Learning lessons: A discussion on the unintended consequences of electronic record adoption on nurses' documentation practices and implications for a national Electronic Health Record (EHR).

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A dissertation submitted to Trinity College Dublin

in partial fulfilment of the requirements for the degree of

Master of Science in Health Informatics

2016

Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

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Abstract

Since the publication of the eHealth Strategy for Ireland (DOH 2013) and the announcement of a national electronic health record (EHR) strategy, discourse surrounding electronic record adoption has gained momentum in Ireland. Along with potential benefits, adoption can also accrue negative unintended consequences (Harrison *et al.* 2007, Jones *et al.* 2011, Middleton *et al.* 2013). One possible explanation is that when a system is perceived as difficult to use it produces a range of challenges. End-users circumvent challenges through the adoption of workarounds which can lead to errors (Harrison *et al.* 2007, Ash *et al.* 2009, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014).

OBJECTIVE: The overall objective of this research was to extract the 'lived experience' of nurses using electronic records to document patient care; and to discuss potential ways challenges may be mitigated or reduced with regard to a national EHR project.

PARTICIPANTS: 22 nurses from three healthcare institutes in the Republic of Ireland, inpatient (specialist), inpatient (general) and day-care environments were represented.

METHODOLOGY: The research took a phenomenological approach, with data analysed using the model based on the work by Giorgi (1997) and adapted by Schweitzer (1998).

CONCLUSION: Although positive about EHR use, challenges and workarounds were discussed by the participants. Perceived challenges were presented under the themes: *Direct/external* or *Indirect/internal* challenges. These themes reflect the sub-themes: "Inadequate number of terminals", "Interruptions by non-nursing users", "Location challenges", "Technical challenges", "Time constraints on learning" and "Individual traits". Workarounds discussed are presented under the themes: *Established Pre-implementation* and *Adopted Post-implementation*. These reflected the sub-themes identified: "Interim recording", "Password workarounds", "Copy and Paste", "Pre-charting". These are fully explored in the subsequent text, along with the potential implications for a national EHR.

Acknowledgements

This acknowledgement is written with the benefit of hindsight and that is important. At the beginning of this research journey, the researcher did not envision how reliant on the knowledge of others that they would become. Nor was it appreciated how much input is required from a range of people to produce such a body of work. It is with heartfelt thanks that I acknowledge those individuals who assisted without restriction or gain.

I would like to express sincere thanks to my supervisor, Prof. Lucy Hederman, for all her help and advice and for keeping me on track when I tried my best to wavier.

To the institutions who facilitated this research and the individual nurses who took time out of their busy day to participate. Your advice, support and encouragement were invaluable and your input, beyond measure.

To the range of informatics nurse specialists that I crossed paths with during this journey. I cannot adequately describe how thankful I am to you or how important your contribution was.

To my student colleagues, Patricia Gaule and Jeannette Francois-Behan, for your encouragement and assistance.

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Abbreviations

ANA	American Nurses Association
CIS	Clinical Information System
CNM	Clinical Nurse Manager
COW	Computers on Wheels
DOH	Department of Health
ED	Emergency Department
EHR	Electronic Health Record
EMR	Electronic Medical Record
EPR	Electronic Patient Record
HFE	Human Factors and Ergonomics
HIT	Health Information Technology
HSE	Health Service Executive
ICT	Information and Communications Technology
ICU	Intensive Care Unit
INS	Informatics Nurse Specialist
MDT	Multidisciplinary Team
NIS	Nursing Information System
NMBI	Nursing and Midwifery Board of Ireland
NUC	Negative Unintended Consequences
POC	Point of Care
PUC	Positive Unintended Consequences
TAM	Technology Acceptance Model

Glossary

Challenges: relate to the tangible and intangible barriers that arise from EHR adoption, that prohibit or limit engagement with an electronic record i.e. terminal location or availability.

Copy and paste: Describes the practice of taking information from one electronic source and depositing it in another (Levinson 2014).

Electronic Health Record (EHR): is a "*Personal consolidated healthcare history, integrated from various source systems at a detailed level to support seamless care delivery across settings. Encompasses electronic medical records(s) from different care settings.*" (Health Service Executive, HSE, 2015, p.50).

Hardware challenges: Refers to barriers relating to the physical elements of the system including availability and location of terminal.

Human factors: "Environmental, organisational and job factors, and individual features that combine to influence behaviour and outcomes" (Clinical Human Factors Group, CHFG, p. 3, 2009).

Interim recording: Using paper to record patient information and transcribing to the patient record (paper or electronic) at a later time (Yeung *et al.* 2012).

Negative unintended consequences (NUCs): Outcomes that are unforeseen, unplanned and undesirable (Merton 1936, 1976).

Nurses' documentation practices: For this study, it is understood to mean all the actions and procedures surrounding the process of logging (hand written or typed) patient information and all process surrounding information retrieval, so that they comply with best practice in nursing documentation as prescribed by the Nursing and Midwifery Board of Ireland (NMBI 2015).

Nursing records: Typically, a combination of patient care plans, day-to-day patient assessments, ward specific information such as pre and post-operative notes, vital signs, prescription documents and the nursing narrative note (or progress note).

Operational challenges: The day-to-day challenges electronic records have on the documentation processes of nurses, either directly or indirectly, for example perceived inflexibility of an electronic system compared with paper.

Positive unintended consequences (PUCs): Unforeseen outcomes of adoption, although unplanned, the outcomes are largely welcomed (Merton 1936, 1976).

Scraps: Personal notes kept by the nurse to assist with work flow, act as a reminder system and highlight important patient care specifics (Hardey *et al.* 2000).

Software challenges: Refers to barriers relating to the systems or programs used to document patient care, for example, incompatibility between screen flow and workflow.

Unintended consequences: Outcomes of adoption that are neither predicted, nor anticipated but are a direct result of a change (Merton 1936, 1976). In "The Unanticipated Consequences of Purposive Social Action" Merton (1936) referred to these as unanticipated consequences, however, they have come to be widely known as unintended consequences.

Usability: ISO standard (ISO 9241-11) is: "*The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.*"

Workarounds: Methods employed by users to circumvent a perceived short-coming or limitation of a system (Debono *et al.* 2013).

Chapter 1: Introduction

Along with presenting the motivation behind the study, the research question and an outline of the methodology used, this chapter provides the reader with an overview of the subject, specifically the purpose of nurses' notes and best practice in documentation.

1.1 Introduction

Expectations surrounding EHR adoption are considerable with cost, time saving and improved continuation of care oft cited as benefits (Jones *et al.* 2011, Department of Health, DoH, 2013 and Health Service Executive, HSE, 2015). The HSE notes that technology:

> *"…allows access to potentially life-saving patient information and faster access to relevant information." (HSE, 2015, p. 7)*

Although worldwide the adoption of electronic records in healthcare has experienced a high-level of success (Clarke *et al.* 2015, Cucciniello *et al.* 2015), in Ireland adoption has been slower. However, with the publication of the eHealth Strategy for Ireland (DOH 2013) and the announcement of a national EHR strategy, discourse surrounding adoption is gaining momentum. As with all changes, technology transitions including EHR implementations can be a complex and unpredictable undertaking (Jensen & Aanestad 2007, O'Mahony *et al.* 2014). Along with the anticipated benefits, adoption can also accrue a number of negative unintended consequences (NUCs) Harrison *et al.* 2007, Ash *et al.* 2009, Bloomrosen *et al.* 2010, Jones *et al.* 2011, Middleton *et al.* 2013, Zadvinskis *et al.* 2014, Gephart *et al.* 2015). The most significant being compromises in patient safety (Harrison *et al.* 2007, Jones *et al.* 2011, Middleton *et al.* 2013).

Speculation abounds as to how NUCs arise; one potential answer posited in the literature is that when an incompatibility between technology and work practices ensues, practitioners adopt coping strategies or workarounds (Harrison *et al.* 2007,

Jones *et al.* 2011). Workarounds describe practices used to circumvent a system (or aspect of a system) that is perceived as difficult to use (Harrison *et al.* 2007, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014). Authors speculate that workarounds undermine the intention of a new system leading to unanticipated outcomes (Harrison *et al.* 2007, Jones *et al.* 2011, Wiedemann 2012, Zadvinskis *et al.* 2014, Gephart *et al.* 2015). Whereas positive unintended consequences (PUCs) can be viewed as "happy surprises" (Harrison *et al.* 2007, p.542), NUCs distil the effectiveness of an EHR, potentially compromising patient safety (Bloomrosen *et al.* 2010, Jones *et al.* 2011, Middleton *et al.* 2013). Subsequently, the focus of this research is on NUCs.

1.2 The importance of the nurses' perspective

Nursing represents a heterogeneous profession, comprising of a range of disciplines across a hierarchy of skills. Not only do they represent the largest number of front line staff in the health services, but also are also heavy users of health technology (Eley *et al.* 2007). Their direct patient contact, coupled with the breadth and depth of their role - clinical component, care manager, health promoter (Hanafin 1997) - means engaging with an EHR will constitute a large part of their workday. Documentation practices were selected for investigation due to its ubiquity in practice and to reflect the significant portion of time spent by nurses documenting care (Westbroke *et al.* 2011). To put this in context, Hendrich *et al.* (2008) found 35% of nurses' time is consumed with documentation with less than 20% involved in direct patient care activities.

No conclusive definition of what constitutes nurses' documentation practices was found in the literature. For this study, it is understood to mean all the actions and procedures surrounding the process of logging (hand written or typed) patient information and all processes surrounding information retrieval, so that they comply with best practice in nursing documentation as prescribed by the Nursing and Midwifery Board of Ireland (NMBI 2015).

1.3 Purpose of nursing notes

While each institution will have an established method for logging patient information, nursing-specific patient care information (in paper-based systems) is generally held in notes away from the medical record. These records are typically a combination of patient care plans, day-to-day patient assessments, ward specific information such as pre and post-operative notes, vital signs, prescription documents and the nursing narrative note (or progress note). Due to the sensitive nature of the information security, privacy and confidentiality are high priority issues. Nursing notes serve three purposes: information store, communication tool and evidence repository (NMBI 2015).

Information: According to NMBI (2015) policy, at a minimum nursing care notes should include an accurate assessment of patient's bio-psycho-social presentation, drawing on subjective and objective evidence. Nursing notes should document all assessments, plan(s) of care, implementation of that plan and evaluation of outcomes.

Communication: Along with providing evidence of the nurse-patient therapeutic relationship, patient care notes can also facilitate communication between patient, family and members of the multi-disciplinary team (MDT) (NMBI 2015).

Evidence Repository: In the case of a query or complaint regarding nursing care, the adage, "If it was not charted, then it was not done" carries weight (NMBI 2015, p 8). The importance of maintaining clear, timely and correct documentation has been illustrated in high profile cases, such as the Lady of Lourdes (Harding Clarke 2006) or the Halappanavar case (HSE 2013). Governance of nursing notes falls under the remit of individual organisation policy, professional rules (NMBI 2015) and national laws, such as Data Protection Acts (1988 and 2003) and Freedom of Information Act (2014).

1.4 Best practice in documentation

Depending on individual ward environments, type of nursing practiced and patient requirements, nurses will demonstrate different patterns of documentation. For example, in the intensive care units (ICU), nurses generally remain with the same patient throughout their shift. Patients are generally acutely unwell requiring frequent clinical interventions. Comparatively, nurses based in the day-care settings document less frequently, but potentially across a longer time period due to the chronic nature of some diseases. Irrespective of differences, best practice guidelines as described in Recommended Practices for Healthcare Records Management (HSE 2011) and Recording Clinical Guidelines (NMBI 2015), outlined in Table 1, govern all types of nursing documentation.

Table 1: Best practice considerations in data entry

Frequency	Frequency of narrative nursing notes is not prescribed a set time, but documentation at time of care is considered best practice.
Communication	It is considered good practice that staff involved in the care of a patient read each other's entries to promote communication between staff and to ensure all team members are aware of changes and updates.
Content	According to NMBI (2015, p. 11) advice "all narrative notes are individualised, accurate, up to date, factual and unambiguous". To achieve this, entries should be free from personal remarks and supported by evidence.
Clarity	All entries must be legible and able to be photocopied. Patients' details (name, record number) on the top of each page (front and back). All entries should be signed, dated and in chronological order with the nurse's registration number clearly printed.
Own entries/errors	Nurses must only enter information on their own behalf; secondary information can be documented, so long as it is clear this is the case.

1.5 Toward a national EHR

Described as a key requirement of future health delivery, national EHR proponents speculate that adoption can help manage challenges facing modern healthcare. These include increased incidences of chronic disease, growing population and financial constraints (HSE 2015). Terms such as electronic health record (EHR), electronic patient record (EPR) and electronic medical record (EMR), while referring to specific hierarchies of electronic record, are often used interchangeably. Whereas EMRs are situated at the organisational level, EHRs span multiple institutions. According to Government documents, an EHR provides:

> *"Personal consolidated healthcare history, integrated from various source systems at a detailed level to support seamless care delivery across settings. Encompasses electronic medical record(s) from different care settings." (HSE 2015, p.50).*

This has two major implications for nursing documentation. Firstly, as data is "… integrated from various source systems…" it follows that all nursing documentation is to be recorded electronically. Subsequently, all nurses will need to use computerised records in their practice, developing an awareness of consequences on nursing documentation practices must be a priority. Secondly, "…at a detailed level to support seamless care delivery across settings", can be problematic without a standardised nursing language. Without a standardised language, sharing information across institutions is open to misinterpretation, potentially compromising patient safety. Several authors purport the absence of a standardised language will inhibit data collection across multiple sites, rendering any research less reliable (Conrad *et al.* 2012, Youn *et al.* 2014, Park & Lee 2015). Although important to documentation processes, discussions surrounding the development of a standardised nursing language is seen as beyond the scope of this research.

1.6 Potential benefits of electronic charting for nursing

Along with missing, or damaged documentation, a number of studies question the validity of the data captured in nursing notes (Gunningberg *et al.* 2008, de Marinis *et al.* 2010, Paans *et al.* 2010, Thoroddsen *et al.* 2013). Reporting on findings of their observational study, de Marinis *et al.* (2010) reported that of the nursing activities observed, only 40% were recorded in the patients' record. Under reporting care was also found to exist in a study by Thoroddsen *et al.* (2013). From a cross-sectional study (29 wards), it was found that identified pressure ulcers were only documented in the patients' record 60% of the time. Along with under reporting care given, several studies have cited poor accuracy in data captured (Gunningberg *et al.* 2008, Paans *et al.* 2010). For example, Paans *et al.* (2010) found entries relating to interventions displayed greater levels of inaccuracies, with admission notes ranking as most accurate by comparison.

Considering the guiding principle of "If it was not charted, then it was not done" (NMBI 2015, p. 8), the question arises as to what can be done to improve things. Supporters suggest that electronic systems could present a solution. When fully implemented and integrated, electronic records can potentially assist documentation practices through a number of functions:

Time saving: searching patient information, previous medical history, previous test results (Dowding *et al.* 2014, Cucciniello *et al.* 2015).

Information quality: improved data accuracy and legibility (Carayon *et al.* 2011, Dowding *et al.* 2014, Cucciniello *et al.* 2015).

Accessibility: to information at all times (Cucciniello *et al.* 2015) and immediately (Dowding *et al.* 2014).

Reduced errors: as information stored EHRs can potentially reduce errors from duplicating information across a range of paper charts (Cucciniello *et al.* 2015).

Improved communication: between clinical staff, reduced time spent confirming orders (Dowding *et al.* 2014).

1.7 Motivation for research

It is evident that electronic records will be a feature of future healthcare delivery, therefore, developing an awareness of the impact of electronic records on nursing documentation practices is imperative. Encouraged by the recent announcement of a national EHR strategy for Ireland, the rationale for choosing this broad, yet important, research topic is three-fold. Firstly, while EHRs were generally perceived as advantageous to their practice by nurses captured in the literature review, no articles related to the Irish context. Secondly, while NUCs are discussed in the literature, the majority favoured computerised physician order entry (CPOE) systems (Ash *et al.* 2009, Jones *et al.* 2011), less is known about the effect of EHR adoption on nurses' documentation practices. Thirdly, although beneficial to practice, nurse respondents across the literature highlighted a range of challenges arising from adoption.

The motivation behind this research, therefore, was to address these deficits and to develop a deeper understanding of the consequences of EHR adoption on nurses' documentation practices.

1.8 Research question and study aims

The central theme addressed in this research was:

> *'Learning lessons: A discussion on the unintended consequences of electronic record adoption on nursing documentation practices and implications for a national EHR project'.*

In order to extract potential lessons, three research questions where constructed after reviewing the available literature and from feedback from the study sites involved.

Question 1: What are the challenges arising from electronic record use?

Question 2: How do nurses cope with these challenges?

Question 3: What lessons learned can be applied to a national EHR project?

The main goals of this study are:

1. Using a phenomenological approach, explore the challenges of electronic record adoption from a nursing perspective in the Irish context.
2. To raise awareness of the potential of NUCs associated with adoption on nurses' documentation practices.
3. To identify nursing-specific considerations that should be addressed when considering a national EHR for Ireland from the perspective of nurses and their documentation needs.

