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Lead clinician needs to be supported</td>
<td>Lourdes/ Port Laois</td>
</tr>
<tr>
<td></td>
<td>Delegate responsibilities</td>
<td>Lourdes/ Port Laois</td>
</tr>
<tr>
<td></td>
<td>Clear and understood list of duties/responsibility and accountability</td>
<td>Bristol/ Hayes</td>
</tr>
<tr>
<td>Staff</td>
<td>Staff provide a service and should be held accountable</td>
<td>Lourdes/Tallaght/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Listen to staffs concerns</td>
<td>Lourdes</td>
</tr>
<tr>
<td></td>
<td>Someone with a good reputation can also make mistakes</td>
<td>Tallaght/Savita</td>
</tr>
<tr>
<td></td>
<td>Staff complaints should not be ignored</td>
<td>Lourdes/Francis</td>
</tr>
<tr>
<td></td>
<td>Team work between disciplines</td>
<td>Bristol/Barrington’s/</td>
</tr>
<tr>
<td></td>
<td>Capacity of resources. Demand vs capacity must be analysed</td>
<td>Lourdes/Hayes/ Look Back Review</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication, courtesy</td>
<td>Lourdes/ Hayes /Look Back</td>
</tr>
<tr>
<td></td>
<td>Communication and learning</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Key stakeholders left out of communications</td>
<td>Tallaght/National Radiology Survey</td>
</tr>
<tr>
<td></td>
<td>Poor quality of communication</td>
<td>Tallaght/Hayes/ Francis</td>
</tr>
<tr>
<td>Management structures need serious changes in training, continuity and accountability.</td>
<td>Lourdes/ Savita</td>
<td></td>
</tr>
<tr>
<td>Develop communication skills</td>
<td>Bristol/ Freedom to speak up/ Francis Report</td>
<td></td>
</tr>
<tr>
<td>Act on findings</td>
<td>Lack of effective action</td>
<td>Tallaght/IOM</td>
</tr>
<tr>
<td>Where problems were reported it did not result in effective action</td>
<td>Tallaght/ Hayes</td>
<td></td>
</tr>
<tr>
<td>Excellence in practice</td>
<td>Lack of knowledge of desired norm</td>
<td>Tallaght/ Hayes</td>
</tr>
<tr>
<td>Things will go wrong but what is acceptable</td>
<td>Tallaght/ Francis</td>
<td></td>
</tr>
<tr>
<td>Failure can creep in and become systematic</td>
<td>Tallaght/ Francis</td>
<td></td>
</tr>
<tr>
<td>Keep up to date</td>
<td>Tallaght</td>
<td></td>
</tr>
<tr>
<td>There can develop an expectation of poor practice</td>
<td>Tallaght</td>
<td></td>
</tr>
<tr>
<td>Invalidated belief in excellence</td>
<td>Tallaght</td>
<td></td>
</tr>
<tr>
<td>Continuous learning, competence assurance, incident reporting with follow through audit</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Change analyses, review and learning are the keys to best practice.</td>
<td>Lourdes/ Hayes</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>Lourdes/Hayes/ Look Back/Barringtons</td>
<td></td>
</tr>
<tr>
<td>Basic correct practices</td>
<td>Therac</td>
<td></td>
</tr>
<tr>
<td>Measuring</td>
<td>Limited clinical audit/monitoring and tracking of measurements</td>
<td>Tallaght</td>
</tr>
<tr>
<td>Review the performance of current IT and act on findings</td>
<td>Tallaght/ Hayes</td>
<td></td>
</tr>
<tr>
<td>Reports from systems must be generated and where</td>
<td>Tallaght</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Location/Reference</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Equity</td>
<td>Inclusive system, sensitive to the needs and cultures of others.</td>
<td>Lourdes/Francis/ Hayes</td>
</tr>
<tr>
<td>Accurate Information and Data</td>
<td>Dta on NIMIS must be verified</td>
<td>Lourdes/NIMIS Survey</td>
</tr>
<tr>
<td>Competency/Capacity</td>
<td>Periodic Appraisal</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td></td>
<td>There should be the capacity to perform</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td></td>
<td>CPD</td>
<td>Lourdes/Hayes</td>
</tr>
<tr>
<td></td>
<td>Enough work to maintain competencies</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Themes and stakeholders are all part of the same process. Each needs the other to achieve the end goal.</td>
<td>Bristol/Hayes</td>
</tr>
<tr>
<td>Cross fertilization</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>Cross fertilisation from other units</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Visit other hospitals</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Results from medico-legal cases should be disseminated.</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Present with other hospitals</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Work in other units</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Key data forwarded nationally</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Lourdes</td>
<td></td>
</tr>
<tr>
<td>Induction.</td>
<td>Lourdes</td>
<td></td>
</tr>
<tr>
<td>Training on clinical governance</td>
<td>Lourdes/Hayes/Savita</td>
<td></td>
</tr>
<tr>
<td>Educate juniors regarding risk and incident reporting</td>
<td>Lourdes</td>
<td></td>
</tr>
<tr>
<td>Education, registration, training, CPD and revalidation as well as disciplinary matters</td>
<td>Bristol/Hayes</td>
<td></td>
</tr>
<tr>
<td>CPD</td>
<td>Bristol/Francis/Hayes</td>
<td></td>
</tr>
<tr>
<td>Learning across professional boundaries</td>
<td>Bristol/Barringtons</td>
<td></td>
</tr>
<tr>
<td>CPD for all professions</td>
<td>Bristol/Hayes</td>
<td></td>