1.9 Research methodology and sites

The research question was addressed through semi-structured interviews using open-ended questions with 22 nurses who utilised a variety of electronic records during their daily practice. In order to derive an understanding of the effect of electronic record adoption on nurses' documentation practices, as opposed to an individual system critique, a purposeful sample pool was drawn from three healthcare institutions in the Republic of Ireland. Nurses from three clinical environments - inpatient (specialist), inpatient (general) and day-care were represented.

Inpatient (specialist) represents areas such as intensive care units (ICU), patients are generally acutely unwell.

Inpatient (general) represents the general medical/surgical ward environment.

Day-care represents the outpatient services.

1.10 Overview of the research

This research describes the phenomena of unintended consequences drawing on the work of Merton (1936, 1976), examples of NUCs are used throughout the chapters. However, it became apparent during the research that our understanding of the NUCs associated with EHR adoption on nurses' documentation practices is limited. The literature, specifically Merton's work, described a range of ways unintended consequences occur. Although many possible causes exist, one route frequently cited in the literature occurs when an incompatibility between technology and work practices gives rise to usability challenges (Jones *et al.* 2011). These in turn, promote end-users to circumvent the system by 'working around' the problem, which can lead to errors (Harrison *et al.* 2007, Ash *et al.* 2009, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014).

The first stage in this research involved a review of the available literature to synthesise all relevant data on the challenges arising from electronic record adoption nurses experience.

The second stage, involved a research study exploring the nurses' experience of using electronic records to document care. Establishing NUCs based on such a small sample is impractical, however, the data can inform what we know about the challenges and how nurses react to them.

The third stage discussed the lessons learned from the research process, culminating in five broad considerations for future implementers.

1.11 Overview of the dissertation

Chapter 2: The aim of this chapter is to present a discussion on the phenomena of unintended consequences, drawing on the work of Merton (1936, 1976). The role of challenges and workarounds in negative consequence generation is outlined.

Chapter 3: Building on the previous chapter, a literature review was conducted to identify common challenges associated with electronic record adoption on nurses' documentation practices. These challenges are presented under the headings: hardware, software, operational challenges and human factors.

Chapter 4: This chapter describes the study sites, participants, data collection and data analysis. The research methodology is described, rationale behind its adoption, along with study limitations.

Chapter 5: Presents an overview of the findings from the research study. Outcomes are organised to compliment the three research questions that were constructed to explore the central question under examination.

Chapter 6: Reporting the findings in relation to the first question: what are the challenges arising from electronic record use? Two main themes that emerged were *Direct/external* and *Indirect/internal* challenges.

Chapter 7: This chapter discussed the findings in relation to question 2: how do nurses cope with these challenges? The discussion is arranged under the themes *Established Pre-implementation* and *Adopted Post-implementation*.

Chapter 8: Building on the knowledge captured in the research and incorporating information from the literature review, this chapter presents a discussion on: what lessons learned can be applied to a national EHR project? Five broad considerations for future implementers are discussed.

Chapter 9: The concluding chapter will outline weakness and the limitations of the research conducted. Along with dissemination of findings to participating institutions. A personal reflection on the research process concludes the assignment.

Chapter 2: The complexity of consequences

While the positives of electronic records are numerous – improved data collection and time saving (HSE 2015), adoption also accrues a number of unintended consequences (Gephart *et al.* 2015). The aim of this chapter, therefore, is to present a discussion on the phenomena of unintended consequences and possible ethnologies, drawing on the work of R.K. Merton (1936, 1976).

2.1 Introduction

Along with the many advantages EHR adoption will bring to documentation practices: better information management, automatic data collection (when fully integrated) and time saving (HSE 2015), studies highlight how adoption can also accrue unintended (positive and negative) consequences (Bloomrosen *et al.* 2010, Jones *et al.* 2011, Creswick *et al.* 2012, Middleton *et al.* 2013, Rohm 2013, Nguyen *et al.* 2014, Cucciniello *et al.* 2015, Gephart *et al.* 2015). This research will focus largely on the NUCs that arise as a result of electronic record adoption. By understanding the NUCs and the latent conditions that potentially facilitate their development, implementers can attempt to mitigate their impact in a national EHR project. This chapter discusses types, potential ethology of NUCs and the role of workarounds in the process.

2.2 Types of unintended consequences

Not confined to technology adoption, unintended consequences refer to outcomes of adoption that are neither predicted, nor anticipated but are a direct result of a change (Merton 1936, 1976). In “The Unanticipated Consequences of Purposive Social Action” Merton (1936) referred to these as unanticipated consequences, however, they have come to be widely known as unintended consequences, in that they are not an intended outcome of a change but arise as a result of it.

Using Merton's (1936) research, consequences can be thought of in two ways:

Negative unintended consequences (NUCs) are outcomes that are unforeseen, unplanned and undesirable.

Positive unintended consequences (PUCs) are also unforeseen, unplanned yet the outcomes are largely welcomed.

2.3 Examples of NUCs

Compromised patient safety has been highlighted as the most significant NUC of electronic record adoption (Bloomrosen *et al.* 2010, Jones *et al.* 2011, Middleton *et al.* 2013). NUCs relating to EHR adoption on nurses' documentation practice, however, are not as defined in the literature. Some authors have highlighted increased information complexity and overload, increased documentation burden and problems with computer access (Yu *et al.* 2013, Gephart *et al.* 2015). A mixed methods study by Ash *et al.* (2009) identified nine types of NUCs surrounding the adoption of a CPOE. They provide an insight into the types of unintended consequences that could potentially arise in the clinical setting due to the digitisation of medical notes. Furthermore, they are reproduced in the Guide to Reducing Unintended Consequences of Electronic Health Records published by the Agency for Healthcare Research and Quality, USA (Jones *et al.* 2011). Nine consequences presented by Ash *et al.* (2009) are:

1. Increased workload: as more patient information can be captured and stored, information that is more detailed is being sought.
2. Workflow changes: as less people are involved in the process, normal checks and clarification routes are removed.
3. Never-ending technical demands: as systems constantly evolve so does the need to devote more financial resources and training time.
4. Paper-persistence: when paper remains, organisations risk creating a dual recording system and missing information.

5. Communication difficulties: through “illusion of communication” (Ash *et al.* 2009 p. S72) which occurs when information is assumed to be received by the correct party simply because it was entered into the system.
6. Negative emotions: such as frustration and stress.
7. New kinds of errors: such as clicking on the wrong button, simply because it was beside the correct one.
8. Changes in the power structures.
9. Overdependence on technology.

2.4 How do NUCs occur?

Exploring the latent or overt conditions that lead to NUCs allows EHR implementers to mitigate or reduce their effect earlier in the technology trajectory (Jones *et al.* 2011). Ascribing an exact cause can be difficult, as Merton (1936, 1976) notes, outcomes can have many causes which can be influenced by factors not originally considered or deemed to be part of the initial problem. Nevertheless, Merton (1936, 1976) advises caution when trying to uncover the true ethology of unintended consequences. Based on this work, implementers should consider two points: causal imputation and inability to determine the actual cause of a given action. Causal imputation describes how consequences are generally the effect of a number of actions, making mapping a single cause with a consequence difficult. Implementers, then, might be inclined to predict the outcome of individual actions. This, Merton (1936, 1976) suggests is also problematic, as human behaviour can be unpredictable and complex. Nonetheless, Merton (1976, p. 5) describes five possible ‘classes of factors’ that precede consequences, these are outlined in the following sub-sections.

- Ignorance
- Error
- Imperious immediacy of Interest
- Basic values
- Self-defeating prediction

2.4.1 Ignorance

Ignorance refers to a situation where individuals strive to capture all the relevant information, yet cannot conceivably attest to knowing everything, rendering them ignorant of some aspect of a problem or outcome (Merton 1936, 1976). Dorner (1996) described how complex systems are made up of many different interconnected parts - individual actors, group dynamics, organisational and professional cultures. Due to their complexity and interrelatedness, relationships or smaller components may be overlooked in favour of larger aspects that are more tangible.

2.4.2 Error

Closely linked to ignorance, errors can take a variety of forms, such as errors in assessing the original problem or not assessing the problem as a whole but instead focusing on a component of the problem. Merton (1936, 1976) also described how using previous solutions to confer the same outcomes to a new problem or situation could also be problematic. As situations evolve, they may require a completely new analysis of the problem.

2.4.3 Imperious immediacy of interest

While ignorance and errors constitute the most significant factors underpinning unintended consequences, a third general factor postulated by Merton (1936, 1976, p. 152) is that of "imperious immediacy of interest". This refers to a situation where immediate needs or interest supersedes the long-term goals or interests. This may not arise from selfish thinking, but instead can occur if an immediate action is expected to lead to the preferred outcome at some future time, but this does not materialise.

2.4.4 Basic values

In a similar vein to the concept of "imperious immediacy of interest", Merton's (1936, 1976) factor of basic values describes how other factors are not considered as part of the original problem due to the immediacy of the initial problem. Instead problem solving centres on obtaining a solution to the problem at hand, rather than considering the problem as evolving.

2.4.5 Self-defeating predictions

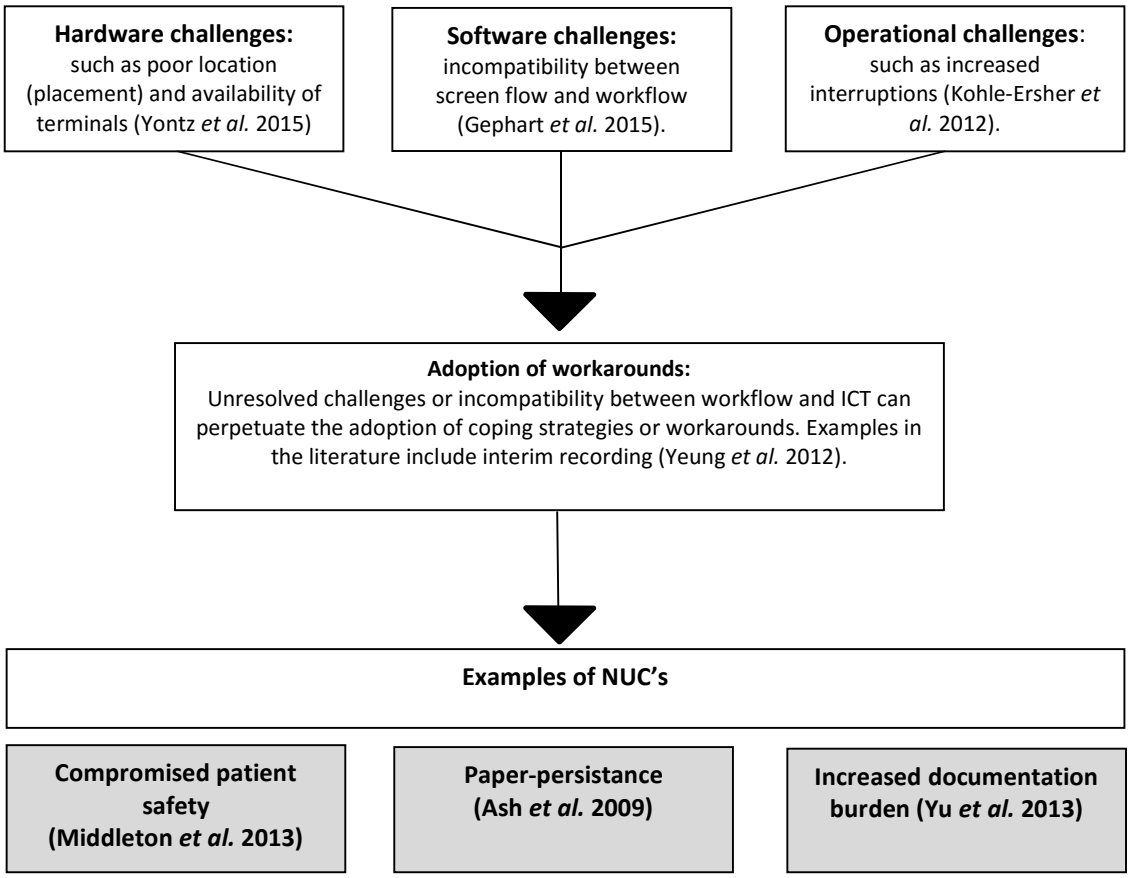
Unlike the previous four classes, the final factor underpinning unintended consequences describes how, by addressing potential problems and outcomes, other, newer unforeseen consequences emerge in their place (Merton 1936, 1976). This presents a conundrum for implementers, in that, by discussing known consequences and mitigating their effect, this could generate other unanticipated outcomes instead. The answer, it would appear, is for implementers to be constantly vigilant rather than view outcomes as static.

2.5 Understanding the impact of workarounds

While the literature is sparse on the exact mechanisms of NUCs, several authors report that the adoption of workarounds in response to usability challenges as one potential route (Harrison *et al.* 2007, Ash *et al.* 2009, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014). It could be inferred that this incompatibility could arise from a combination of Merton's (1976) classes of factors, however, this was not adequately addressed in the literature. Nonetheless, to provide a substantive discussion on the topic, this study will centre on the effect of workarounds as one potential cause of NUCs.

Not limited to technology adoption (Tucker *et al.* 2014) workarounds are ways users circumvent a perceived short-coming or limitation of a system (Debono *et al.* 2013, Flanagan *et al.* 2013, Friedman *et al.* 2014). For example, the use of interim-recording which describes using paper to record patient information and transcribing to the patient record (paper or electronic) at a later time (Yeung et al. 2012). Along with undermining the original intention of electronic record adoption, circumventing prescribed practice through workarounds may also introduce errors (Harrison *et al.* 2007, Ash *et al.* 2009, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014). An overview of this relationship is presented in figure 1, information was extracted from the accompanying literature review and is fully discussed in Chapter 3.

Figure 1: Potential routes from challenge via the adoption of workarounds to NUC's.



As end-users, such as nurses, get used to incorporating workarounds into their documentation practices without retribution, they become the norm (Friedman *et al.* 2014). A possible explanation for this lies in the work of psychologists B.F. Skinner (1904-1990) and A. Bandura (1925-). B.F. Skinner's theory of operant conditioning describes how, when a subject receives a reward or reinforcement (praise or admiration) for an action (in this case quicker documentation times) the action is then continued (Weiten 2010). In addition, using Bandura's (1977) social learning theory, it could be argued that along with continuing the practice, or copied (modelled) by others. While it might be appealing to address workarounds, understanding the enablers or challenges behind them, might offer more reward in terms of increasing user acceptance of an electronic record and improving perceived ease of use.

2.6 Research challenges

The small numbers of studies available in relation to NUCs associated with EHR adoption on nurses' documentation practices was not the only problem encountered. A difficulty that was apparent early in this research was the overlap between what some authors perceived as challenges others perceived as unintended consequences. That is, the same theme, disruption to work-flow for instance, was found to be both a challenge (Dowding *et al.* 2014) and a NUC (Gephart *et al.* 2015). To add further complexity, Carrington *et al.* (2015) include barriers (or challenges) and workarounds as unintended consequences.

To avoid any ambiguity, for this study, challenges relate to the tangible and intangible barriers that prohibit or limit engagement with an electronic record i.e. terminal location or availability. Whereas, workarounds are methods employed to overcome these challenges i.e. copy and pasting information. Staying true to Merton's (1936) original definition NUCs are seen as unforeseen outcomes arising from the adoption of electronic records, for example, introducing new kinds of errors (Ash *et al.* 2009). Discussing the topic in this hierarchy allows the potential solutions be sought at the right level, that is, downstream at the source of the original challenge.

2.7 Conclusion

This chapter explored what was meant by 'unintended consequences' referencing the work of Merton (1936). While a range of negative consequences were evident in relation to EHR and CPOE adoption, a comparatively smaller number related to nurses' documentation practices. However, a number of studies did note that NUCs surround increase information burden and computer access (Yu *et al.* 2013, Gephart *et al.* 2015).

A more general overview of the potential negative outcomes was provided by research by Ash *et al.* (2009), although not specific to electronic records, their findings provide an interesting insight into potential consequences arising from the digitisation of nursing notes. The chapter also discussed how NUCs might occur. A number of studies link challenges arising from adoption of electronic records to negative outcomes via

the adoption of workarounds (Harrison *et al.* 2007, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014). This chapter also discussed the problems surrounding researching unintended consequences, where it was found a number of articles had assigned the same outcomes of adoption as either an unintended consequence or a challenge of adoption.

Building on the interpretation that unintended consequences potentially arise from usability challenges via the adoption of workarounds, the following chapter presents the findings of a literature review that identified usability challenges from the perspective of the nurse.

Chapter 3: Literature Review

This chapter details the findings of the literature review including a full description on the methodology. Outcomes are presented under the headings: hardware, software, operational challenges and human factors.

3.1 Purpose

Building on the knowledge that unintended consequences potentially arise from challenges, a literature review was conducted to:

> *Synthesise pre-existing data on the challenges experienced by nurses arising from electronic record adoption, to their current documentation practices.*

3.2 Methods

3.2.1 Search strategy

This literature review took a meta-narrative approach described by Greenhalgh *et al.* (2005). This method espouses an interpretive, inductive approach, as opposed to a categorisation of the literature. This enabled a richer analysis of the text and a more in-depth examination of the challenges by drawing from a wide pool of theories and methodologies. This was important because apart from a small number of articles retrieved, pertinent information was often consumed into a larger narrative rather than being a standalone finding.