</tr>
<tr>
<td>Multi-professional teams to learn, train and develop together</td>
<td>Bristol/Hayes</td>
<td></td>
</tr>
<tr>
<td>Review competency for roles</td>
<td>Bristol/Freedom to speak up</td>
<td></td>
</tr>
<tr>
<td>There must be validation and re-validation of skills</td>
<td>Bristol/Francis</td>
<td></td>
</tr>
<tr>
<td>Staff should be adequately qualified</td>
<td>Bristol/Port Loais</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Bristol/Hayes/Francis</td>
<td></td>
</tr>
<tr>
<td>A few high-quality performance indicators</td>
<td>Bristol/Hayes/Francis</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Publication of performance and standards</td>
<td>Bristol/ Hayes</td>
<td></td>
</tr>
<tr>
<td>Lack of appropriate protocols</td>
<td>Tallaght/ look back/Hayes/ IOM</td>
<td></td>
</tr>
<tr>
<td>Failure of implementation of policy</td>
<td>Tallaght/Hayes/Port Laois</td>
<td></td>
</tr>
<tr>
<td>Failure of reporting compliance with policy</td>
<td>Tallaght/Port Laois</td>
<td></td>
</tr>
<tr>
<td>Lack of a single corporate identity with a strong sense of direction</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Adopt protocols as a condition of licensing</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Implement protocols</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Develop and implement monitoring frameworks</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Consider administrative staff being monitored through the clinical directorate structure.</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Need effective peer review and independent audit</td>
<td>Tallaght/Hayes</td>
<td></td>
</tr>
<tr>
<td>Changes need not be high tech or expensive</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Accurate note taking</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Awareness of correct data</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>IT support necessary</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>All should have basic computer skills</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Should be possible to extract key data for internal and external audit</td>
<td>Lourdes/Hayes</td>
<td></td>
</tr>
<tr>
<td>Multidisciplinary clinical audit to the core</td>
<td>Bristol/ Hayes</td>
<td></td>
</tr>
<tr>
<td>A single approach to data collection</td>
<td>Bristol/ Hayes</td>
<td></td>
</tr>
<tr>
<td>Invest in IT so that the fundamental principles of</td>
<td>Bristol/ IOM</td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>Care must be of an appropriate standard</td>
<td>Bristol/ Hayes/ Savita</td>
</tr>
<tr>
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<td>----------------------------------------</td>
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</tr>
<tr>
<td></td>
<td>Single set of standards - use national ones where possible</td>
<td>Bristol/ Radiology Survey/ Hayes</td>
</tr>
<tr>
<td></td>
<td>Standardisation of care</td>
<td>Lourdes/ Savita</td>
</tr>
<tr>
<td></td>
<td>Same standards regardless of hospital.</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td></td>
<td>No micro managing just robust protocols</td>
<td>Tallaght/ Hayes/ Savita</td>
</tr>
<tr>
<td></td>
<td>No personal and unwritten guidelines</td>
<td>Lourdes/ Hayes/ Francis</td>
</tr>
<tr>
<td></td>
<td>Set standards</td>
<td>Hayes</td>
</tr>
<tr>
<td></td>
<td>Continually review standards</td>
<td>Hayes/ Savirta</td>
</tr>
<tr>
<td>Patients</td>
<td>Patients must be involved in decisions about their care</td>
<td>Bristol/Savita</td>
</tr>
<tr>
<td></td>
<td>Partnership between healthcare professions and the patient</td>
<td>Bristol/Savita</td>
</tr>
<tr>
<td></td>
<td>Keep the patient informed</td>
<td>Bristol/ Savia</td>
</tr>
<tr>
<td></td>
<td>Communicate with patients</td>
<td>Bristol/Savita</td>
</tr>
<tr>
<td>Topic</td>
<td>Description</td>
<td>Responsible Party</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Support Patients</td>
<td>Consent should be a process, not just signing a form</td>
<td>Bristol/ Savita</td>
</tr>
<tr>
<td></td>
<td>Accept feedback from patients</td>
<td>Bristol/ Savia/ Baringtons</td>
</tr>
<tr>
<td></td>
<td>Patient outcome central</td>
<td>Bristol/ Baringtons</td>
</tr>
<tr>
<td></td>
<td>Must be patient centred</td>
<td>Bristol/ Baringtons</td>
</tr>
<tr>
<td></td>
<td>Hear and take into account patients and publics perspectives.</td>
<td>Bristol/ Baringtons</td>
</tr>
<tr>
<td>Complaints</td>
<td>Procedures for dealing with complaints</td>
<td>Lourdes/ Francis</td>
</tr>
<tr>
<td></td>
<td>Audit of complaints</td>
<td>Lourdes/ Hayes</td>
</tr>
<tr>
<td>Sentinel Events</td>
<td>Regular alert process</td>
<td>Lourdes/ Therac</td>
</tr>
<tr>
<td></td>
<td>Sentinel events</td>
<td>Lourdes/ Therac</td>
</tr>
<tr>
<td></td>
<td>Report sentinel events daily (no clinician can say “I did not know it was happening”)</td>
<td>Lourdes/ Hayes/ Look back Review</td>
</tr>
<tr>
<td></td>
<td>Report sentinel events</td>
<td>Bristol/ Lourdes/ Therac</td>
</tr>
<tr>
<td></td>
<td>Errors will happen. Important that they will be promptly detected, and remedial action taken</td>
<td>Tallaght/ Therac/ Look Back Review</td>
</tr>
</tbody>
</table>
Appendix III.  Document for consent to Access NIMIS

Consent Document for access to NIMIS to allow access to extract data to populate scorecard. This consent for access is in line with the case hospital’s data protection policy.

Dr Bryan Kenny
Clinical Director
Diagnostic Directorate
UL Hospitals
University Hospital Limerick

I am planning a research project to develop a Radiology Quality Assurance Programme. I intend to develop KPI’S for this purpose. I will need access to the NIMIS system to collect the appropriate data to enable me to calculate the measurements against the selected KPI’s. I am requesting consent to access the NIMIS System to collect the appropriate statistical data in the weekly reports generated by NIMIS. I will not be accessing any patient Health Care Records. I will be following the Data Protection and confidentiality policy of the HSE.

I thank you for your interest in my research.

Regards,

Martha Lötter

marti.lotter@hse.ie
Appendix IV.  

Consent Document for Radiologists

Consent Document for Radiologists/radiographers participating interview to select the appropriate Key Performance Indicators for the Radiology Department (KPI’s)

I am currently in the process of doing a research project developing a quality measurement scheme for a Radiology Department. For this purpose, a list of appropriate KPI’s must be selected from a list of KPIs generated from the extensive literature Review. I will appreciate if you will take part in the consensus Group to facilitate the selection of a short list of appropriate KPI’S for our specific Radiology Department.

It is a very simple and not time consuming. All you need to do is tick the KPI’s on the check list that you will deem most appropriate and useful from the list and give a short validation for the selection. I intend to repeat this elimination of KPI’s twice to reduce the list to a manageable number of KPI’s.

I will give feedback regarding the outcome of the consensus Group and follow it up with an interview and a Group meeting to discuss the outcome.

__________________________  ______________________  ____________
Radiologist                  Witness                     Date
Appendix V. Consent Document Used for Interviews

The following conditions were stipulated for the interviews.

My name is Marti Lotter and I would like to thank you for taking the time to meet with me today. I would like to talk to you about your experiences participating in radiology assurance programme (RAD-QAP) The purpose of this interview is to evaluate the programme’s effectiveness. I will use the information gained from these interviews to evaluate the programme and to improve it where interviewees find it to be weak. The interview should take less than half an hour. I will take notes, but I will not be able to write fast enough so I will also be taping the interview. Because we’re on tape, please be sure to speak up so that we don’t miss your comments. All responses will be kept confidential. This means that your interview responses will only be shared with me and my supervisor and we will assure that any information we include in our report does not identify you as the respondent. Remember, you don’t have to talk about anything you don’t want to and you may end the interview at any time.

Would you like to ask any questions?

I am willing to participate in this interview

__________________  ____________________  __________
Interviewee         Witness                Date
Appendix VI.  Conditions for Staff Interviews

One of the line managers required the following conditions be adhered to and this was acceptable.

1. UUNet will be identified by name in the final text without your visibility of the draft of that reference and context.

2. The views expressed by any participants are entirely their own and does not necessarily reflect the views of the HSE or the Department of Health and Children. In this context, academic freedom will be respected and recognised.

3. Any senior staff participants are approved to participate but at their own discretion on invitation from the researcher and no costs - travel, replacement, additional time- will be incurred by the services because of the participation of a staff member in the study.

4. Radiology Management approve of staff participation in the study during working hours unless where the requirement takes them away from duties or responsibilities that would in the view of their line manager compromise the service.

5. Once approval from the line manager was obtained, the participant was contacted and asked to participate.

__________________________  ________________  ____________
Interviewee                Witness            Date
Appendix VII. Interview Questions – Clinical Specialists /Managers in Modalities

These questions were used in the problem definition and validation phase of RAD-QAP.

<table>
<thead>
<tr>
<th>Probes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you elaborate on that idea?</td>
</tr>
<tr>
<td>I’m not sure I understand what you’re saying.</td>
</tr>
<tr>
<td>Is there anything else?</td>
</tr>
<tr>
<td>Would you explain that further?</td>
</tr>
<tr>
<td>Would you give me an example?</td>
</tr>
</tbody>
</table>