The following databases were searched: Medline, CINAHL, PsycLine, UK and Ireland Reference Centre, Xplore, Scopus, Science Direct and Cochrane Library. Only contemporary literature was retrieved (2010-2015). Using a recent time frame ensured the most up-to-date information was captured. Initially the key terms “nurse”, “documentation”, “electronic records”, “unintended consequence” were used. This proved too restrictive, so the search was widened to encompass all nursing groups “nurs*”, “electronic record” and/or “challenges” and/or “unintended consequences”.

From the articles retrieved (n=979) 22 (17 case-studies, 5 literature reviews) were included in the review. The search strategy depicted in figure 2 is described in the following sections. An overview of literature reviewed is provided in Appendix A, along with an outline of the research studies and literature reviews provided in Appendices B and C.

3.2.2 Selection criteria framework

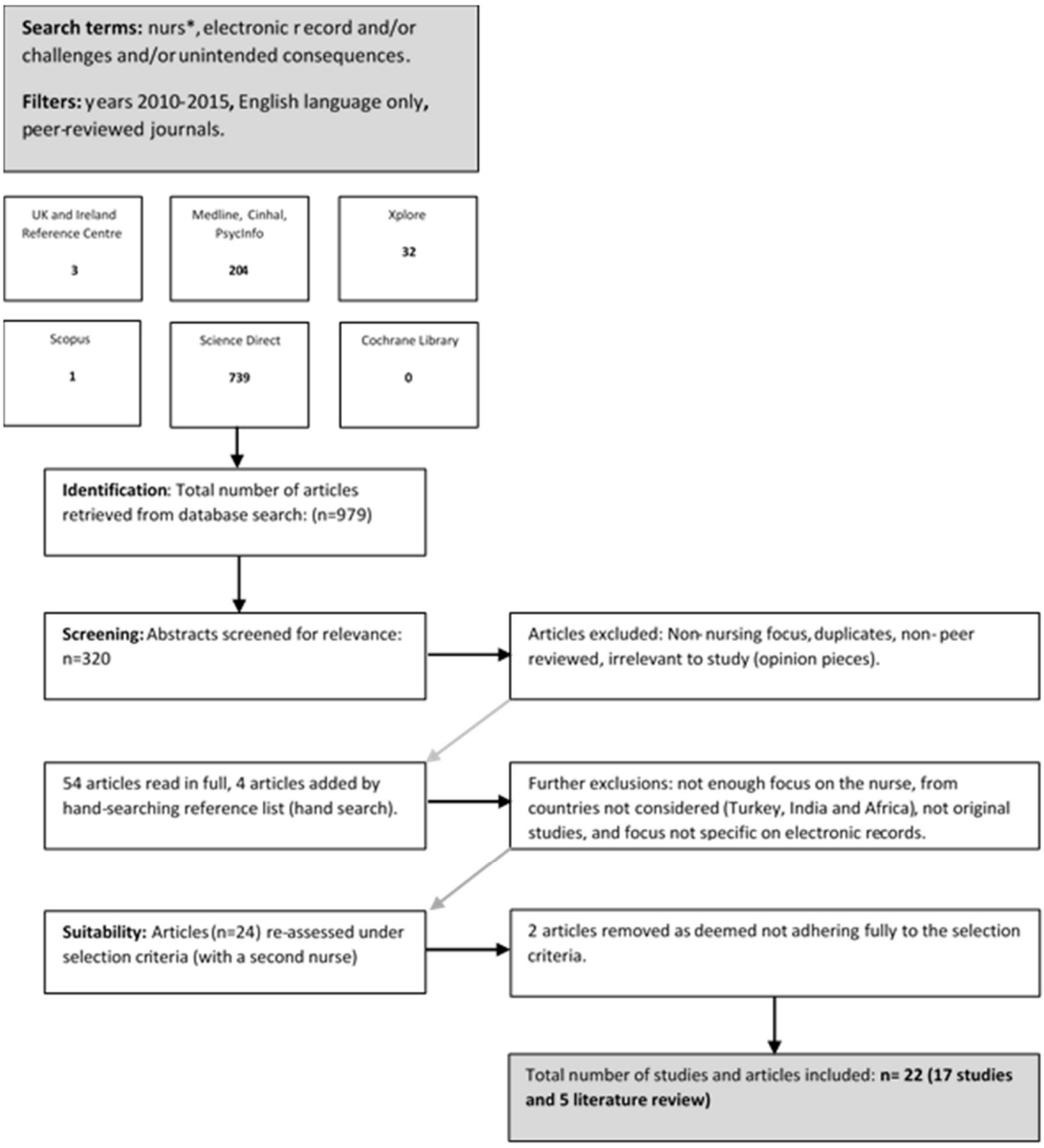
To ensure validity of results and reduce the potential for bias, the search incorporated the principles of a systematic literature review as prescribed by Cochrane (Higgins & Green 2011). To ensure comparability the following framework was utilised.

Study types: Restricted to empirical, quantitative, qualitative and mixed methods studies. Editorial, comment and opinion pieces were excluded. It was important that papers retrieved noted their methodology in order to verify their methods. Only English language, peer-reviewed articles were considered.

Terminology: The terms electronic medical record (EMR), electronic patient record (EPR) and electronic health record (EHR) while referring to a hierarchy of record types, were used interchangeably. As a result, all forms of electronic records were considered that were used by nurses to document patient care. Other terminology issues that arose were that of an overlap between challenges and unintended consequences with similar findings appearing as both, depending on specific author.

Nursing studies: A significant number of studies retrieved related to electronic record adoption, however, comparatively nursing was poorly represented - an issue echoed in the literature (Ward *et al.* 2011, Rogers *et al.* 2013, Sockolow *et al.* 2014). Initially, the purpose of the review was to present the general nurses' perspective, accordingly, only studies focusing on this cohort was included. This was a major stumbling block as the majority of nurse-related studies were either mixed (general and specialist) or specialist areas only.

Figure 2: Flow diagram representing the search strategy



Scope: In order that information was applicable to the Irish context, it was deemed appropriate to limit the inclusion criteria to countries with a similar socio-economic background: Europe, Australia, Iceland, Japan, New Zealand, Norway, Switzerland, Canada, and the USA, a measure used in a similar study by McGinn *et al.* (2011). The majority of articles retrieved, originated from the USA; one possible explanation for this is a government initiative promoting a national electronic recording. Studies not conducted in an acute setting, such as primary care centres or residential homes, were excluded.

Data extraction: Extracting information solo can be subject to confirmation bias. This phenomenon refers to a situation where results are interpreted to confirm a preconceived theory or hypothesis (Nickerson 1998). To validate findings, a second person (a nurse) reviewed the selected papers. On their recommendation two studies were removed as they were deemed to underrepresent the purpose of the review.

3.3 Overview of challenges

To present a succinct review, challenges identified in the literature were reassigned under four headings – hardware, software, operational challenges and human factors.

Hardware challenges: Refers to barriers relating to the physical elements of the system including availability and location of terminal.

Software challenges: Refers to barriers relating to the systems or programs used to document patient care, for example, incompatibility between screen flow and workflow.

Operational challenges: The day-to-day challenges electronic records have on the documentation processes of nurses, either directly or indirectly, for example perceived inflexibility of an electronic system compared with paper.

Human factors: "Environmental, organisational and job factors, and individual features that combine to influence behaviour and outcomes" (Clinical Human Factors Group, CHFG, p. 3, 2009).

It is worth noting that challenges and indeed benefits, often arise from hardware and software choices. Findings should therefore not be viewed in isolation but rather they are influenced by systems and environment within which they are utilised. In addition, hardware, software and operational challenges are also affected by human factors, such as stress, and vice versa.

3.4 Usability: what is it and why it can become a challenge

A major finding of the literature review was that usability of a system directly and indirectly impacts on documentation practice. Usability, as described by the ISO standard (ISO 9241-11) is:

> *"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."*

This relates to factors that are essential to construct a functioning system – users, objectives, system efficiency and the environment within which the technology is to be used. For a system to be considered 'usable' all factors must be included. Referencing the work of Nielsen (1993), Rogers *et al.* (2013) stated that usability, a composite theory, refers not only to technology utility but also to the ease of learning (a system). Using Nielsen's (1993) usability heuristics as a framework, Rogers *et al.* (2013) investigated the use of a nursing information system that was part of a larger EHR.

Adopting a scenario-based methodology, the nursing participants (n=12) used the system and reported their perceptions of system usability. Rogers *et al.* (2013) found usability shortcomings, such as complicated menu structure and increased documentation time; they concluded that the impact of system design on nurses' practice is often overlooked in favour of interface design.

3.5 Overview of results

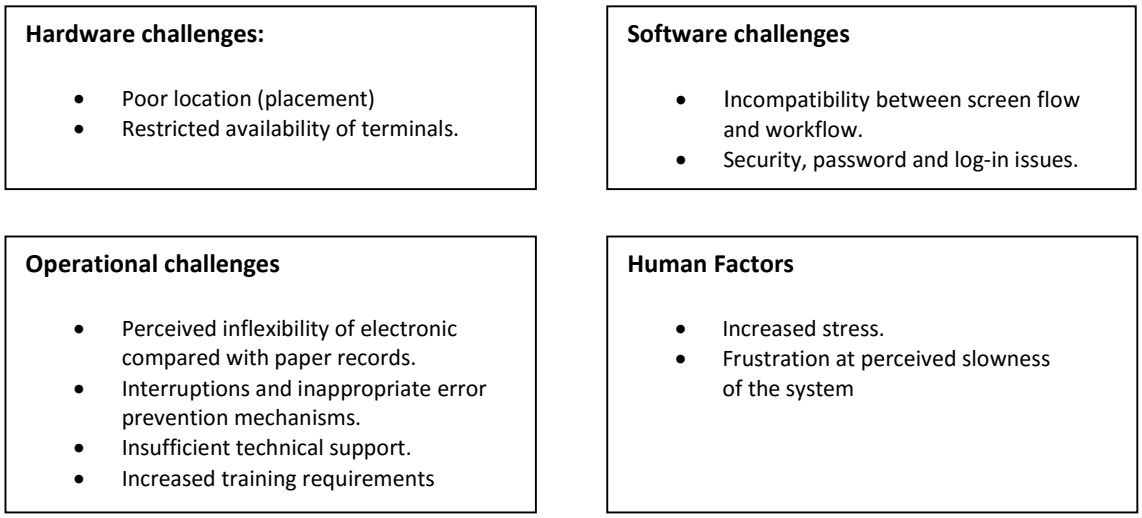
From a total of 17 case studies and 5 literature reviews, the followings findings emerged:

- Overall, nurses were generally positive toward using an electronic record, which improved over time as they became more familiar with the system. Whether this arose because ease of use increased as nurses gained familiarity or usability improved via the adoption of workarounds was not fully explored.
- Incompatibility between electronic systems and documentation practices produced a range of usability challenges.
- Usability challenges were influenced by individual hardware, software, operational and human factors.
- To overcome challenges, nurses developed coping strategies or workarounds, which undermined the benefits of using electronic systems.
- No articles retrieved discussed how adoption improved or inhibited adherence to best practice in documentation principles.

3.6 Discussion of findings

How nurses integrate electronic charting systems into their practice depended on the system usability, both perceived and real. The findings should be viewed cognisant of what individual hardware and software options can afford. For example, hand-held devices afford mobility compared with static, desktop computers, yet screen size may be too small, consequently, presenting different challenges. Challenges were experienced to varying degrees in individual studies, the recurring nature of them validates their inclusion in this review. An overview of the usability challenges, as described in the literature retrieved, is presented in figure 3.

Figure 3: Threats to usability arising from hardware, software, operational challenges and human factors.



The following sub-sections explores common usability challenges and workarounds reported by nursing participants in the literature. Although presented separately, crossover is evident, therefore, each theme should be viewed as being interrelated and influenced by the system employed and individual users' characteristics.

3.7 Hardware challenges

Hardware relates to the physical elements of the computer terminal including availability of a terminal. For clarity, location in this review refers to the physical placement of the hardware.

3.7.1 Location

Several authors reported how challenges relating to hardware location negatively impacted documentation practices (Kohle-Ersher *et al.* 2012, Yeung *et al.* 2012, Dowding *et al.* 2014, Sockolow *et al.* 2014, Zadvinskis *et al.* 2014, Yontz *et al.* 2015). For example, nurses reported dissatisfaction with terminals located away from the patient, as it meant they had to turn their backs on the patient to document care (Kohle-Ersher *et al.* 2012). While only using a sample (n=20), findings from Kohle-Ersher *et al.* (2012) were also replicated in a study by Yontz *et al.* (2015) comprising of

80 peri-operative nurse participants. In addition, participants (nurses) in Yontz *et al.* (2015) recounted their frustration that static terminals placed away from the patient meant they sometimes had to leave the room entirely to document notes or access information.

While the inference is that charting at the bedside is optimal, terminals located at the bedside also demonstrated challenges. For instance, telephoned information cannot be put directly into the nursing notes (Dowding *et al.* 2014). In an ethnographic study by Yeung *et al.* (2012) based on 44.5 hours of observation, nurses reported that charting at the bedside raised privacy concerns, specifically when a patient has visitors, was subject to interruptions (by patients and visitors), along with other environmental influences such as noise, a sentiment echoed by Kohle-Ersher *et al.* (2012).

The obvious solution would seem to be mobile terminals. Mimicking the flexibility of a paper chart and facilitating opportunistic documentation, mobile terminals such as workstations on wheels (WOW) or computers on wheels (COW), can be moved from location to location as required, rendering the debate surrounding location redundant. However, nurse participants from a study by Zadvinskis *et al.* (2014) reported that pushing equipment around evoked increased stress and anxiety in users. From a patient's perspective, cumbersome mobile terminals risked disrupting quality of care delivered through increased interruptions, slower service delivery and a perception of constant documentation (Zadvinskis *et al.* 2014). Pros and cons of using a hand-held device were not discussed sufficiently by any of the studies retrieved as such their effect on nursing documentation practices should be seen as an area for future study.

Debate surrounding terminal choice, and its subsequent link to location, was consumed within a broader narrative with no clear answer offered as to what constituted the best option for nursing. While static terminals must be sited with regards to features of the facility such as electrical points, available space and internet connection (Bain 2015); mobile devices are not bound by such limitations and they allowed point of care documentation, yet may be subject to increased financial output, infection control and security concerns (Schick-Makaroff & Molzahn 2015).

3.7.2 Availability

Along with hardware challenges arising from incompatible location, terminal availability was also problematic for documentation (Stevenson *et al.* 2010, Yeung *et al.* 2012, Zadvinskis *et al.* 2014, Mills *et al.* 2015, Yontz *et al.* 2015). The current practice with paper-based systems is that nursing notes are kept apart from the main medical record allowing nurses to document at time and location suited to their needs and work patterns. Both Mills *et al.* (2015) and Yeung *et al.* (2012) found that an inadequate number of terminals slowed documentation as many users (doctors and allied health professionals) try to use them at the same time. Yontz *et al.* (2015) notes that nurses experienced frustration when a high number of staff tried to access the terminal at the same time. To work around this challenge, the nurse participants in a study by Dowding *et al.* (2014) of general/surgical (inpatient) nurses, found that some nurses worked around the problem by utilizing paper and entering data into the EHR at a later time, with a retrospective time stamp.

Along with frustration, inability to document as required increases the potential for paper-persistence (Yeung *et al.* 2012). Findings from the Yeung *et al.* (2012) study investigating how nurses' documented vital signs (comparing paper and electronic methods) describe how lack of availability in the latter stimulated nurses to transcribe results (onto paper) and enter them at a more convenient time. This workaround, or interim recording, increased the possibility of an incorrect result entered into a patients' record but also meant there was a time gap between known results and their availability to other members of the team.

Although a perpetuating factor in paper-persistence, both poor location and terminal available are not singularly responsible for the practice: indeed, personal nursing notes have always been a feature of nursing. Referred to as 'scraps', these are personal notes kept by the nurse to assist with work flow, act as a reminder system and highlight important patient care specifics (Hardey *et al.* 2000). All nurse participants in one study (two institutions) were observed printing the handover sheet and documenting notes throughout their shift to assist patient care, time management or take notes from telephone calls (Dowding *et al.* 2014).

3.8 Software challenges

Software challenges relate to barriers arising from systems or programs employed to document patient care. In terms of its impact on nursing as a group, these results should be viewed cautiously, in that they are system specific and as such may not demonstrate universal application. However, by understanding what system elements are antagonistic to nursing practice, it allows developers to limit or omit their inclusion in future projects.