**Authority Component**

1. Why is strong leadership important to running a Radiology Department?
2. Please describe the governance structures Radiology Department?
3. Please describe how you think that those in a governance role can add to the improvement of the running of the Radiology Department?
4. Can you describe the role that managers have in ensuring patient safety in the Radiology Department?
5. What in your opinion can managers do to improve patient safety in the Radiology Department?
6. How do you think managers can improve the efficiency of the Radiology Department?
7. Can you give me an example of how managers have improved efficiency in the Radiology Department?
8. How do you think that managers can work to improve quality management in the Radiology Department?
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Can you give me an example of how a manager has improved quality in the Radiology Department?</td>
</tr>
<tr>
<td>10</td>
<td>In relation to patient safety within the Radiology Department, can you describe the role of senior management outside of and above those in the Radiology Department?</td>
</tr>
<tr>
<td>11</td>
<td>In relation to the efficient running of the Radiology Department can you describe the role of senior management outside of and above those in the Radiology Department?</td>
</tr>
<tr>
<td>12</td>
<td>Is strong leadership from outside the department important?</td>
</tr>
<tr>
<td>13</td>
<td>Is there a role for externals such as HIQA in the safe and efficient running of the department?</td>
</tr>
<tr>
<td>14</td>
<td>Can you give me an example of how a senior manager outside of the Radiology Department contributed to patient safety within Radiology Department?</td>
</tr>
<tr>
<td>15</td>
<td>There are different professions such as speech therapist, physiotherapists, nurses, and admin staff within the department. What do you think is the role of the managers in each profession in relation to the safe and efficient running of the department?</td>
</tr>
<tr>
<td>16</td>
<td>Can you describe the aforementioned how managers manage the quality of the data enter into the clinical information systems in the department?</td>
</tr>
<tr>
<td>17</td>
<td>Can you describe how the aforementioned managers can contribute to assuring the accuracy of the quality data within the clinical information systems?</td>
</tr>
<tr>
<td>18</td>
<td>Can you describe how the aforementioned managers contribute to ensuring staff use systems the captured data pertaining to quality to their fullest potential?</td>
</tr>
<tr>
<td>19</td>
<td>Why do you think audit is important for the safe running of Radiology Department?</td>
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<tr>
<td>20</td>
<td>Is evidence based best practice important?</td>
</tr>
<tr>
<td>21</td>
<td>How do you think a department should verify that evidence based best practice is followed?</td>
</tr>
<tr>
<td>22</td>
<td>Why do you think a department should measure its standards?</td>
</tr>
<tr>
<td>23</td>
<td>How do you think that a department should prove that it is operating in line with evidence based best practice?</td>
</tr>
<tr>
<td>24</td>
<td>Why do you think quality improvement is important?</td>
</tr>
<tr>
<td>25</td>
<td>Should quality improvement be incorporated into the day to day running of the Radiology Department?</td>
</tr>
<tr>
<td>26</td>
<td>Can you give an example of a quality improvement initiative that was successful in this Radiology Department?</td>
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<tr>
<td>27</td>
<td>Can you give an example of a good idea that was successful in this Radiology Department?</td>
</tr>
<tr>
<td>28</td>
<td>Can you give an example of an innovation that was successful in this Radiology Department?</td>
</tr>
<tr>
<td>29</td>
<td>How do you think that good practice, ideas and innovation should be disseminated?</td>
</tr>
<tr>
<td>30</td>
<td>Can you give an example of how good practice, an idea or an innovation was disseminated in this Radiology Department?</td>
</tr>
<tr>
<td>31</td>
<td>Why in your opinion is it important to address poor clinical performance?</td>
</tr>
<tr>
<td>32</td>
<td>How in your opinion should poor clinical performance be addressed?</td>
</tr>
<tr>
<td>33</td>
<td>What in your opinion is the importance of professional development programmes?</td>
</tr>
<tr>
<td>34</td>
<td>Can you give an example of how a professional development programme improved care delivery in the Radiology Department?</td>
</tr>
<tr>
<td>35</td>
<td>What in your opinion is the importance of high quality data keeping and record keeping?</td>
</tr>
<tr>
<td>36</td>
<td>Without high quality data keeping and record keeping how do you feel a Radiology Department can run successfully?</td>
</tr>
<tr>
<td>37</td>
<td>What in your opinion is the best way to assure high quality data?</td>
</tr>
<tr>
<td>38</td>
<td>What in your opinion is the best way to assure high quality record keeping?</td>
</tr>
<tr>
<td><strong>Quality Assurance Team</strong></td>
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</tr>
<tr>
<td>39</td>
<td>How do you think a team structure can drive the Quality Assurance Programme?</td>
</tr>
<tr>
<td>40</td>
<td>What in your opinion is the importance of coordinating the management of the quality of care in a department?</td>
</tr>
<tr>
<td>41</td>
<td>How do you think that a quality assurance team can contribute to the efficient running of the Radiology Department?</td>
</tr>
<tr>
<td>42</td>
<td>What role if any does the quality assurance team have in ensuring patient safety in the Radiology Department?</td>
</tr>
<tr>
<td>43</td>
<td>What role does the quality assurance team have in ensuring the quality of care in the Radiology Department?</td>
</tr>
<tr>
<td>44</td>
<td>Can you give me an example of how the quality assurance team has improved the efficiency of the computer systems in the Radiology Department?</td>
</tr>
<tr>
<td>45</td>
<td>Can you provide an example of how the quality assurance team has improved the running of the Radiology Department?</td>
</tr>
<tr>
<td>46</td>
<td>Would the Radiology Department be better off without a quality assurance team? (Can you expand on your answer?)</td>
</tr>
<tr>
<td><strong>Stakeholders</strong></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Can you describe how it is advantageous to have all staff represented on the</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>quality assurance team of the Radiology Department t?</td>
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</tr>
<tr>
<td>In your opinion who should be on the audit committee (roles not individual names)?</td>
<td></td>
</tr>
<tr>
<td>In your opinion who should not be on the audit committee (roles not individual names).</td>
<td></td>
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<tr>
<td>How would you structure a quality assurance team?</td>
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</tr>
<tr>
<td>51. Who in your opinion has the most to offer to a quality assurance team?</td>
<td></td>
</tr>
<tr>
<td>52. Can you describe how staff of all levels and professions within the department can contribute to the safe management of computer systems and medical devices?</td>
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</tr>
<tr>
<td>Can you describe how staff of all levels and professions within the department have a role in ensuring the quality information and data contained in the systems and medical devices?</td>
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<tr>
<td>Can you describe how staff of all levels and professions within the department have a role in flagging risks associated with medical devices?</td>
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<tr>
<td>Can you describe how staff of all levels and professions within the department can contribute to ensuring that medical devices and software systems are used to their fullest capacity?</td>
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<tr>
<td>Please describe how you feel that setting standards contributes to the efficient running of the Radiology Department?</td>
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</tbody>
</table>

**Standards**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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</thead>
<tbody>
<tr>
<td>Can you describe any existing standards in the Radiology Department?</td>
<td></td>
</tr>
<tr>
<td>In your opinion are standards important that X-Rays are taken correctly and in line with the ALARAP Principle?</td>
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<tr>
<td>How do you feel that standards contribute to the efficient reporting of X-Rays?</td>
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<tr>
<td>Question</td>
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<td>-------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Can you give an example of how having a standard has contributed to patient safety in the Radiology Department?</td>
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<tr>
<td>Can you describe how standards support the quality of the information in clinical information systems in the Radiology Department?</td>
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<tr>
<td>Can having standards reduce risk within the department?</td>
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<tr>
<td>Can having standards reduce the risk associate with clinical information systems within the Radiology Department?</td>
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<tr>
<td>Can set standards improve the quality of the data within information systems?</td>
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<tr>
<td>Can standards help that quality data captured are used to their fullest capacity?</td>
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<tr>
<td>Would the Radiology Department be better off without standards? (can you expand on your answer)</td>
<td></td>
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</tbody>
</table>

**Policies, procedures, protocols and guidelines**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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</thead>
<tbody>
<tr>
<td>What in your opinion is the function of Policies, Procedures, Protocols and Guidelines (PPPGs) for the Radiology Department?</td>
<td></td>
</tr>
<tr>
<td>Do PPPGs improve patient safety in the Radiology Department?</td>
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<tr>
<td>Can you give an example of how PPPGs contribute to patient safety in the Radiology Department?</td>
<td></td>
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<tr>
<td>Can you give an example of how PPPGs contribute to efficiency in the Radiology Department?</td>
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<tr>
<td>Does the existence of PPPGs reduce risk in the Radiology Department?</td>
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</tr>
<tr>
<td>Can you provide an example of how a PPPG reduced risk to a patient in the Radiology Department</td>
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<tr>
<td>In your opinion, would the Radiology Department be better off without PPPGs?</td>
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<tr>
<td>Communication</td>
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<tr>
<td><strong>74</strong> Can you explain how information is communicated across the Radiology Department?</td>
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</tr>
<tr>
<td><strong>75</strong> Is the current communication strategy in the Radiology Department effective? (Please expand)</td>
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<tr>
<td><strong>76</strong> What would improve the quality of communication across the Radiology Department?</td>
<td></td>
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<tr>
<td><strong>77</strong> Is a communication strategy necessary? (Please expand on your answer)</td>
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<tr>
<td><strong>78</strong> How does a communication strategy contribute to reducing risk to patients?</td>
<td></td>
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<tr>
<td><strong>79</strong> Can you give an example of how the communication strategy has worked in the Radiology Department?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Systems</th>
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<tbody>
<tr>
<td><strong>80</strong> Do you feel that it is important that the data produced by clinical information systems used for quality improvement in the Radiology Department?</td>
</tr>
<tr>
<td><strong>81</strong> Should the management and use of the quality data produced by computer systems be included as part of the day to day running of the Radiology Department?</td>
</tr>
<tr>
<td><strong>82</strong> Should the information re quality on the computer systems be audited regularly?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KPI’s</th>
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<tbody>
<tr>
<td><strong>83</strong> Do you know what a KPI is?</td>
</tr>
<tr>
<td><strong>84</strong> Are you aware of any Departmental Key Performance Indicators(KPI’s)</td>
</tr>
<tr>
<td><strong>85</strong> How do KPIs contribute to the day to day running of the Department?</td>
</tr>
<tr>
<td><strong>86</strong> Can you explain the role of KPI’s in ensuring patient safety in the Radiology Department?</td>
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<td>88</td>
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<tr>
<td><strong>Outcomes and unplanned outcomes</strong></td>
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<tr>
<td><strong>Incident Forms and Risk Register</strong></td>
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<td>Question</td>
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<tr>
<td>contributed to increasing patient safety?</td>
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<tr>
<td>If an adverse event occurs why do you think it should be highlighted?</td>
</tr>
<tr>
<td>How do you think adverse events should be handled?</td>
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<tr>
<td>In your opinion is there learning to be gained from adverse events?</td>
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<tr>
<td>What in your opinion is the importance of learning from adverse events?</td>
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<tr>
<td>How do you feel that the learning from adverse events should be handled?</td>
</tr>
<tr>
<td><strong>Policies, Procedures, Protocols and Guidelines</strong></td>
</tr>
<tr>
<td>Is there an advantage to auditing policies procedures protocols and guidelines?</td>
</tr>
<tr>
<td>Can you outline the advantages to having PPPGs in place?</td>
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<tr>
<td>Should staff be encouraged to adhere to PPPGs?</td>
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<tr>
<td>How in your opinion can a department be run without PPPGs?</td>
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<tr>
<td>Can you give an example of where practice improved following implementation of a PPPG?</td>
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<tr>
<td><strong>Patient experience</strong></td>
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<tr>
<td>Is there a benefit to managing patient experience?</td>
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<tr>
<td>Can we learn from patient experience?</td>
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<tr>
<td>Can we incorporate learning from patient experience into our day to day activities?</td>
</tr>
<tr>
<td>What in your opinion is the benefit to having satisfied patients?</td>
</tr>
<tr>
<td>If good outcomes are being achieved, what in your opinion is the necessity for patient satisfaction?</td>
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<tr>
<td>Can you give an example of an improvement that occurred as a result of a patient satisfaction survey?</td>
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<td><strong>137</strong></td>
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<td><strong>Timeliness</strong></td>
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<tr>
<td><strong>Equity of Care</strong></td>
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<tr>
<td>Question</td>
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<tr>
<td>Should male patients be processed faster than females?</td>
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<tr>
<td>Should females be processed faster than male?</td>
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<tr>
<td>What in your opinion should be the difference between the services provided to male patients as opposed to that provided to female patients?</td>
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<tr>
<td>What in your opinion should be the difference between the service provided to those with health insurance and those without?</td>
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<tr>
<td>Should patients under 21 years be processed faster than those equal to over 21 and under 65?</td>
</tr>
<tr>
<td>Should patients over 65 be treated differently to those less than 65 yrs?</td>
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<tr>
<td>How should patients of different religions be treated in Radiology Department?</td>
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<tr>
<td>Should patients be treated differently based on their racial background?</td>
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<tr>
<td>Should members of the travelling community be treated in a different fashion to members of the settled community?</td>
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<tr>
<td><strong>National and Regional Priority Topics</strong></td>
</tr>
<tr>
<td>In your opinion how should national priority audits be treated?</td>
</tr>
<tr>
<td>Have you any examples of a national priority audit benefiting the patients of the Radiology Department?</td>
</tr>
<tr>
<td>What is the benefit of National Priority Audits?</td>
</tr>
<tr>
<td><strong>Patient Forums</strong></td>
</tr>
<tr>
<td>How do patient forums contribute to the efficient running of the Radiology Department?</td>
</tr>
<tr>
<td>Can you give an example of a patient’s suggestion improving patient safety or reducing risk to the patients in the Radiology Department?</td>
</tr>
<tr>
<td>Is there any benefit to patient’s suggestions being incorporated into the</td>
</tr>
</tbody>
</table>
## Structures (explain what a structure is)