3.8.1 Incompatibility between screen flow versus workflow

In terms of usability, software challenges discussed in the literature relate to navigation between worksheets or individual components of the electronic record (Dowding *et al.* 2014, Horte & Visconti 2014, Sockolow *et al.* 2014) and a mismatch between screen flow and actual care assessment or delivery (Carayon *et al.* 2011, Rogers *et al.* 2013, Horte & Visconti 2014, Sockolow *et al.* 2014, Zadvinskis *et al.* 2014, Gephart *et al.* 2015, Saleem *et al.* 2015, Yontz *et al.* 2015). The result was extra time spent on documentation (de Veer & Francke 2010), confusion scrolling between windows and increased cognitive workload (Sockolow *et al.* 2014).

These illustrates an important potential advantage of paper over electronic records. As discussed in Houben *et al.* (2015) paper affords more direct navigation between data sheets and speedy access to multiple information sources. However, it could be argued that electronic systems afford users exactly this, but faster and from even a greater range of material. Furthermore, the benefits derived from paper are based on the assumption that all pages are filed correctly, legible and available when required. Nonetheless, problematic navigation through EHRs were reported as negatively impacting user satisfaction (Horte & Visconti 2014). Based on a sample population of nurses from an Interventional Radiology (IR) department, Horte & Visconti (2014) found navigating between different windows to document care was time consuming and took time away from patient care. The authors did not disclose system specifics such as screen size, which might have altered the result as larger screens may positively influence navigation, compared with smaller hand-held devices. As a result,

this finding should be viewed cautiously and future studies should address the effect of screen size on usability.

Respondents in Creswick *et al.* (2011) reported discontent with the number of 'clicks' required to access information. Whereas, an empirical study (n=12) by Sockolow *et al.* (2014) found that excess 'scrolling' instilled a fear that information would be missed. As demographic information was not collected, a correlation between computer literacy, previous experience and navigational issues could not be formed. Although, this point was alluded to, it was not fully addressed in Horte & Visconti (2014). Dowding *et al.* (2014), however, found no distinguishing characteristics between nurses in their sample (age, experience, or previous computer experience).

The underlying causes of perceived navigational issues, whether they be individual (related to the nurse) or systematic (related to the interface) should be more comprehensively investigated. A clue to the answer may be found in the time nurses have been using the system. Although the system under investigation by Dowding *et al.* (2014) was in use for three years, it was unclear how long the nurse (who reported navigational issues) had been using it. Whether a longitudinal investigation would reap the same outcomes or if navigational challenges are transient and dispel as experience is gained with a particular issue is unclear.

3.8.2 Security, passwords and log-in issues

Security and privacy concerns relating to electronic records use has been well documented in the literature (McGinn *et al.* 2011, Kohle-Ersher *et al.* 2012, Cucciniello *et al.* 2015). For example, Cucciniello *et al.* (2015) report fear of reduced security as records, not physically confined to the clinical area, could be accessed from home. Thereby increasing the potential for misuse and widening the area of risk beyond the health institution. While various legislative and technological factors have been developed to improve data security and privacy, issues still arise. Kohle-Ersher *et al.* (2012 p. 132) describe the occurrence of "incidental disclosure". This refers to patient, families or other patients extracting information when terminals based in the shared wards are visible. This can occur with paper-based systems, however, the nurse is able to move to a more discrete part of the clinical area to document their notes.

Increased security measures, such as complex or frequently changing passwords, while protecting data, also has the potential of making access difficult and reduce usability. From a literature review by Stevenson *et al.* (2010) along with slowness of system and difficulty navigating between multiple windows, nurses found multiple log-ins as barriers to effective use. In addition, one nurse respondent in Kent *et al.* (2015) noted how, in a disconnected system, having to remember multiple passwords increased log-in time, a sentiment echoed in Saleem *et al.* (2015) and Yontz *et al.* (2015). In another study, nurses reported increased frustration with forgotten passwords (Zadvinskis *et al.* 2014). Whereas, nurses in a time-motion study by Read-Brown *et al.* (2013) were observed entering patient details into the system (pre-charting) prior to their arrival in the operating theatre, when asked to explain their rationale behind the practice, nurses responded that this was a method to overcome the number of log-ins that was required. Further demonstrating how nurses adopt workarounds to overcome perceived system deficits.

3.9 Operational challenges

Along with hardware and software usability challenges, a number of operational challenges were highlighted in the literature that negatively impacted on both usability or perceived ease of use (Carayon *et al.* 2011, Rogers *et al.* 2013, Saleem *et al.* 2015, Yontz *et al.* 2015). Operational, in this instance refers to day-to-day challenges electronic records have on the documentation processes of nurses, either directly or indirectly, such as perceived inflexibility of electronic systems, interruptions and inappropriate error prevention mechanisms, technical support and training issues.

3.9.1 Perceived inflexibility

Using a rapid ethnography approach, Saleem *et al.* (2015) evaluated clinical information systems (CIS) and described how poor usability was a limiting factor in user satisfaction. Convoluted presentation of information and blank fields meant it was difficult to assess ‘at a glance’ what was the most important piece of information regarding the patient (Saleem *et al.* 2015). Describing an ‘off-the-shelf’ information system, participants reported that the system contained both too many options in

some parts and too few in others. Their sample (n=69 observations and opportunistic interviews) contained all end-users, including nurses. They noted poor customization as a barrier, highlighting how a one-size-fits all approach can be too encompassing and lacking flexibility, with compromises in usability an inevitable consequence (Saleem *et al.* 2015). Nurse participants in Yontz *et al.* (2015) revealed that the inability to insert notes relating to patient vital signs at opportune points in the patient record promoted dissatisfaction (Yontz *et al.* 2015).

While advantages of electronic record adoption are evident, obstacles are also profound. Without due consideration of usability, meaningful interaction and use of the EHR can be stilted and the learning curve prolonged. For example, factors (not limited to nursing) such as complex drop-down menus (Silow-Carrell *et al.* 2012) or unclear functionality (Rogers *et al.* 2013), potentially increase frustration and dissatisfaction with the system. Using Nielsen's usability heuristics as a framework, Rogers *et al.* (2013) investigated a nursing information system (NIS) that was part of a larger EHR. Using a scenario-based methodology the nursing participants (n=12) used the NIS and reported their perceptions of system usability. Rogers *et al.* (2013) found that usability shortcomings, such as complicated menu structure increased documentation time.

While free-text fields allow nurses to document patient care using the patient's words and capture the diversity of nursing care, their usefulness to data collection is minimal. Free-text presents problems in data aggregation and sorting (Silow-Carroll *et al.* 2012). This presents two major difficulties for system designers. Check boxes or drop down menus need to be comprehensive enough to encompass all possible patient presentations. In doing so, a large pool of data (to asses all potential presentations) can become too cumbersome to navigate. Sockolow *et al.* (2014) note it is impossible to develop a list so comprehensive to describe all potential patient presentations, prompting nurses to utilizing free text rather than search long listings. Although, Saranto *et al.* (2014) agree that while structured lists promote information gathering, implementers should use this approach with caution as they may also hinder individualisation of patient care.

3.9.2 Interruptions and inappropriate error prevention

In five articles retrieved nurses discussed how adopting electronic charting raised concerns surrounding increased interruptions (Kohle-Ersher *et al.* 2012, Yeung *et al.* 2012, Sockolow *et al.* 2014, Zadvinskis *et al.* 2014, Gephart *et al.* 2015). When terminals were not located in the patient's room, nurses reported having to walk back and forth to ask questions and then enter patient information extending the time taken to document a patient's admission (Kohle-Ersher *et al.* 2012). Along with extending documentation time, the potential for information to be reinterpreted between answer and input exists. Nurses in Sockolow *et al.* (2014) raised the issue that interruptions (by patients or visitors) while charting at the bedside could result in errors, whereas environmental (noise) was raised by Yeung *et al.* (2012).

Discussions surrounding EHR adoption note their potential to reduce errors (HSE 2015), although, inappropriate or abused error prevention mechanisms may actually propagate the reverse. While EHRs promote patient safety through initiating a number of safety checks such as patient identification and pre-medication dispensing, when these checks increase administration time or are perceived as burdensome, workarounds may be enacted that lead to unsafe practices. For example, one nurse in Dowding *et al.* (2014) was observed storing medication in their pocket for a number of patients rather than going back to the system for each patient, rendering the error prevention mechanism ineffectual.

Errors can originate from either the system (Sittig & Singh 2013) or the user (Meeks *et al.* 2014). For example, Bowman (2013) discusses adjacency errors, which describe how a user clicks on the option next to the correct one. The potential for small errors to be perpetuated throughout the patients' electronic record has also been raised as a safety concern (Ward *et al.* 2015). Yeung *et al.* (2012) noted how information errors arising from transcribing paper notes to computer can decrease patient safety. In addition to these transcription errors, research by Saleem *et al.* (2015) noted how mistakes can be carried forward through the patients' information, but posited that one way to reduce the potential for error is to insert a number of verifications across the patient journey. While data entry can lead to erroneous information in the patient record, Rogers *et al.* (2013) discussed how a confusing interface can promote errors,

with respondents describing how unclear signifiers (or visual clues) rendered users cautious about using the system - either under or over clicking. Signifiers, according to Norman (1999, 2013) provide the user with clues or indications as to the functionality of an object (or interface). While respondents in Rogers *et al.* (2013) noted that they used workarounds to avoid this, the specifics of the workaround were not discussed.

3.9.3 Insufficient technical support

Challenges arising from insufficient technical support were described by nurses in two studies (Colligan *et al.* 2015, Saleem *et al.* 2015). Colligan *et al.* (2015) noted that while technical support was increased during the initial implementation phase, the participants in the study (74 paediatric nurses) reported increased stress once this extra support was reduced. Saleem *et al.* (2015) found both perceived inadequacy and promptness of technical response lead to dissatisfaction with electronic documenting. While Colligan *et al.* (2015) and Saleem *et al.* (2015) explore technical support as a challenge, Yontz *et al.* (2015) discuss it in terms of its ability to be a facilitator, with a majority of respondents having a positive experience of technical support resulting in a more responsive implementation process. However, one respondent raised a lack of support outside of normal work hours, especially weekends. This is an important point, as the majority of nurses provide care 24/7, 365 days a year.

A challenge for implementers when allocating resources (people and finance) for technical support is that, as Colligan *et al.* (2015) explained, support requirements are not spread evenly throughout a nursing cohort. Subsequently, addressing the needs of many may be difficult. Previous computer experience rather than participant's age seemed to be a more reliable indicator of acceptance (Colligan *et al.* 2015). This is similar to a finding in a literature review by Huryk (2010), who found that previous experience was positively correlated with electronic record use. Although consensus among the literature was absent as to what was the ideal template for support services, Colligan *et al.* (2015, p. 474) advises against a *one-size-fits-all approach".

In addition to structured training, the literature describes 'super-users' as prominent in meeting training needs of staff (Horte & Visconti 2014, Saleem *et al.* 2015). The term 'super-user' refers to a staff member who has received extended training, develops

increased knowledge surrounding the new system and is available to guide other staff members through the process (Horte & Visconti 2014). The benefits of involving super-users are apparent, such as ward level interaction with end-users and familiarity with organisational protocols. While, Cucciniello *et al.* (2015) described the super-user in terms of project champions, other studies have raised negative aspects of their dual role. For example, complications described by Saleem *et al.* (2015) include staff turnover which, could include super-users and interruptions to their own daily tasks to assist other staff members or to take part in extra training.

3.9.4 Increased training requirements

Closely linked to technical support issues, operational challenges arising from perceived inadequate training was found in five of the articles retrieved (Huryk 2010, McGinn *et al.* 2011, Nguyen *et al.* 2014, Cucciniello *et al.* 2015, Saleem *et al.* 2015). Comparable with the debate on what constitutes the 'right' amount of technical support, consensus was not reached on what constitutes the ideal training programme. Nevertheless, from research using a mixed method approach (case study, interviews and observations) Cucciniello *et al.* (2015) advise that training should form a large component of the implementation stage. Specific requirements of training are dependent on the individual needs of the end-user. From their research, Topkaya & Kaya (2014) noted a positive correlation between computer use (personal and professional) and adoption of health information technology (HIT). While many definitions of computer literacy exist, put simply it is the ability to utilise a computer system (Topkaya & Kaya 2014).

To promote learning a new skill, Huryk (2010) raises the importance of protecting training sessions, along with providing education to compliment all competency's and levels of computer literacy. Computer literacy is not a static skill, nor is it spread evenly throughout the nursing profession, accordingly some individuals will require more training than others (Huryk 2010). McGinn *et al.* (2011) note that when training requirements are fully met, nurses are more receptive to new system adoption. Conversely, both Saleem *et al.* (2015) and Nguyen *et al.* (2014) found that ineffective training regimes can act as a barrier to adoption.

3.10 Human factors

Human factors are "environmental, organisational and job factors, and individual features that combine to influence behaviour and outcomes" (CHFG, p. 3, 2009). They generate challenges to electronic record adoption through increased stress associated with change and frustration with the new system. They can be seen as both influencing and influenced by hardware, software or operational challenges.

3.10.1 Increased stress

Applying a human factors lens, distraction and mental fatigue according to Shappell & Weigmann (2000) are examples of adverse mental states that promote unsafe crew conditions possibly leading to aviation errors. Applying the same thinking to healthcare, adoption of electronic records increases cognitive workload and work stress, especially in the early stages of implementation (Colligan *et al.* 2015). Approaches to implementation should be aware of this and plan accordingly. A number of studies retrieved discussed how the adoption of electronic records was both a stressful time for nursing (Zadvinskis *et al.* 2014) and a source of frustration (Huryk 2010, Stevenson *et al.* 2010, Rogers *et al.* 2013).

Addressing these issues is important, as increased stress is a common precipitator of compromised patient safety (Sexton *et al.* 2000). All change processes will, to some extent, introduce a level of stress for all stakeholders (HSE 2008), therefore, extinguishing stress completely is unrealistic, implementers should instead attempt to minimise stress by looking at the precipitating factors which could arise from hardware, software, operational or personal challenges or a combination of all four. Personal challenges include elements such as limited computer literacy skills (Topkaya & Kaya 2014).

3.10.2 Frustration at perceived slowness of the system

Although the EHR will remove any problems associated with illegible documentation, adoption can introduce a new range of technical (systems) issues. A case study by Yontz *et al.* (2015) into the implementation of a peri-operative EHR found that respondents reported frustration with the apparent slowness of the system compared with traditional paper-based methods. Slowness arose from factors such as system

freezing or increased login times. Participants in Yontz *et al.* (2015) noted that while the system was useful for documenting care during long surgical procedures, shorter cases proved challenging as login times were standard. In addition, comparative slowness of system was reiterated in Horte & Visconti (2014) and literature reviews by Stevenson *et al.* (2010) and Huryk (2010).

'Pre-charting' refers to the practice where information is entered prior to the patient encounter (Read-Brown *et al.* 2013, Yontz *et al.* 2015), an exercise that could be construed as conflicting with nursing practice where documenting at point and time of care provision is the considered best practice (NMBI 2015). Dowding *et al.* (2014) also observed nurses copy-and-pasting entries as a method of speeding up documentation time. Although their system employed computers on wheels (COW) as opposed to a static terminal, these workarounds demonstrate that when a new system is incompatible with workflow, end-users can adopt bad practices to overcome or compensate for perceived limitations.

3.11 Conclusion

This chapter reported on the findings of the accompanying literature review, conducted to synthesise pre-existing data on the challenges experienced by nurses arising from electronic record adoption. It appears that while nurses favour electronic charting (Huryk 2010), challenges are evident and can be grouped as hardware, software, operational challenges and human factors. A natural interrelatedness between challenges was evident, for example, operational challenges such as interruptions to documentation time was often brought about by hardware challenges such as placement of terminal which lead to stress (Kohle-Ersher *et al.* 2012, Sockolow *et al.* 2014). Stress falls under the theme of human factors, and can lead to errors and decreased job satisfaction (Colligan *et al.* 2015). Similar to findings from a number of other studies (Stevenson *et al.* 2010, Yeung *et al.* 2012, Sockolow *et al.* 2014), dissatisfaction appears to originate from an incompatibility between current practice and usability. By understanding the various challenges, remedies can be initiated earlier, so that time between implementation and acceptance is expedited and the

effect of workarounds lessened. Future studies should assess the use of hand-held devices as this was not adequately addressed in the retrieved literature.

The following chapter will detail the methodology of the research study conducted to ascertain the 'lived experience' of nurses' using electronic records to document patient care in the Irish healthcare setting and how this information could be potentially useful for a national EHR project.

Chapter 4: Research Methodology

In response to the hardware, software, operational challenges and human factors identified in the literature review a research study was conducted, primarily, to understand the consequences of electronic recording systems on nurses' documentation practices from an Irish perspective. This chapter describes the study sites, participants, data collection and analysis. The research methodology is described, rationale behind its adoption, along with study limitations.

4.1 Introduction

> *"When nurses view documentation as a difficult and cumbersome task, it often slows down the technology's acceptance" (Piscotty et al. 2015, p.288).*

While incompatibility between nurse's work and electronic recording systems may propagate the manifestation of NUCs, conversely, systems deemed usable and complementary may promote positive unintended consequences such as increased nursing autonomy (Creswick *et al.* 2012). Hence, it would appear that addressing known challenges, is not merely prudent, but rather vital to the long-term success of a national EHR. However, here in lies the challenge, as late adopters our understanding of what are the challenges comes largely from international research based on the specialist nurse perspective, yet, voices from nurses providing care in the Irish setting is largely absent. Furthermore, when deployed in the Irish setting, with the exception of a number of private institutions, to date electronic systems are localised to smaller, specialist areas.