165 Where a topic is selected for review should the audit process involve a review of the relevant structures?

166 Is it necessary to have correct structures in place?

167 Can we get by without any structures?

168 Can you give an example of some structures that are in place?

169 Can you give an incidence where a structure has improved the quality of the service provided?

## Define Processes (explain what a process is)

170 Is it important that staff follow correct process?

171 Can you give an example of correct process being followed?

172 Does all staff follow correct process always?

173 Should correct process be monitored?

174 Can processes become flawed if they are not monitored?

## Define Desired Outcomes

175 What is a good outcome for a patient in the radiography department?

176 What is a good outcome from the data stored on clinical computer systems?

177 What is a good outcome for a patient in radiology?

178 Do you agree with measuring outcomes?

179 Can the service provided by the department be improved by measuring outcomes?

180 Is it important to have a definition of a good outcome?
<table>
<thead>
<tr>
<th>Page</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>181</td>
<td>Can the use of quality data produced by clinical computer systems be used to improve patient outcomes?</td>
</tr>
</tbody>
</table>
| 182  | **Engage Correct stakeholders**  
For a particular audit say for example compliance with shoulder protocol does it matter who is involved with that audit? |
| 183  | Should it be purely a management exercise? |
| 184  | What can staff on the ground contribute to increasing compliance? |
| 185  | What in your opinion is the role of managers in auditing each specific audit topic? |
| 186  | What in your opinion is the role of managers in auditing each specific audit topic? |
| 187  | **Engage Governance Relevant to the Topic**  
When a topic is chosen for audit is it important to engage the correct line manager? |
<p>| 188  | Can improvements be made without the line managers being involved? |
| 189  | Can you outline what you think is important about line managers driving change? |
| 190  | Can you give an example where good practices occurred due to the line manager’s involvement? |
| 191  | Can you provide an example of where change failed to occur due to lack of involvement of line managers? |
| 192  | If the line manager does not want to engage is it appropriate to engage more senior line managers? |
| 193  | Should the manager of one profession manage a staff member in another? |
|      | <strong>Define objectives</strong> |</p>
<table>
<thead>
<tr>
<th></th>
<th>Why is it necessary to define objectives for the audit?</th>
</tr>
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<tbody>
<tr>
<td>195</td>
<td>Can you describe how you think having an objective might contribute to the success of a project?</td>
</tr>
<tr>
<td>196</td>
<td>In your opinion, can projects succeed without defined objectives?</td>
</tr>
<tr>
<td><strong>Set Standards</strong></td>
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<tr>
<td>197</td>
<td>What in your opinion is the role of setting standards for an audit?</td>
</tr>
<tr>
<td>198</td>
<td>When an audit topic has been chosen is there any benefit to setting a standard to measure against?</td>
</tr>
<tr>
<td>199</td>
<td>Can you give an example of a standard that was set for an audit?</td>
</tr>
<tr>
<td>200</td>
<td>Can a department be successfully run without setting standards?</td>
</tr>
<tr>
<td><strong>Collect Data</strong></td>
<td></td>
</tr>
<tr>
<td>201</td>
<td>In your opinion is it necessary to collect data for audit?</td>
</tr>
<tr>
<td>202</td>
<td>Would it better not to collect data?</td>
</tr>
<tr>
<td>203</td>
<td>What are the main advantages to collecting data?</td>
</tr>
<tr>
<td>204</td>
<td>Can you give an example where the collection of data improved practice?</td>
</tr>
<tr>
<td>205</td>
<td>Can you give an example of a situation where the collection of data was not necessary for a successful audit?</td>
</tr>
<tr>
<td><strong>Change Practice</strong></td>
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<tr>
<td>206</td>
<td>Can you give an example of practice changing in this department because of an audit?</td>
</tr>
<tr>
<td>207</td>
<td>What is the advantage to changing practice as part of an audit?</td>
</tr>
<tr>
<td>208</td>
<td>Is it necessary to change practice as part of a quality improvement process?</td>
</tr>
<tr>
<td>209</td>
<td>Would it be better not to change practice?</td>
</tr>
<tr>
<td>210</td>
<td>Should patients be treated differently based on their religious beliefs?</td>
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<tr>
<td>211</td>
<td>Following development of a policy is it necessary to monitor compliance with it?</td>
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<tr>
<td>212</td>
<td>Does the existence of a policy guarantee that it is followed?</td>
</tr>
<tr>
<td>213</td>
<td>Can you give an example of a policy being followed without compliance being monitored?</td>
</tr>
<tr>
<td>214</td>
<td>Is compliance with policies a high priority in the Radiology Department?</td>
</tr>
<tr>
<td>215</td>
<td>Are staff aware of the existence of all policies?</td>
</tr>
<tr>
<td>216</td>
<td>Is it necessary that staff are aware of the existence of all policies?</td>
</tr>
<tr>
<td>217</td>
<td>Can you please describe why it is necessary to follow policies?</td>
</tr>
<tr>
<td>218</td>
<td>Why in your opinion should audit results be published?</td>
</tr>
<tr>
<td>219</td>
<td>What is the advantage of publishing audit results within the Radiology Department?</td>
</tr>
<tr>
<td>220</td>
<td>Would we be better off keeping audit results confidential?</td>
</tr>
<tr>
<td>221</td>
<td>Can you give an example of where publishing an audit result led to an improvement in practice?</td>
</tr>
<tr>
<td>222</td>
<td>Can you give an example of an audit result improving patient safety and reducing risk to the patient?</td>
</tr>
<tr>
<td>223</td>
<td>Should we define our expected outcomes i.e. reject rate, timeliness of X-Rays, missed diagnosis?</td>
</tr>
<tr>
<td>224</td>
<td><strong>Performance Measurement and Escalation</strong></td>
</tr>
<tr>
<td>225</td>
<td>Most staff are hardworking and conscientious, should they be left to their own devices?</td>
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<tr>
<td>225</td>
<td>In the event that a non-compliance with an audit what if any is the advantage of compulsory education?</td>
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<td>Question</td>
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<tr>
<td>There is currently a QA programme in place for continuous KPI compliance: What do you think is the advantage of this?</td>
<td></td>
</tr>
<tr>
<td>What if any is the advantage to staff being interviewed or spoken to by their line manager in the event of continual non-compliance with a protocol?</td>
<td></td>
</tr>
<tr>
<td>Have you ever been involved in a performance reviews?</td>
<td></td>
</tr>
<tr>
<td>Is there any advantage to performance Reviews?</td>
<td></td>
</tr>
<tr>
<td>Can you give an example within the Radiology Department of where a process can be improved?</td>
<td></td>
</tr>
<tr>
<td>In the event of an audit showing non-KPI compliance should there be an escalation process?</td>
<td></td>
</tr>
<tr>
<td>How does the escalation process benefit the patients?</td>
<td></td>
</tr>
<tr>
<td>Does the escalation process improve efficiency in the Radiology Department?</td>
<td></td>
</tr>
<tr>
<td>Does the escalation process improve patient safety and reduce risk in the department?</td>
<td></td>
</tr>
<tr>
<td>Would the Radiology Department be better off without an escalation process?</td>
<td></td>
</tr>
<tr>
<td>What are the activities currently in place to manage protocol compliance?</td>
<td></td>
</tr>
<tr>
<td>What do you think of the activities for protocol compliance?</td>
<td></td>
</tr>
<tr>
<td>Is the escalation process fair?</td>
<td></td>
</tr>
<tr>
<td>Does the escalation process take bias out of the equation?</td>
<td></td>
</tr>
<tr>
<td>Do you agree with continuous protocol compliance?</td>
<td></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>What is your role in improving the quality of patient care in the Radiology Department?</td>
<td></td>
</tr>
<tr>
<td>242</td>
<td>What is your role in reducing risk in the Radiology Department?</td>
</tr>
<tr>
<td>243</td>
<td>In what capacity, do you interact with information systems?</td>
</tr>
<tr>
<td>244</td>
<td>Is a quality programme necessary in Radiology Department?</td>
</tr>
<tr>
<td>245</td>
<td>Should improving the quality of the service provided be part of the day to day running of the department?</td>
</tr>
<tr>
<td>246</td>
<td>What do you think of the quality programme currently in place in the Radiology</td>
</tr>
<tr>
<td>247</td>
<td>Do you find RAD-QAP simple to use?</td>
</tr>
<tr>
<td>248</td>
<td>Do you find RAD-QAP simple to understand?</td>
</tr>
<tr>
<td>249</td>
<td>Did you realize the value of quality data produced by the clinical computer systems in Radiology?</td>
</tr>
<tr>
<td>250</td>
<td>Is Monthly selection and review of KPI compliance enough to assure quality?</td>
</tr>
</tbody>
</table>
Appendix VIII. **Themes Extracted from Interviews**