4.2 Research question

The central theme addressed in this research was:

> *'Learning lessons: A discussion on the unintended consequences of electronic record adoption on nursing documentation practices and implications for a national EHR project'.*

In order to extract potential lessons, three research questions where constructed after reviewing the available literature and from feedback from the study sites involved.

Question 1: What are the challenges arising from electronic record use?

Question 2: How do nurses cope with these challenges?

Question 3: What lessons learned can be applied to a national EHR project?

The main goals of this study are:

1. Using a phenomenological approach, explore the challenges of electronic record adoption from a nursing perspective in the Irish context.
2. To raise awareness of the potential of NUCs associated with adoption on nurses' documentation practices.
3. To identify nursing-specific considerations that should be addressed when considering a national EHR for Ireland from the perspective of nurses and their documentation needs.

4.3 Methodology

A plethora of research methods exist, spanning a spectrum from quantitative to qualitative, including exploring numerical data to capturing individual experience to observational field work (Gerrish & Lacey 2010). Though many methods were initially considered, a qualitative approach was deemed most appropriate. Although a quantitative approach might yield a greater number of responses, this was quickly discounted for two reasons. Firstly, the objective of the research was to ascertain the 'lived experience' of nurses, rather than a critique of an individual system. As such, unquantifiable elements such as users' perceptions of advantages and obstacles was sought which did not lend itself to a quantitative lens. Secondly, electronic systems were already being used by the study participants and no base-line figures existed, making any comparisons between pre and post implementation stages impossible. It was decided that in order to take an exploratory, as opposed to explanatory stance, qualitative analysis was a better fit.

4.3.1 Rationale for adopting a qualitative approach

A research approach that would address the following was sought:

- Explore the research question from a 'real world' perspective of the nurse.
- Decipher opinions of electronic recording from opinions of individual systems.
- Explore potential usability challenges as experienced by nurses that could be interpreted in the context of the accompanying literature review.
- Generate rich data from a smaller sample size.
- Uncover themes that may, or may not have, been raised in the literature.
- To allow the researcher to approach the study with pragmatism cognisant of limited financial outlays, a definite time-line and a single researcher.

On reflection, it was deemed appropriate to adopt a qualitative methodology, specifically a phenomenological approach.

4.3.2 Phenomenological approach

Within a qualitative framework, there are many different types of approaches that can be selected, such as phenomenology or grounded theory, each demonstrates a range of pluses and minus. For this research a phenomenological approach was deemed most suitable as it aims to understand experiences from the perspective of the person, offering a subjective insight from the 'inside' (Gerrish & Lacey 2010, p. 177).

Originating in the work of Edmund Husserl (1859-1938) there are essentially two schools of phenomenological thought – descriptive and interpretive or hermeneutic (Holroyd 2001). The first school, descriptive, stays close to it roots as prescribed by Husserl, espousing an empirical approach when researchers suspend any presumptions or personal biases, referred to as 'bracketing' (Gerrish & Lacey 2010, p. 181). In practice, this occurs when a researcher does not start out with a hypothesis or stated theory to prove or disprove, rather the role of the researcher is to extract new knowledge surrounding a topic. This does not mean that the researcher should not be well-informed about their subject area, but rather they should question all assumptions as if viewing the topic for the first time.

Conversely, an interpretive or hermeneutic approach, believes that researchers are unable to suspend their own bias, referred to as 'sensitizing' and should interpret their findings in light of these presumptions (Gerrish & Lacey 2010, p.181). It describes how researchers can use their experience to observe a situation and uncover new learning based on their own experiences. Debate abounds on which perspective is superior, while both sides display pros and cons. Holroyd (2001) notes that while each piece of research should be assessed individually, basic guidelines exist. For this research a descriptive approach was utilised after considering three factors:

- The researcher's experience of nursing notes was limited to paper systems, as such, they did not hold a personal bias for or against electronic systems. Although, it was considered that their experience with paper systems, and indeed their nursing background, could impart an unconscious bias.

- Interpretations of EHR advantages, challenges and unintended consequences were limited to those discussed in the (international) literature, no Irish articles were retrieved. Thereby limiting the usefulness of a hermeneutic approach as it encourages researchers to use their own experience and knowledge to interpret meaning from the raw data.

- Regardless of findings, a concern of the researcher was that if a hermeneutic approach was utilised, outcomes would be interpreted to fit in with established themes and could not be seen as providing a truly Irish perspective.

For a phenomenological approach to be considered valid, the researcher must follow set procedures and established methods (Pereira 2012), the method employed for this research is based on the work by Giorgi (1997) and adapted by Schweitzer (1998) due to its ease of use. Holloway & Wheeler (1998, p.124) note that following a single, prescribed method avoids 'method slurring' which occurs when a researcher incorporates aspects from a number of methodologies into their research. Incorporating elements from Technology Acceptance Model 2 (TAM2) (Venkatesh & Davis 2000) was considered as a data analysis method, but discounted for this reason. Along with lacking rigor, cherry picking aspects of methodologies or merging incompatible approaches can produce false results (Holroyd 2001).

4.3.3 Study sites

The acute healthcare sector was chosen to conduct the research based on two factors – the diversity of nursing care provided and their high number of nursing staff employed. No distinction was made between public and private practices. The research was not intended to be a critique, or otherwise, of an individual system. Rather its purpose was to ascertain how nurses view electronic records and the impact on documentation practices. To capture the latter, and avoid the former, three study sites where identified following discussions with an informatics expert, each employing a range of electronic systems from local (to the ward level) to hospital wide. All study sites where based in the Republic of Ireland and all provided acute care. Each institution delivered a 24 hour, 365-day service across a range of departments. Along with meeting these criterion, specific sites were selected that would yield the greatest

variety of nurses (across departments). More sites meet the inclusion criteria, but cognisant of available time only three sites were pursued for this research.

It was noted that in each organisation an informatics nurse specialist (INS) was employed. Deemed an official nursing discipline in 1992 by the American Nursing Association (ANA) and provide a link between clinical practice and health technology (ANA 2008). Rojas & Seckman (2014) point out that along with their clinical expertise and volume of numbers, nurses have an intimate knowledge of workflow. INS have the added benefit of also understanding the technical aspects of implementing an electronic record and usability evaluation (Rojas & Seckman 2014, ANA 2008). Therefore, due to their specific skill set the INS from each site was approached to introduce the research topic and to seek their assistance in generating participants. Their input into the research itself was initially sought but due to a limited participant pool and the type of information sought (user perspective) it was not pursued.

4.3.4 Population and sampling

In research, 'sampling' refers to the process of participant selection in order to obtain the richest source of data to answer the research question. In general, sampling in qualitative research generally incorporates a non-probability and purposeful approach (Miles & Huberman 1994). In non-probability sampling limitations are imposed restricting the potential population to a purposeful set. In addition, weight is given to the opinion of the researcher when selecting participants, unlike probability sampling that employs a random approach, as such, is less likely to be open to bias.

Participant selection was limited to the following criteria:

- *A registered nurse (general division).*
- *Using electronic records to document nursing care as part of their daily routine.*
- *Working in the acute healthcare sector in the Republic of Ireland.*

Discussions with an INS at the individual institutions identified potential ward areas that met the criteria and may be interested in participating. Following these

discussions, each clinical nurse manager (CNM) was contacted via email, informed about the study and asked if they would like their ward area to participant. Site visits were arranged with four clinical areas interested. To include a representative sample, it was important to gather narratives from a range of clinical areas. Ideally a randomised sample would be chosen, this describes a situation where a list of potential candidates is compiled. From this list, a percentage is deemed appropriate for inclusion, participants are selected at random, say every fifth person on the list, in order to give the research the best chance at delivering a non-biased account. This was not practical as a list with the names of nurses who used electronic records does not exist. And if it did, contacting them through their human resources department was deemed too invasive.

Along with the site visits CNMs were sent a 'call to participate' poster to display in their ward area (Appendix D). Feedback from one CNM raised the point that although a useful tool to introduce the research to their staff, it was their view that posters hung on a noticeboard did little to attract participants as nurses are constantly approached for research and a single poster can get lost in the busyness of the clinical environment. This view was confirmed with a poor response obtained directly from the poster (n=2), therefore, to generate interest in the study, a number of methods where employed.

- *Planned:* nurses were introduced to the topic during handover or at another opportune time and asked to participate.
- *Opportunistic/convenience sampling:* The researcher remained in each unit for a period of time to facilitate any nurses who would be willing to be interviewed and was available to do so. Although setting a specific time would benefit the researcher, identifying a time when nurses are less busy was deemed impractical.
- *Snowball sampling:* Nurses were asked to identify other nurses who may be interested in participating (snowball sampling).

The majority of participants were recruited via snowball sampling. Snowball sampling, a form of convenience sampling, refers to a type of non-probability sampling where

participants are chosen due to ease of access and at the recommendation of others (Gerrish & Lacey 2010). Main deficits of this type of sampling relate to under or over representation bias (Gerrish & Lacey 2010). This describes a situation where nurses (or clinical areas) who held strong opinions on electronic record adoption might be more receptive to being interviewed. Results, therefore, might show a bias in favour or against adoption and lack transferability to a wider nursing population.

4.3.5 Sample size

A consideration of any research is the identification of an adequate sample size, this can be an arduous undertaking: too small a sample and results can be difficult to infer, too large can be too unwieldly to manage (Gerrish & Lacey 2010). While no fixed number represents the ideal sample size, there is some guidance. Bryman & Bell (2003) advise that in quantitative studies the sample size should be a ratio of the total population identified. With qualitative enquiries, they advise researchers gather data until saturation occurs. This refers to a point in the data-gathering phase where the same themes begin to reoccur. The latter method was employed for this research, with a total population of participants of 22 included. This is represented in table 2, the total participant pool is divided by clinical area but not by institution. It is presented in this fashion to guard participant anonymity, organisation identification and ensure confidentiality. As the possible institutes for selection was limited, by documenting the clinical areas utilising electronic records it was judged that a reasonable risk of identification was evident. The information in figure 3 provides a demographic overview of total participants, using Benner's (1984) novice to expert classification.

Table 2: Total participants by clinical area from three healthcare institutions

Clinical environment	Total participants interviewed (N=22)
Inpatient (specialist)	N=11
Inpatient (general)	N=5
Day-care	N=6

Table 3: Demographic profile of sample pool

Years system in operation	In each institution, the system was employed for a minimum of 36 months.
Minimum length each participant was using the system employed.	<12 months= n=1 >12 months= n=21
Male:Female ratio	2:20
Years qualified (participants)	Novice 0-1 year (n=2) Competent 2-3 years (n=1) Proficient 4-5 years (n= 3) Expert 5-10 years (n= 4) > 10 years (n = 12) (Total n=22)

4.3.6 Questionnaire development and pilot study

A pilot study was conducted to test the usability of the semi-structured questionnaire. Pilot studies are conducted to test the suitability and appropriateness of the methodology used prior to conducting a full study (Gerrish & Lacey 2010, Bryman & Bell 2003). Using a convenience sample of nurses who trained in the Irish healthcare system, but currently based in hospitals in the UK, interviews were conducted via Skype or email. As this research is primarily a health informatics study, the purpose of this pilot was to develop the wording of the open-ended questions so that they were understandable to a nursing cohort that may not be familiar with technical terminology (Appendix E). This was indeed the case and the questionnaire went through several iterations before arriving at the final draft. The questionnaire was used during each interview as a guide rather than a prescribed format. The pilot sample was based on a convenience sample identified through social media. The researcher, a recently qualified nurse, is a member of two online nursing groups. The total number of participants used in the sample was six nurses, this number was not included in the main findings.

4.3.7 Data collection

In order to extract the best data to suit the research question and ensure the study was conducted in a robust and scientific manner, the study design took consideration of most appropriate method of data collection and analysis. Using focus groups was considered, but discounted, as individual participants might be unwilling to discuss their opinions in an open forum. Face-to-face interviews was judged the most appropriate method for this research. Data collection and analysis in all qualitative methodologies, according to Giorgi (1997) follows a basic five-step sequence:

1. Collect data
2. Read data
3. Distil data into smaller parts
4. Organise data into themes
5. Synthesis and present findings

To adopt a phenomenological approach, Giorgi (1997) notes that although the universal sequence remains the same, each stage will demonstrate variations from a general approach in order to extract shared meanings from the data rather than just categories. Therefore, this research will utilise Schweitzer's (1998) adaptation of Giorgi's (1997) phenomenological method as described in Holroyd (2001).

While Schweitzer's model begins when data collection has occurred, Giorgi (1997) provides advice on this; while information can be collected in many forms, face-to-face interviews are considered the best practice (Giorgi 1997, Gerrish & Lacey 2010). This format demonstrates many benefits such as the transmission of non-verbal cues and it allowed the researcher to take field notes during each interview. Data from these notes were also included in the analysis stage. Face-to-face interviews also demonstrates many drawbacks; the biggest being balancing the time constraints of a stated deadline with the busyness of a hospital ward and how the two could be managed in order that interviews be held. To facilitate nurses leaving the ward area, each interview was limited to 20 minutes. This time frame was extended rather than disrupt the flow of the interview but more often reduced to allow nurse to return to the ward. A total of seven hours and 55 minutes of recording was captured. Along with time constraints and availability a further limitation was geographical in nature.

Geographical constraints meant that as interviews were held face-to-face, participant selection was limited to those within a set travelling distance. This disadvantage might have been diminished by conducting telephone interviews, however, as Opdenakker (2006) notes face-to-face interviews can take advantage of the extra information provided by a participant's body language; do they appear interested or disinterested, do they appear to be happy to answer the questions? Furthermore, sitting face-to-face allows both parties to develop a rapport or transient relationship (DiCicco-Bloom & Crabtree 2006). Face-to-face interviews also needed to be transcribed, further depleting available time (Opdenakker 2006).

Data was collected using the semi-structured questionnaire developed in the pilot study, with each open-ended questions worded to extract the broadest data possible. Each interview took place in the facility were staff nurses were employed, a quiet area

(office space) was provided by each CNM away from the clinical area. This provided a confidential space within which to conduct the interviews.

Time was set aside prior to each interview to inform participants of the purpose of the study, their right to withdraw, refuse to answer all or any of the interview questions, that all interviews would be recorded but that all voice recordings would be destroyed upon completion of the research. The interviewer (researcher) reiterated that all information supplied would be treated as confidential with no personal or institutional information required. Findings would be presented as a whole (across the three participating institutions) making it difficult to assign answers or opinions to a specific nurse. Written consent was not collected, but each participant was informed that by answering the following questions consent was implied.

4.3.8 Data analysis

Central to data analysis from a phenomenological approach is the identification of themes. In order to analyse the data collected and extract themes, interviews were transcribed and themes extracted using a descriptive/inductive approach. Initially TAM2 (Venkatesh & Davis 2000) was considered as a theoretical framework. However, to truly reflect the phenomenological nature of the research it was decided to employ Schweitzer's (1998) adaptation of Giorgi's (1997) method. This six stage model, prescribes a sequential format and was used to captured pertinent data from the transcribed interviews. An overview of the process is depicted in figure 4 and elaborated in the following sub-sections.

Figure 4: Schweitzer's (1998) adaption of Giorgi's (1997) phenomenological method

Stage 1: Understand the raw data

The transcribed (*verbatim*) raw data was read and reread. Preconceived ideas or biases were 'bracketed' to ensure adherence to the descriptive analysis approach. There were two main ideas that were bracketed. Firstly, based on personal experience and findings from the literature review an inevitable assumption is that all nurses experience challenges to some degree when utilizing electronic records. Secondly, the assumption that nurses who had used electronic records could, in turn, be a useful source of knowledge for other projects. *(Bracket – not all nurses experience challenges or to the same extent, not all information is useful or transferable).*

Stage 2: Develop a participant profile

A summary for each participant was developed. To arrive at the profile, the natural meaning units (NMUs) as described by Schweitzer's method were extracted. These are self-expressed opinions of the end-users taken from the data. Using NMU's, the researcher was able to identify sub-themes. This bottom-up approach allowed the researcher to develop themes from the data.

Stage 3: Forming a thematic index

During the third stage, the researcher used all the participants' profiles to construct a thematic index. This is essentially a catalogue of sub-themes derived from the data, it is constructed by unpicking and analysing central themes and referents. Referents are specific words that describe the participants' experience (Holroyd 2001). Repeated or non-relevant data were removed using an iterative process. This is depicted in Table 4: referents are underlined in the first column and an example of the trajectory from raw data to a thematic index is also illustrated. Table 4 portrays parts from a single interview (participant BI1), the final thematic index combined all the data collected.