The themes extracted were triangulated with other data sources such as the literature review that included published article, inquiries, legislation and standards.

<table>
<thead>
<tr>
<th>Demonstrate and lead by example</th>
<th>Leaders must provide guidance and clarity</th>
<th>Prioritise urgent issues</th>
<th>Correct structures reduce risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Management - clarity from above</td>
<td>Involve key stakeholders</td>
<td>Up-to-date standards</td>
<td>Staff aware of issues on the ground</td>
</tr>
<tr>
<td>Set goals to be achieved</td>
<td>Continuously communicate status</td>
<td>Communication process may not be followed</td>
<td>Clear goals reduce risk</td>
</tr>
<tr>
<td>Confident leader who can lead</td>
<td>Staff overwhelmed/a lot of white noise</td>
<td>Reduce and focus information</td>
<td>Persist- never give up</td>
</tr>
<tr>
<td>Belief/experience /clinical and non-knowledge</td>
<td>Need structured protected time for Quality management</td>
<td>Clarity re goals</td>
<td>Measuring the performance gives you something to work off</td>
</tr>
<tr>
<td>Provide positive examples</td>
<td>Context and reality rather than perception</td>
<td>Set goals through consultation</td>
<td>Policies empower management</td>
</tr>
<tr>
<td>Confident leader who can lead</td>
<td>Staff overwhelmed/a lot of white noise</td>
<td>Reduce and focus information</td>
<td>Persist- never give up</td>
</tr>
<tr>
<td>Continuous reviews with a set agenda</td>
<td>Feedback from staff</td>
<td>spot checks not always enough-regular performance reviews</td>
<td>Document evidence of quality improvement activity</td>
</tr>
<tr>
<td>Leader must take ownership</td>
<td>Must be correct information and patient flow</td>
<td>Local champions/drivers a benefit at the</td>
<td>Change management complex</td>
</tr>
<tr>
<td>Policies are needed to support leaders</td>
<td>Need people with interest/enthusiasm</td>
<td>Educating staff can lead them to being champions</td>
<td>Keep staff up to date</td>
</tr>
<tr>
<td>Task orientated without leaders</td>
<td>Need a champion to Drive individual QIPs</td>
<td>Need local drivers</td>
<td>External review lead to improvements</td>
</tr>
<tr>
<td>Need management and communications structures</td>
<td>Your team need to believe/trust the leader and process</td>
<td>Projects need to be driven from the top down</td>
<td>Two-way communication structure</td>
</tr>
<tr>
<td>Listen to and empower staff on the ground</td>
<td>Need to involve the whole team</td>
<td>People can get used to change</td>
<td>When pressure is on a good leader can hold it together</td>
</tr>
<tr>
<td>Policies must be up to date</td>
<td>Policies must be up to date</td>
<td>Experienced leader</td>
<td>Staff on the ground can drive quality</td>
</tr>
<tr>
<td>No policy - cause upset- uncertainty</td>
<td>Policy must be communicated/accessible</td>
<td>Leader with credibility and respect</td>
<td>Need to have everyone on board</td>
</tr>
<tr>
<td>Policy standardises practice</td>
<td>Staff can provide local solutions</td>
<td>Assign duties and responsibilities</td>
<td>Everyone can be all over the place need to sit back and device a plan</td>
</tr>
<tr>
<td>Communication needs to be reviewed</td>
<td>Persist and you will find solutions</td>
<td>Adequate back up and resources/cover for annual leave</td>
<td>Keep the bigger picture in mind –step back to digest all detail</td>
</tr>
<tr>
<td>Staff can provide local solutions</td>
<td>Continually listen and try to correct problems</td>
<td>Nothing remains static and this can lead to</td>
<td>Must standardise</td>
</tr>
<tr>
<td>Improvements</td>
<td>Process Improvements</td>
<td>Continuous Monitoring Risk If Policy Not Adhered To</td>
<td>Wellbeing of Staff Important</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Continuously listen, learn act and improve</td>
<td>Standardising processes frees up other time</td>
<td>Good to observe</td>
<td>Staff on ground know best</td>
</tr>
<tr>
<td>Patients needs to be consulted and aware of priorities</td>
<td>Continuous monitoring</td>
<td>Risk if policy not adhered to</td>
<td>Wellbeing of staff important</td>
</tr>
<tr>
<td>Benefit to peer support</td>
<td>Energy should be spent where the need is</td>
<td>Staff can and interpret policy differently</td>
<td>Need to triangulate the knowledge</td>
</tr>
<tr>
<td>Working with peers can reduce duplication and make processes lean</td>
<td>Cascade info from top down</td>
<td>PPPGs provide clarity</td>
<td>Tap into staff on the grounds knowledge</td>
</tr>
<tr>