Table 4: Example of a section of a participant profile at Stage 3

Participant Profile: BI1			
Extract from transcribed interview (Referents underlined)	**NMU's (from nursing narrative)**	**Central Themes (formulated meanings)**	**Thematic Index (Sub-theme)**
"Sometimes, you know what, (laughs), there's always an issue (with passwords), you have to jot down because it only last for a certain amount of time."	Passwords can reduce security if organisational protocols are deemed complex	Security - Password protocols can negatively impact security of system.	Password workaround

Stage 4: Searching the Thematic Index

The researcher reviewed the thematic index, searching for clusters of information within the data relating to the research aims and questions. From this, a set of interpretive themes was constructed. A phenomenological approach does not set out to prove or disprove a hypothesis, instead interpretive themes are built using thematic indices to build a picture relating to the research question. Interpretive themes, therefore, can be seen as core concepts. Table 5 provides an example of how thematic indices relate to interpretive or main themes.

Table 5: Example of thematic indices and corresponding interpretive themes

Examples of thematic indices from a sample of participants (Sub-themes)	Interpretive themes (Main themes)
Inadequate number of terminals available	Direct challenge
Time constraints on learning	Indirect challenge
Technical challenges	Direct challenge

Stage 5: Develop an extended description

From the interpretive themes, the researcher extracted meaning and knowledge pertaining to the topic under investigation, providing an extended description of the phenomena. Data was reviewed and arranged using the research questions.

Stage 6: Review extended descriptions

The final stage, as described by Schweitzer's (1998) involves synthesizing and reviewing these extended descriptions. Upon completion of this evaluation, the descriptions provide a detailed portrait of the 'lived experience' of the topic under investigation from the perspective of the participant. The researcher constantly referred back to the original data (referents, NMU's, sub-themes) to ensure description accurately described the participants' subjective experience rather than the researchers inferred meaning.

4.3.9 Validity and rigor

Ideally, in phenomenology, participants should be re-interviewed and presented with the description of their interview to ascertain their views on the researcher's description. This allows the subject to reflect on the interview and gives them an opportunity to add or subtract information they feel important. According to Colaizzi (1978) as cited by Holloway & Wheeler (1998) this ensures rigor and validity of the final outcomes. However, for a variety of reasons (time, availability of participants) this was not always practical. Eight of the 22 interviews were reviewed with participants, however, it is noted as a limitation of the study.

4.3.10 Transferability

Transferability describes how findings from a smaller cohort can be applied to a larger population (Holloway & Wheeler 1998). Along with establishing the trustworthiness of the data, the researcher also wanted to ensure transferability of the findings to a larger nursing population. This can be problematic in qualitative enquires as the purpose is to try to identify and understand the phenomena under investigation rather than understand its distribution (as happens in quantitative methods) (Holloway & Wheeler 1998). Mindful of this, the researcher considered the sample selection to endeavour to ensure transferability of findings:

- Participants displayed a spectrum of years qualified from novice to expert, based on Benner's (1984) stages of clinical competence framework.
- Data collection avoided using a single source, mindful of the influence of organisational culture.
- Participants were included from a range of clinical areas: inpatient (general), inpatient (specialist) and day-care environments.
- All participants had used paper-based systems in the past, but were currently using electronic systems.

4.4 Limitations of the study

Although displaying a range of benefits, a phenomenological approach, by its very nature (qualitative) can also demonstrate a range of limitations. For example, it can be a time consuming endeavour with outcomes resting on the talents of the interviewer and willingness of the interviewee to discuss their true experiences. 'Bracketing' as prescribed by a phenomenological approach, can be difficult to perform in practice, suspending one's 'knowing' in order to attain new learning, and can require a significant amount of self-restraint. In addition to known limitations, the findings of this study should be viewed cognisant of specific restrictions.

- The findings represent the attitudes of a small sample of nurses; applicability of findings should therefore be viewed with caution pending further investigation.

- The initial interview was limited to 20 minutes to facilitate nurses leaving the clinical area. A better approach would have been to remove any time constraints; however, this was not possible.

- Due to time constraints, a second interview was not possible with all subjects.

- Participants' selection was primarily based on snowball sampling, and as such, cannot be considered a random sample. This could have affected outcomes in that nurses with a bias for or against electronic records might have been keen to air their personal views.

- Challenges discussed reflect the nurses' recall of the specific obstacles they encountered since they began to use an electronic system rather than at specific stages such as initial or full implementation.

Future studies investigating the impact of a national EHR should address these points.

4.5 Ethical Approval Processes

The researcher must consider a number of factors when approaching ethical considerations, such as the potential for harm to participants, issue of consent and participant/organisational privacy (Bryman & Bell 2003).

4.5.1 Ethical considerations

The study involved a face-to-face interview, therefore it was assessed that there was no harm to participants. Extended time away from the clinical area was a consideration, therefore, each interview was proposed to last 20 minutes. Prior to commencing interviews each participant was informed about the purpose of the study, that they were free to withdraw, answer any or all questions and were given the email address of the researcher should they think of any questions or wish to withdraw at a later time. Written consent was not sought as each participant was instructed that by answering the questions consent be implied. No personal or organisational information was captured and each participant was assigned a code to protect their anonymity in case of loss. In the event of a participant wishing to withdraw, a legend was kept that allowed the researcher identify individual interviews. Voice recordings were saved to a secure server and paper stored in a secure location on site in one of the institutions.

4.5.3 Developing a research proposal

Along with interviewing nursing staff, the research initially included capturing the views of INS, in conjunction with an observational study and a review of patient charts. A list of potential organisations was identified based on relevancy to study and time constraints of researcher, three were approached and agreed to be part of the research. A fourth institution was approached and permission to interview their INS was granted, but this was not pursued due to time constraints. Other institutions met the criteria for inclusion no further participants were sought, again due to time constraints. After discussing the concept with the various institutions, the scope of the research was deemed too large. The final study was limited to capturing experiences of nurses who use electronic records as part of their daily practice (Appendix F).

4.5.3 Confidentiality

Prior to conducting any interviews ethical approval was granted (in writing) from each participating institution and from Trinity College, Dublin (Appendix G). As the possible organisations available for selection was limited, by documenting the names of the institutions or printing approval letters it was judged that there was a reasonable risk of identifying individual participants. Therefore, to maintain confidentiality no institutional information is included in this research.

4.5.4 Overview of the process

The ethical approval process, while at times complex, was very beneficial to the research. From individual feedback, a number of suggestions were made, specifically in relation to the scope of the project. Due to time constraints, it was considered prudent, that although approval for an additional observational component and chart review was granted, it was more feasible to focus on the staff nurses' narratives.

4.6 Conclusion

This research set out to describe the 'lived experience' of electronic record adoption on nurses' documentation practices. To achieve this, a phenomenological approach was considered the most appropriate option; a discussion on the rationale for this decision is included in this chapter. The chapter provides a full description of the methodology used (study sites, sampling, questionnaire development, data collection and analysis, ethical considerations and limitations). Although data analysis using the TAM2 (Venkatesh & Davis 2000) was initially considered, Schweitzer's (1998) adaption of Giorgi's (1997) phenomenological method was judged to be a better fit. Sub-themes identified were built into main themes that emerged and assigned to the research questions as appropriate. These are discussed in detail in the following chapters along with implications for a national EHR.

The following chapter presents an overview of the findings captured in the research.

Chapter 5: Overview of the findings

In this chapter an overview of the findings from a phenomenological study are presented. The most notable being that while challenges are evident, given the choice, the majority of nurses interviewed would not return to a paper-based documentation system. Direct quotations from participants are used to illustrate and provide evidence for the conclusions reached; each quote is assigned a participant code.

5.1. Introduction

This chapter presents the findings from a phenomenological analysis of the raw data captured from 22 interviews with nurses who use electronic records to document care. All participants were based in the acute healthcare setting in the Republic of Ireland. A phenomenological approach aims to understand the 'lived experience' of a topic or issue from the perspective of the user. To enable pertinent information to emerge the data were analysed after extensive reading of the material and field notes taken during the interviews.

The sample pool (n=22) was drawn from three separate healthcare institutions, spanning three ward environments - inpatient (specialist), inpatient (general) and day-care). Participants spanned a range of years qualified from novice to expert, using Benner's (1984) stages of clinical competence framework. At the time of data collection, electronic systems had been employed in each environment for over 36 months. With the exception of one nurse, all participants had a minimum of 12 months' experience using their individual systems.

This chapter outlines how the findings will be presented across the following chapters along with a discussion on advantages of adoption. While not part of the research, it was felt inclusion truly represented the narratives and provided a holistic account of end-uses experience. Direct quotes from participants are used throughout the findings sections; each is marked with a unique code relating to the specific respondent.

5.2 Exploration of research questions

Three research questions were constructed to extract pertinent information relating to the central topic under investigation:

> *Learning lessons: A discussion on the unintended consequences of electronic record adoption on nurses' documentation practices and implications for a national Electronic Health Record (EHR).*

Question 1: What are the challenges arising from electronic record use?

Question 2: How do nurses cope with these challenges?

For questions 1 and 2, inductive themes were generated by collating concepts (or sub-themes) with reference to the associated question (Appendices H and I). Sub-themes not related to the research question were eliminated and the remaining concepts were built into main themes to explain the phenomena under investigation. A full description of the methods is provided in chapter 4. A larger pool of sub-themes was reduced to 10 through an iterative process. Table 6 is an overview of the sub-themes and their distribution within the raw data (transcribed interview responses) in relation to the research question. The findings to questions 1 and 2 are explored in chapters 6 and 7 respectively.

Question 3: What lessons learned can be applied to a national EHR project?

Using deductive reasoning, information relating to question 3 was developed by reviewing the participants' responses and identifying obstacles described by nurse respondents. This allowed the researcher to develop an understanding of what aspects of EHR use nurses perceived as helpful or hindering their documentation processes. This collected knowledge is presented as a discussion in relation to question 3. Along with the findings of the research, the discussion draws on the literature and established theory were appropriate.

Table 6: Overview of the inductive themes and their distribution within the raw data

			Day-care setting						Inpatient specialist setting											Inpatient general setting				
	Themes	**Sub-theme**	**Participant code**						**Participant code**											**Participant code**				
			AO1	**AO2**	**AO3**	**AO4**	**BG1**	**BG2**	**AI1**	**AE1**	**BI1**	**BI2**	**BI3**	**BI4**	**BI5**	**BI6**	**BI7**	**BI8**	**BI9**	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**
Perceived usability challenges	**Direct/external challenges**	Inadequate number of terminals	Y		Y	Y		Y											Y	Y	Y	Y		Y
		Interruptions by non-nursing users	Y	Y				Y	Y	Y	Y			Y				Y	Y	Y	Y		Y	Y
		Location challenges			Y									Y	Y				Y		Y	Y	Y	
		Technical challenges			Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y				Y
	Indirect/internal challenges	Time constraints on learning	Y					Y			Y	Y	Y	Y	Y	Y		Y				Y	Y	Y
		Individual traits		Y	Y		Y										Y	Y	Y				Y	
Workarounds	**Established Pre-implementation**	Interim recording	Y	Y	Y		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Password workarounds		Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		Y	Y	Y	Y				
	Adopted post-implementation	Copy and Paste						Y		Y	Y	Y	Y	Y			Y		Y					
		Pre-charting								Y		Y												

5.3 Overview of findings

Based on the interview outcomes of 22 nurses currently using electronic records (for over 12 months with one exception), findings largely echo that of the literature review. That is, participants generally saw electronic records as beneficial to their documentation practices. Respondents described a spectrum of responses to first hearing about the prospect of using an electronic system from "challenging" (AO2:13), "apprehensive" (BG2:17) to "positive" (CS2:19-20). The majority reported that after a period of time they became familiar with the system. With one exception, respondents reported that if given the choice they would not revert to a paper-based system. The length of this initial period of time was indeterminate.

5.3.1 Question 1: overview of findings

What are the challenges arising from electronic record use?

- Challenges to documentation practices described by participants can be categorised as directly affecting nurses' documentation practices (terminal availability, interruptions, location and technical) or indirectly affect documentation practices (time constraints and personal traits).
- The perception formed was that while information retrieval was advantageous, barriers surrounding data entry were evident.
- Not all clinical environments experience challenges to the same extent, for example, availability of a terminal did not appear to be problematic in the inpatient (specialist) areas where nurses each had a terminal at the bedside.
- Comparatively, nurses in the inpatient (general) setting raised terminal availability as a major limitation to their documentation processes.
- In relation to terminal availability, there appeared to be 'peak use times' that is a number of nurses reported how at certain times of the day shift terminals were in demand (from both nursing and non-nursing staff). In addition, one nurse noted how no such demands occurred during the night shifts.

5.3.2 Question 2: overview of findings

How do nurses cope with these challenges?

- It emerged from reviewing the data that interim reporting did not appear to arise in response to challenges, rather, participants disclosed how the practice was established prior to electronic record adoption.
- An impression was formed that workarounds can be categorised as: established in practice, opportune or facilitated by the EHR or responding to a challenge.
- A number of respondents discussed how they wrote down their password or only changed a single digit at a time, potentially undermining the security of the system.
- Workarounds, while evident, were not as pervasive in the findings as in the literature review with interim reporting the most common type reported by respondents. This could be a result of the type of research undertaken with an observational study possibly yielding a broader range of examples.

5.3.3 Question 3: overview of findings

What lessons learned can be applied to a national EHR project?

- NUCs in relation to EHR adoption on nurses' documentation practices was not well defined in the literature.
- No conclusive finding in relation to unintended consequences was extracted from the data. Further longitudinal studies are required to address this knowledge deficit.
- Five broad considerations for future implementers were discussed: potential for NUCs, known challenges and workarounds, best practice in documentation, heterogeneity of nursing and clinical engagement and the effect of stress.

5.4 Perceived advantages of adoption

While the following chapters will discuss challenges and workarounds, it was felt that for the discussion to truly represent the narratives collected, highlighting what was perceived as advantageous was also important. The impression captured in the transcribed interviews was that overwhelmingly nurses' perceived electronic records as beneficial to their documentation processes. From a total of 22 interviews, 21 nurses voiced that they would not return to a paper system if given the choice. The main impression captured was that adoption of an EHR resulted in a simplification of the documentation process specifically data retrieval. This occurred through a number of mechanisms, for example, ease of access to information and improved data clarity. The narratives also described how EHRs facilitated access to a wider variety of data and more quickly compared with paper-based system, "*with the click of a button as opposed to going through sheets*." (AO2:40).

In addition, the sample group described electronic records as improving not only quality of patient data but also how they had an expanded role beyond documentation. Participants described how electronic platforms could provide alerts and/or notifications, minimizing errors due to incorrect interpretation of results. EHRs also prompted nurses to carry out all care required. However, a principal benefit was that electronic systems improved the clarity of the data within the record. The majority of respondents noted that typed patient notes/orders when compared with handwritten documentation were less ambiguous due to improved legibility of entries. Not only did this reduce frustration, but also improved safety, as one respondent (BI6:34-36) stated, *"… [doctors notes] are legible and it's rare that I make a mistake [through interpreting handwriting]."*

Healthcare generates a large amount of patient data, which can be difficult to physically manage and maintain. Removing the need for manual documentation management (retrieving lost charts, preparing paper chart for use) saved time according to a number of respondents. Referred to by one participant (BG2:2-3) as "… *the laborious task* …", another (AO3:8-9) stated that "*It [electronic record] does cut down on the time when looking for information*." Peripheral benefits in relation to missing charts were discussed by another participant (BG1:46-47) who described how

they felt it was "*embarrassing having to report a lost chart*". While largely undiscussed in the literature, the burden of manual documentation management was well represented by participants based in day-care and inpatient (general) settings. Inpatient (specialist) respondents did not allude to it with as much vigour. A possible explanation for this is that, in the latter area patients are usually nursed on a one-to-one basis making the management of patient records an easier task compared with having multiple patients. This was not fully explained by the data. However, an interesting perspective raised during data collection was that although time was saved by not having to find lost charts, this was not really a time saving for nurses but rather the ward clerk.

> *"I might not have spent all that time looking for the written information, I would have got someone else to do it, whereas, now I don't need to do it, it's done. But it hasn't really saved a nurses' job, that's the ward clerk's job." (AO3:12-14)*

From reviewing the raw data and field notes the emerging pattern was that, in general, nurses perceived electronic records as beneficial to their documentation practices, specifically information retrieval. Based on the nurses' narrative, it can be inferred that electronic record adoption can result in a simplification of their documentation process and decreased documentation time through a variety of mechanisms such as ease of access to a broader range of information and speedier retrieval. While common advantages were evident, based on the clinical environment within which the nurse was based, certain advantages held higher importance over others. For example, respondents from the inpatient (specialist) services did not discuss lost or missing charts, but did focus on how data entry had become easier since adopting a ubiquitous collection record.

5.5 Conclusion

This chapter provided the reader with an overview of the findings in relation to the research questions and how this information would be discussed in the subsequent chapters. The main impression gathered, in relation to the benefits of adoption was that it resulted in a simplification of the documentation process, specifically information retrieval. One of the major findings was that although challenges are evident, when given the choice, nurses would not return to a paper-based system. While information relating to perceived challenges and the adoption of workarounds (questions 1 and 2) are drawn directly from the interview transcripts, question three (implications for a national EHR) is consumed into a larger discussion based on the previous findings and lessons learned through the study process. To fully represent the 'lived experience' advantages of adoption were also discussed.

The next chapter presents a detailed discussion on the findings in relation to: what are the challenges arising from electronic record use*?*

Chapter 6: Question 1 – Challenges of adoption

The chapter reports on the findings in relation to the question: what are the challenges arising from electronic record use? Six sub-themes were extracted from the data; these were reassigned under the themes: *Direct/external* and *Indirect/internal* challenges. Direct quotations from participants are used to illustrate and provide evidence for the conclusions reached; each quote is assigned a participant code.

6.1 Introduction

Although electronic records demonstrate significant benefits to documentation practices, they also present a number of challenges. Mirroring the findings of the accompanying literature review many of the limitations revealed related to hardware, software, operational challenges and human factors. However, participants viewed them, not in such neat categories. To complement this, and provide a true account of the responses, the findings discussed here will echo the nurses' narrative captured in the raw data. Challenges arising from electronic record adoption are presented under the two main themes: *Direct/external* and *Indirect/internal* challenges. These main themes are constructed from six sub-themes: "inadequate number of terminals", "interruptions by non-nursing users", "location", "technical challenges", "time constraints on learning" and "individual traits". Individual traits describe factors such as computer literacy levels or previous computer experience. These sub-themes are further described in the following sub-sections.

Direct/external challenges discuss the experience of the nurse participants surrounding barriers that negatively affect their practices at time of documentation, such as "inadequate number of terminals", "interruptions by non-nursing users", "location", and "technical challenges". They are external to the individual, arising at the intersection between the perceived constraints of the technology and how nurses historically document care.

Indirect/internal challenges capture barriers, such as "time constraints on learning" and "individual traits". While less tangible, they are no less pertinent and appeared to influence negatively both system usability and perceived satisfaction.

Table 7: Overview of question 1 themes and sub-themes

Main themes	Sub-themes
1. Direct/external challenges	1a. Inadequate number of terminals 1b. Interruptions by non-nursing users 1c. Location challenges 1d. Technical challenges
2. Indirect/internal challenges	2a. Time constraints on learning 2b. Individual traits

6.2 Theme 1: Direct/external challenges

Direct/external challenges discuss the experience of the sample participants surrounding barriers that negatively affected their documentation practices, such as "inadequate number of terminals", "interruptions by non-nursing users", "location challenges" and "technical challenges".

Sub-theme 1a: Inadequate number of terminals

Direct quotes describe how nurse respondents felt about perceived inadequate terminal access: *"finding a computer is a big issue also." (CS3:33-36) and "access can be problematic, there is more nurses than terminals, you have to haggle to get to the computers." (CS5:16-18)* Similar to findings reported in the literature review, access to a terminal was noted as a major challenge by nurse participants. Unlike the literature,

however, not all groups described it as negatively impacting their practice to the same extent. For example, nurses based in the inpatient (general) or day-care environment revealed limitations to access as a major barrier, compared to nurses in specialist areas. Although it is noteworthy that the majority of nurses in the latter had access to a terminal at all times and at the patient's bedside. The discourse surrounding limited availability uncovered how competition between staff members for an available terminal could lead to delayed data entry and was therefore an impediment to best practice in documentation. That is, to document as close to the time of care delivery as possible (NMBI 2015).

Sub-theme 1b: Interruptions by non-nursing users

> *"… we have [a terminal] at each bedside so it's not necessarily an issue, but I think that, yes sometimes with physios and doctors coming in, they will use a computer for a while and we will have a backlog of information to add in." (BI4:17-22)*

The above quote illustrates how, even with an adequate number of terminals for nursing staff, a pattern emerged from the raw data highlighting how this was not the only perceived barrier to access. A number of nurses discussed how interruptions by non-nursing staff reduced the number of terminals available. Interruptions, for the purpose of this study, describes how other members of the MDT would use a terminal for patient care purposes, for example, updating care notes, retrieve a result or chart medications. This was not an issue previously as medical and nursing notes were separate entities, facilitating both professions to document simultaneously if required. These disruptions appeared to culminate in the same challenges, such as delayed data entry, as an inadequate number of terminals for nurses, albeit the effect was often temporary. Two interesting points emerged, firstly, some of the respondents noted that at certain times, demand for terminals increased, as evidenced by the following quote:

> *"They [other allied health and medical professionals] use the computers also so it's quite hard to get access, but in the evening time rush hour is over so it's easier." (CS4:9-11)*

Secondly, while the experiences between different cohorts relating to inadequate number of terminals showed disparities, in relation to interruptions by non-nursing users, no discrepancy between cohorts was observed, that is it appeared to be a universal challenge among all respondents.

Sub-theme 1c: Location challenges

Location challenges capture issues that are largely ergonomic oversights such as physical distance between patient and inputting device. Challenges arise mainly from the type of hardware employed coupled with the influence of the physical environment within which the system is utilised. A number of respondents reported limitations arising from static systems, as evident in *"… because our computer is placed so far away from the patient, you can't turn around and ask a personal question ..." (AO3:27-28). In addition,* problems relating to monitoring an unwell patient, while simultaneously documenting their care, with one respondent (BI5:11-13) noting, *"If it [computer] was at a desk, and the patient was sick, you would be disregarding the patient."* Even with mobile units or laptops, respondents reported how environmental constraints affected their documentation practices. For example, one respondent (CS4:18-20) noted how it was initially envisioned that computers would be brought to the bedside to document care, but *"… the noise level [in the room] and the furniture ..."* rendered the practice void. Although respondent (BI4:10-14) found that even with bedside terminals, issues arose:

> *"… I think the screen should be separated [from the rest of the equipment] and put at the end of the bed because it is too congested and there is too much going on [at the bedside]."*

Sub-theme 1d: Technical challenges

The narratives discussed a range of technical issues, such as system slowdowns, shutdowns, freezes, loss of power or internet connection or password issues that are problematic for documentation process. When discussed, the main emotion to emerge was one of frustration. This is evident in the narratives of participants who reported they felt "… it's really *frustrating …*" *(BG1:39-43),* and *"… frustrating because it was stalling ..." (BI7:54-56).* Along with frustration, respondents also voiced how this lead to an increase in their documentation time *(AO4:27).* Problems posed by password changes were also evident in the data as barriers to documentation practices.

> *"Passwords, changing passwords – forgetting the password is the worst for me." (BG2:59-62)*

Password access is important for security; however, change protocols that are perceived as complex or unduly frequent can promote dissatisfaction. Participants discussed how passwords could prove challenging for users as they are required to be changed at regular intervals. If passwords were forgotten users were 'locked' out of the system, rendering them unable to document any care until assistance was secured from appropriate technical support. In addition, as one nurse raised, passwords were also a barrier to employing agency or temporary staff: *"… we can't give them passwords … so they can't do any documentation."* (BI7:33-36).

6.3 Theme 2: Indirect/internal challenges

Indirect/internal challenges refer to a range of barriers discussed that are less tangible in nature. They arise from perceived difficulties related to the user as opposed to the system. Although largely invisible, they are no less challenging to documentation practices. This theme encompasses two sub-themes: "Time constraints on learning" and "Individual traits".

Sub-theme 2a: Time constraints on learning

> *"… getting to know the system. We got some basic training on it, but there is so many features ..." (AO1:17-18)*

Along with the range of direct challenges previously discussed, the narratives also provide descriptions of barriers relating to time constraints associated with becoming familiar with the system and how these can negatively impact day-to-day documentation practices. For example, *"… there could have been more training, but there were time constraints ..." (BG2:24-28)* and *"It takes a while to get used to it, to learn just the basics…" (CS5:5-7).* It would appear that the issue of time limitations was not consistent across the technology trajectory, respondents highlighted the initial implementation period as presenting increased difficulties in terms of time challenges for staff.

Sub-theme 2b: Individual traits

Once end-users became familiar with the system, perceived ease of use appeared to increase. It was not possible to assign a specific time to this learning curve with respondents citing a range of times before they felt at ease with electronic record documenting. Identifying the exact traits that expedited or lengthened this period was not fully explored by participants, however, computer literacy levels and previous experience did appear to be influential. In addition, increasing perceived ease of use was not limited to merely knowing the elements of the system; in fact, typing skills were noted by two respondents as presenting challenges.

> *"One member of staff didn't appear to be resistant but they felt quicker writing and the [electronic system] slowed them down… they're just coming around after 5 years." (BG1:62-63)*

Although setting aside time for training is important as learning a new skill can take time, a prescribed time is not easy to deduce as individual computer literacy and experience will impact training time required according to respondents.

> *"I know there has been the older generation that did struggle, not that there was anything wrong with the system, but their use of computers was lacking so it was alien to them." (BI7:47-49)*

> *"Others were more computer literate but not me, I needed more training …" (BI8:34-36)*

6.4 Summary of findings for question 1

Despite each clinical area providing a range of preparatory initiatives, such as training sessions, respondents experienced challenges to their documentation practices both directly and indirectly. Arranging six sub-themes into two main themes represents the impression formed that challenges could be categorised as originating with the 'system', and therefore seen as external to the end-use or originating with the end-user, rendering them internal challenges. While common challenges exist, the degree to which they are experienced by individuals appears to be influenced by characteristics of the user and the type of care provided. For example, access to a computer terminal appeared to be less of an issue in areas where nurses provided one-to-one care and when each bedside had their own terminal. "Interruptions by non-nursing users" was captured in data from all clinical environments, the inference being that the demand for terminals is not static but rather peaks throughout a shift as other members of the MDT enter the clinical area.

The bulk of challenges favoured the more direct, visible barriers; the motivation for this was unclear. On one hand, it could be interpreted that visible or tangible barriers are easier to interpret as challenges. On the other hand, personal traits could be interpreted negatively by individuals in the sample pool and as such they were less inclined to discuss them. An impression was formed that suggested the entry phase of documentation (data input) was associated with a greater incidence of challenges,

compared with information retrieval. Indeed, aspects associated with retrieval were largely seen as advantageous.

6.5 Conclusion

This chapter explored the perceived challenges of adoption. Six sub-themes extracted from the data were further categorised under two main themes: D*irect/external* and *Indirect/internal* challenges, reflecting their effect on documentation and the source of the perceived obstacles. While common challenges exist, highlighting one as more prominent than another is problematic, as elements such as clinical area and user characteristics all influence perceived ease of use. That said, access to a terminal when required did seem to influence nurses' satisfaction. The findings highlight the complexity of challenges and provide an argument as to why implementers should consider both tangible and intangible elements. Tangible obstacles such as computer availability affect documentation processes in an obvious way. Conversely, less visible factors such as previous computer experience also influence the process, yet, in a more insidious fashion, rendering them harder to quantify and address. These findings largely echo the findings of the literature review, however, the distinction between clinical environments was more apparent in the study sample.

Using the same methodology, the following chapter discusses the findings of the study in relation to the second question: how do nurses cope with these challenges?

Chapter 7: Question 2 - Coping with challenges

This chapter discusses the findings in relation to: how do nurses cope with these challenges? Guided by workarounds discussed, the chapter is arranged under the themes: *Established Pre-implementation* and *Adopted Post-implementation*. While it is clear from the data that workarounds are routinely utilised across ward areas in various guises, what is less clear is if they are a reaction to perceived difficulties, to circumvent a problem or whether they are used because they are available.

7.1 Introduction

Some respondents noted how system upgrades/revisions and investments in hardware had improved system usability since initial deployment. Similar to findings from the literature, however, participants also discussed how they 'worked around' perceived problems. Workarounds describe how healthcare professionals circumvent prescribed best practice to overcome a perceived problem or workflow difficulty (Debono *et al.* 2013, Flanagan *et al.* 2013, Friedman *et al.* 2014). A variety of mechanisms were illustrated in the literature such as interim recording as documented in Dowding *et al.* (2014) or copy and paste as described by Levinson (2014). The literature speculates that when a perceived incompatibility between technology and work practices ensues, practitioners adopt these workarounds, which can undermine the intention of the system and potentially lead to unanticipated outcomes (Harrison *et al.* 2007, Ash *et al.* 2009, Jones *et al.* 2011, Wiedemann 2012, Flanagan *et al.* 2013, Friedman *et al.* 2014).

Table 8: Overview of question 2 themes and sub-themes

Theme	Sub-theme
3. Established Pre-implementation	3a. Interim recording 3b. Password workarounds
4. Adopted post-implementation	4a. Copy and Paste 4b. Pre-charting

7.2 Theme 3: Established pre-implementation

Along with describing how systems were updated in response to a problem or investment in extra terminals, participants reported using a range of workarounds to overcome perceived shortcomings of their current system. However, when investigated further it was evident that a number of the methods described had long been an established part of clinical practice, specifically interim recording and password workarounds.

> *"… if you are in assessing a patient you would jot down a few things on a sheet, just main points, you know when you have a few different patients and your assessing them … That's not because of the computer system, that's just the practice, it was the same with nursing [paper] notes." (AO2: 27-28)*

Sub-theme 3a: Interim recording

From the raw data, it was evident that a majority of participants described how they would use (personal) pieces of paper or their handover sheet to document care and enter information later into the patient's record. A variety of reasons were given for this practice such as information on handover sheets was "… *more concise and prioritised …*" (AO2:36-37). Other reasons include:

> *"If it [electronic record] freezes, you just use paper and update information at a later time." (BG2:72-74)*
>
> *"… if it was really, really busy and I had a very sick patient I might grab a piece of paper and may just write [a note] to trigger my memory and remind me later on." (BI4:36-40)*
>
> *"I write everything [on the handover sheet]; it's like my to-do list in work…" (CS1:33-37)*

From the data, a pattern emerged illustrating how nurses used handover sheets to capture patient information at opportune or busy times. What was not fully captured in the narratives was why this practice was so prevalent post-electronic record adoption. One potential answer was that paper persisted throughout the clinical areas to compensate for times when a terminal was not readily available (AE1:89-93). However, as paper (handover sheets or personal 'scraps') was a feature of practice before the arrival of an electronic platform such causation is difficult to infer.

Sub-theme 3b: Password workarounds

> *"[changing passwords] you learn to tackle it [pause] you need to write it down somewhere." (BI2:10-11)*

Along with the prevalence of interim recording in the clinical area, several instances pertaining to workarounds promoted by password difficulties were evident from the narratives. A range of shortcuts were identified by the participants ranging from changing a single digit each time, "*I only slightly change the password each time*." (BI4:25-26) to writing the password down, *"I write it behind my ID so I have less errors…"* (BI8:12-15). Along with obvious connotations for data security, frequently changing or complex password protocols appeared to promote dissatisfaction for some participants: "*There are rules for passwords, and it's a struggle to try and make up a new one each time. It's annoying."* (BI5:23-25).

7.3 Theme 4: Adopted post-implementation

While the first two sub-themes reported workarounds adopted pre-electronic record adoption, others such as copy and pasting information or pre-charting were facilitated by an electronic platform.

Sub-theme 4a: Copy and paste

The sub-theme "copy and paste" describes the practice of taking information from one source and depositing it in another. This practice poses significant risks such as inaccurate information being entered and then propagated through the EHR (Bowman 2013). A recent report found that copy and pasting information between or across EHRs could lead to fraudulent healthcare claims due to increased or incorrect procedures documented in the EHR (Levinson 2014). The respondents who discussed this practice described how copying text was used to save time, "*I only copy and paste, things like 'checked with RGN' to save time."* (BI3:35-37); *"Sometimes when you're busy it's better to copy and paste" (BI1:22-23).* However, an awareness among some participants had developed based on previous errors, which resulted in the function being withdrawn.

> *"We did have copy and paste function but it was taken away because of errors ..." (BG2:89-93)*

Sub-theme 4b: Pre-charting

Pre-charting occurs when staff enter patient information prior to their arrival in the clinical area, information captured is from previous episodes. This was raised by only two of the 22 respondents as a way of speeding up data input in case they were busy later. Pre-charting risks erroneous information proliferating through the EHR if data is not verified.

> *"We know the patient is definitely coming to us, we get them into the system ... It saves time." (BI2:31-33)*

7.4 Summary of findings for question 2

The preceding discussion explored the type of workarounds captured in the nurses' narratives. The use of workarounds in practice is evident and in some cases used as a time saving measure. Workarounds related to interim reporting and passwords were used prior to electronic record adoption. Comparatively, sub-themes 4a and 4b, ("copy and paste" and "pre-charting" respectively) were directly linked to adoption. It was unclear from the findings if workarounds occurred in all cases due to challenges or whether it was because the functionality was available. As only small number of respondents mentioned the effect of workarounds, this should be further explored.

7.5 Conclusion

This chapter discussed the findings in relation to how nurses deal with challenges arising from electronic record adoption. While respondents noted how current systems had gone through a number of iterations based on their feedback, the practice of workarounds was evident. From reviewing the data, it is apparent that the participants not only employed workarounds to overcome a problem, but also that certain practices were so ingrained in their professional culture and because the opportunity (or functionality) presented itself. Coupling a specific challenge to a corresponding workaround proved difficult, reflecting a similar situation that appeared in the literature review. The workarounds discussed were interim recording, password workarounds, copy and paste and pre-charting.