<td>peer feedback important</td>
<td>Staff need to be informed</td>
<td>Persistent review will get you there</td>
<td>Vast amount of knowledge in staff</td>
</tr>
<tr>
<td>end user needs to be aware of priorities</td>
<td>When situation get worse monitor more frequently</td>
<td>Regular meetings</td>
<td>Knowledge must match current standard</td>
</tr>
<tr>
<td>Listen to staff and pay attention to their issues</td>
<td>Communicate clearly and often</td>
<td>Reward effort and good performance</td>
<td>Show positive results</td>
</tr>
<tr>
<td>Leader with belief</td>
<td>Need to feedback/acknowledge and reward effort</td>
<td>Risk if policy not adhered to</td>
<td>We need happy staff</td>
</tr>
<tr>
<td>Start with no preconceptions</td>
<td>Need to show positive results</td>
<td>Staff can and interpret policy differently</td>
<td>Need to triangulate the knowledge</td>
</tr>
<tr>
<td>Persistent review will get you there</td>
<td>Vast amount of knowledge in staff</td>
<td>PPPGs provide clarity</td>
<td>Tap into staff on the grounds knowledge</td>
</tr>
<tr>
<td>--------------------------------------</td>
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<td>------------------------------------------</td>
</tr>
<tr>
<td>Include and engage all staff</td>
<td>Can be more structured if you step back</td>
<td>Patient must be included</td>
<td>Less need to monitor as practice improves</td>
</tr>
<tr>
<td>Supports for those with responsibility</td>
<td>Provide knowledge</td>
<td>Review non-compliances</td>
<td>Review after incidents</td>
</tr>
<tr>
<td>Leader must drive</td>
<td>Plan and assess continuously</td>
<td>Review unplanned outcomes</td>
<td>Assessment will give proper view</td>
</tr>
<tr>
<td>Communication forums needed</td>
<td>Difficult to get people to read policies</td>
<td>Review risks</td>
<td>QIP need a leader</td>
</tr>
<tr>
<td>Include and engage all staff</td>
<td>Can be more structured if you step back</td>
<td>Important to set goals</td>
<td>Important to set goals</td>
</tr>
<tr>
<td>Learn from experience and teach bothers</td>
<td>CPD necessary to prove competence</td>
<td>Must have timeframes</td>
<td>Must set timeframes</td>
</tr>
<tr>
<td>Listening to patients is very important</td>
<td>CPD support that people are adequately trained</td>
<td>If no goals people can get busy with other things</td>
<td>If not timely people can forget</td>
</tr>
<tr>
<td>Review unexpected events</td>
<td>Clarity minimises risk</td>
<td>If timely it will be done</td>
<td>Equity important when some can be more dependent</td>
</tr>
<tr>
<td>Regular feedback</td>
<td>Empower staff to lead change</td>
<td>Adhere to national standards</td>
<td>Second quality measurement analysis review</td>
</tr>
<tr>
<td>Empower staff to lead change</td>
<td>Keep patient central</td>
<td>Listening to patients is very important</td>
<td>No one can do everything</td>
</tr>
<tr>
<td>Staff on the ground for practical solutions</td>
<td>Ask staff on the ground for solutions</td>
<td>Work as a team</td>
<td>No one is an expert at everything</td>
</tr>
<tr>
<td>------------------------------------------</td>
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<td>---------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Need timeframes</td>
<td>Need timeframes</td>
<td>Communicate with staff</td>
<td>Can take long trying to get policies signed off</td>
</tr>
<tr>
<td>All patients entitled to a high standard of care</td>
<td>Knowledge increases moral</td>
<td>Individual staff have talents and we need to use them</td>
<td>Staff can impart knowledge and impart it to others</td>
</tr>
<tr>
<td>Staff have a lot of knowledge</td>
<td>People more accepting of policies that reflect work practice</td>
<td>Holistic approach</td>
<td>Feedback on education</td>
</tr>
<tr>
<td>People more accepting of policies that reflect work practice</td>
<td>Does not all have to be external education</td>
<td>Relevant education</td>
<td>Address local issues</td>
</tr>
<tr>
<td>Committed Leader</td>
<td>Staff have a lot of knowledge</td>
<td>Openness in communication</td>
<td>Find the truth - things not always as you think they are</td>
</tr>
<tr>
<td>Staff more clued into front line tissues. Do not want their time to be wasted</td>
<td>Leader must be in a position of authority</td>
<td>Leader must me committed</td>
<td>Staff become disillusioned if they think their energies are being wasted</td>
</tr>
<tr>
<td>Continuous communication</td>
<td>Continuous review</td>
<td>Follow up as required</td>
<td>Support from senior management</td>
</tr>
</tbody>
</table>