The next chapter presents a discussion in relation to the question: what lessons learned can be applied to a national EHR project?

Chapter 8: Question 3 – Implications for a national EHR

Building on the knowledge captured, this chapter presents a discussion surrounding: what lessons learned can be applied to a national EHR project? Topics discussed include challenges, workarounds and the heterogeneity of the nursing profession. Based on lessons learned, five broad considerations for implementers are discussed.

8.1 Introduction

This chapter draws together all the learning that has occurred throughout the study and presents it as a discussion to the final sub-question: what lessons learned can be applied to a national EHR project? Subjects discussed are based on topics raised during the research interviews and from discussions with a range of INS. Appropriate literature and theory are also incorporated into the discussion where appropriate. The most notable finding from both the study and the literature review was that, despite challenges, nurses generally perceive electronic records as beneficial to practice. Developing a framework for implementation was deemed beyond the scope of this research. Indeed, the limited amount of research on the topic to date and the small sample size used in this research would render any proposed framework redundant. That said, initial lessons have been learned from reviewing both the literature and the nurses' narratives that can be incorporated into future projects. Consequently, rather than offering specific recommendations, five broad considerations are discussed. These are outlined below and discussed in the following sub-sections.

Future projects should consider:

1. The potential for NUCs
2. Best practice in nurses' documentation practices
3. Known challenges and workarounds
4. The heterogeneity of nursing
5. Clinical engagement and the effect of stress

8.2 Consideration 1: Implications of a national EHR

As stated in chapter 1, a national EHR will require patient data to be "… integrated from various source systems" it follows then, that the project will have implications for all nurses and their documentation practices. As discussed, all nurses will need to use computerised records in their practice; therefore, developing an awareness of potential unintended consequences on nursing documentation practices must be a priority. Although a range of NUCs associated with EHR and CPOE adoption are described in the literature, by comparison, information relating to the effect on nurses' documentation practices is sparse. Furthermore, difficulties dissecting challenges from unintended consequences make identifying true NUCs difficult. That aside, consequences to nurses' documentation discussed in the literature include information complexity and overload, increased documentation burden and problems with computer access (Yu *et al.* 2013, Gephart *et al.* 2015). However, Ash *et al.* (2009) provided a more comprehensive account of NUCs, albeit relating to CPOE adoption, citing paper-persistence and overdependence on technology as unintended outcomes.

That we can only speculate as to the exact consequences of adoption on nurses' documentation practices is seen as a limitation of the study. On one hand this is unfortunate, on the other it raises an interesting question: given the large volume of nurses working in a health system and the pervasion of their documentation, why are associated NUCs not more defined? No definite conclusions were drawn from the literature, therefore, exploring the exact NUCs associated with EHR adoption on nurses' documentation practices is an important area of future research. The first consideration, therefore, for future implementers and indeed all stakeholders, is to:

> *Consider the potential for NUCs associated with EHR adoption and the effect on nurses' documentation practices.*

8.3 Consideration 2: Challenges

Merton (1976) proffered a range of reasons, such as ignorance and error, explaining why NUCs occur. No direct evidence, however, was found in the literature identifying one over another as the cause of NUCs relating to EHR adoption. While the exact ethology is unclear, what we do know from the literature is that when a disparity between new technology and established work patterns exist, a range of challenges for end-users may be produced (Sockolow *et al.* 2014, Zadvinskis *et al.* 2014, Kent *et al.* 2015). The literature described a variety of challenges relating to hardware, software, operational challenges and human factors. These were largely evident in the research findings; and are presented under the themes *Direct/external* or *Indirect/internal* challenges.

Direct/external encompasses topics raised by the participant sample, including location or technical challenges. Conversely, *Indirect/internal* challenges captured both the time it took to learn a new system and the effect of individual characteristics on the process. While less visible, participants did not refer to *Indirect/internal* challenges in such a way that they could be perceived as less influential on the documentation process. Challenges identified from the study data are outlined in table 9 and for clarity a brief description of each is also included.

According to Holden & Karsh (2010), a fundamental aspect underpinning whether HIT implementation is successful or not, is individual end-user's acceptance; a point reiterated in several other studies (Boonstra & Broekhus 2010, Carnicero & Rojas 2010, Greenhalgh *et al.* 2013). While acceptance is based on a variety of factors, Davis *et al.* (1989) and later Venkatesh & Davis (2000) in their Technology Acceptance Models (TAM and TAM 2) argue that perceived ease of use and perceived usefulness play critical roles in acceptance of new technologies.

Table 9: Challenges to nurses' documentation process (all participants)

Theme 1: Direct/external challenges	
Sub-theme 1a: Inadequate number of terminals	Inadequate number of terminals was discussed as a major challenge as it curtailed documentation to times when a terminal was available.
Sub-theme 1b: Interruption's by non-nursing staff	Participants described how interruptions from other staff members (non-nursing) prohibited their documentation practices due to interruptions. Some respondents described how this frequently occurred at 'peak-times', such as doctors rounds.
Sub-theme 1c: Location challenges	Largely, but not solely, influenced by the type of terminal employed, respondents voiced dissatisfaction at times with location of terminals.
Sub-theme 1d: Technical challenges	The narratives discussed a range of technical issues, such as system slowdowns, shutdowns, freezes, loss of power or internet connection and password issues, all proving problematic for documentation.
Theme 2: Indirect/internal challenges	
Sub-theme 2a: Time constraints on learning	A number of participants raised how training and practising on the system could have been increased but time constraints and demands of the clinical environment appeared to influence how much time was made available for learning or practicing.
Sub-theme 2b: Individual traits	A pattern to emerge from the raw data was how computer literacy skills and previous experience with computers could influence system usability.

A socio-technical approach proposes there is a relationship between technology used in healthcare and the social systems within which they are used (Reddy *et al.* 2003). This perspective describes that the way systems are perceived by users is dependent on the interaction between the technology and the individual. This perspective goes someway to explain why addressing challenges is complex, as it encompasses a variety of mechanisms outside the visible hardware and software. Ensuring then that technologies complement, rather than antagonise, established best practice is fundamental. Best practice in documentation describes a range of elements such as the data type and frequency of entries. These evidence-based protocols ensure accurate, quality documentation is maintained and promoted. Future studies should assess how EHRs can promote or hinder adherence to best practice in documentation, thereby, reducing potential for workarounds. Therefore, the second consideration should be to:

> *Consider how system choices (hardware and software) can promote or inhibit best practice in documentation.*

8.4 Consideration 3: Workarounds

It would be remiss to suggest implementers can foresee, remove or address all the potential permeations of challenges that could arise post-adoption. It is important, therefore, to understand how nurses cope when challenges arise. The narratives noted that while some challenges resulted in system changes or hardware adjustments, workarounds were also evident. While not attempting to explain all reactions to all challenges, workarounds as described by Debono *et al.* (2013) is the practice of circumventing prescribed best practice to overcome a perceived problem or workflow difficulty. Although a range of workarounds were demonstrated in the study, the most frequent being interim reporting and password issues.

There are a number of precipitating factors that encourage the adoption of workarounds, and Debono *et al.* (2013) identified conflicts between new technology or policies and current practice as the most common cause. However, this does not fully explain how workarounds may lead to NUCs, to fully understand the link, it is important to explore the potential consequences of workarounds. Take interim recording, for instance; this refers to a practice where nurses use paper (scraps or their handover sheet) to document care and enter into a patient's record at a later time. Along with the potential for transcription errors, Ash *et al.* (2009) point out that when paper persists there is a risk that a dual recording system will evolve and information could be missed. Whereas, Fernando (2009) discusses how passwords, while there to protect patient data, if change protocols are perceived complex or frequent can have the opposite effect by encouraging users to write passwords down or only slightly changing them each time. Copy and pasting text was also noted as being problematic in a recent report by (Levinson 2014). Their findings noted how the practice lead to an erroneous number of procedures being inserted into the patient's chart.

Narratives from the study sample seem to reinforce the findings of the literature, that workarounds are used in practice (Jones *et al.* 2011). Where they diverge is that the respondents described how both interim recording and password workarounds were embedded in practices prior to transitioning to an electronic record. To what extent these were enhanced or diminished by adoption was not discussed by respondents. The copy and paste function, however, is only available on an electronic platform,

therefore could only be adopted post-adoption. What is unclear from the data is if this function was incorporated to bypass a challenge or used simply because it was there. A study by Flanagan *et al.* (2013) found copy and pasting text to be the most frequently used (computer-based) workaround. Therefore, understanding nurses' document practices and how technology may affect it, is important if the potential negative outcomes are to be avoided. Table 10 lists the workarounds described by the sample pool and provides examples.

Table 10: Workarounds noted in nurses' narratives

Theme 3: Workarounds established pre-implementation	
Sub-theme 3a: Interim recording	*Example from the data:* Using paper to capture patient information or workflow and inputting into final destination at a later time.
Sub-theme 3b: Password workarounds	*Example from the data:* Changing a single digit each time, writing passwords on paper, or on staff ID badge.
Theme 4: Workarounds adopted post-implementation	
Sub-theme 4a: Copy and Paste	*Example from the data:* Copy text from one part of the EHR to another.
Sub-theme 4b: Pre-charting	*Example from the data:* Entering patient information prior to arrival on ward.

The preceding two sub-sections form the background for the third consideration, which is to:

> *Consider ways to make electronic data entry easier by addressing known challenges and workarounds.*

8.4 Consideration 4: Heterogeneity of the nursing profession

Nursing is not a homogenous group, rather it is a constellation of sub-disciplines under the umbrella term of "nursing". The importance of this is two-fold. Firstly, the majority of the literature reviewed described the experiences of nurses working in specialist areas. Similarly, the largest cohort, albeit employing a small sample, in the participant pool was also from the inpatient (specialist) environment. Although commonalities, in both challenges and workarounds, were evident in the narratives of all respondents' differences in their severity were also observed. For example, as each ICU bedside had its own system they did not appear to experience terminal availability as a challenge to the same extent as other areas such as the inpatient (general) setting.

Secondly, although influenced by clinical and patient needs, nurses in the sample expressed how personal traits such as computer literacy levels affected their perceived usability of their system. While a range of feelings were expressed in relation to levels of training required, from, "… *maybe because I am comfortable with computers, but a lot of its intuitive…*" (BI7:100-102) to a participant who described a colleague who was, *"… just coming around after 5 years*" (BG1:62-63). Training and practice requirements should therefore be mindful of individuals. Nevertheless, implementers should also be aware that mandatory training sessions for an entire workforce would have implications for patient care, in terms of time away from the clinical area. Further research is required to focus solely on the needs of the nurse in the inpatient (general) setting to ensure that systems are compatible and promote best practice in documentation. Information regarding patterns of nurses' documentation practices, regarding the time, location and type of entries, can assist implementers with hardware and software choices to suit the needs of the environment, minimizing the potential for usability challenges and subsequent workarounds. Subsequently, implementers should:

> *Consider exploring the individual usability challenges associated with clinical area and type of service provided, specifically the inpatient (general) environment, allowing for the heterogeneity of the nursing profession.*

8.5 Consideration 5: Early intervention to promote clinical engagement

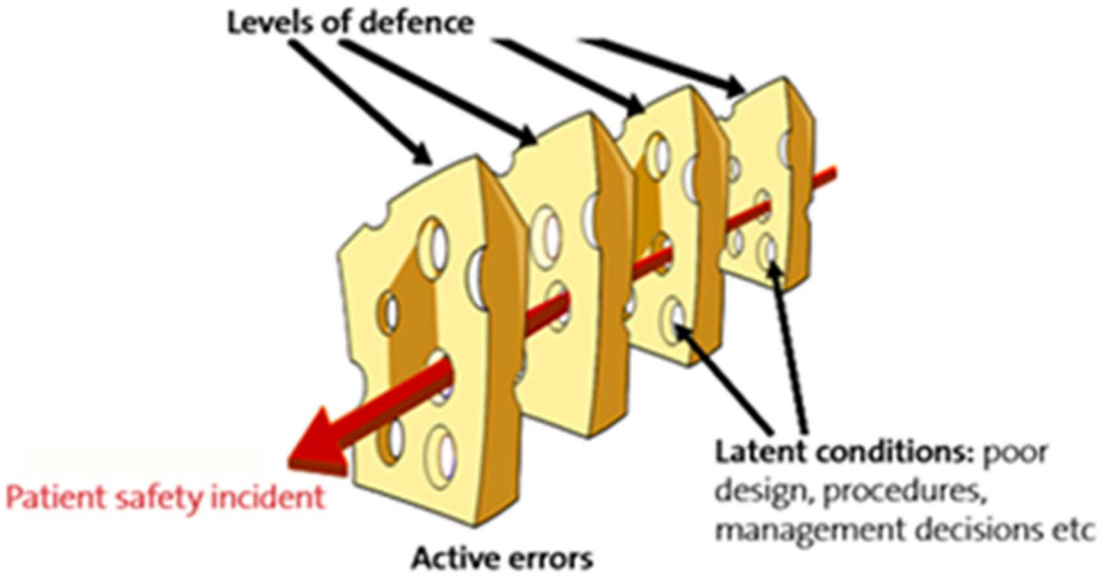
A pattern to emerge from the raw data eluded to the fact that nurses were more accepting of the electronic system when they felt they were part of the process.

> *"Start talking about it very early, a long time before it starts and get people to understand what is going to be required … because the more people have an idea of what's involved the more they will feel part of it and accepting of it." (BG1:56-59)*

According to Kent *et al.* (2015) and Zadvinskis *et al.* (2014) including the nurses' perspective early in the design stage and developing a comprehensive understanding of nursing processes are both vital for successful change processes. Stress was also pinpointed as an inhibiting factor (Sockolow *et al.* 2014, Kohle-Ersher *et al.* 2012). While all end-users will be affected by HIT implementation, Kirkendall *et al.* (2013) note that nurses displayed more concern about the transition from paper to electronic recording. One hypothesis suggests that this is a result of nursing's heavy reliance and use of medical records to direct and document patient care (Kirdendall *et al.* 2013). The effect of stress on staff should not be overlooked as it can play a role in error propagation. In the 'Swiss Cheese' Model, Reason (1995, 2000) described how latent conditions align to produce a potential critical error. If individual conditions (or smaller errors) occur but are remedied, harm is avoided (figure 5).

The problem arises, according to Reason (1995, 2000) when many latent conditions align in multiple 'layers of defence', without interruption or remedy. These 'smaller' errors can occur due to a number of factors including stress (CHFG 2009, Reason 2000, Carayon et al. 2014). It is important, therefore, to consider human factors and economics (HFE). Closely associated with the aviation industry, a HFE approach extracts knowledge from multiple disciplines to uncover the complexities behind errors (Shappell & Wiegmann 2000). HFE can be defined as the "environmental, organisational and job factors, and individual features that combine to influence behaviour and outcomes" (CHFG 2009, p. 3).

Figure 5: Swiss Cheese Model.
Diagram reproduced from CHFG (2009)



Subsequently, due to the pervasive nature of nurses' documentation, implementers should consider a HFE perspective to assess the impact of adoption on stress and its role in error manifestation. Therefore, the final consideration is that implementers should:

> *Consider the opinions and perspectives of a wider spectrum of nurses early in the developing stages to ensure nurses documentation needs are met, to promote clinical engagement and to reduce stress associated with the change process.*

8.6 Summary of findings for question 3

The information presented in this chapter is a combination of all the knowledge captured during the research process. It is by no means exhaustive, but rather, the discussion attempts to provide an overview of the complexities involved in technology transitions for nurses' documentation processes. The findings demonstrate that unintended consequences in relation to nurses' documentation practices are largely underexplored. Applicability of findings is always a question in research, although attempting to include a cross-section of nurses the majority of information retrieved was from inpatient (specialist) or day-care settings. Further studies should focus on understanding the needs of the nurse based in the inpatient (general) setting. While this research included a number of participants from this area, electronic systems have not permeated this environment to the same degree, therefore, it leaves a knowledge gap which future studies should address.

Providing a framework for future projects, or indeed recommendations, is deemed beyond the scope of this research. Rather based on the knowledge accumulated five broad, but by no means exhaustive, considerations emerged from the findings. A review of these considerations are presented here:

1. Consider the potential for NUCs associated with EHR adoption and the effect on nurses' documentation practices.
2. Consider how system choices (hardware and software) can promote or inhibit best practice in documentation.
3. Consider ways to make electronic data entry easier by addressing known challenges and workarounds.
4. Consider exploring the individual usability challenges associated with clinical area and type of service provided, specifically the inpatient (general) environment, allowing for the heterogeneity of the nursing profession.
5. Consider the opinions and perspectives of a wider spectrum of nurses early in the developing stages to ensure nurses documentation needs are met, to promote clinical engagement and to reduce stress associated with the change process.

8.7 Conclusion

This chapter discussed what lessons have been learned in relation to EHR adoption and nurses' documentation process. The most significant lesson learned is that more research is required to develop a full understanding of EHR adoption and the long-term effect on nurses' documentation practices. To complement this, five broad considerations were developed for future implementers. These considerations emerged from the research journey and while by no means exhaustive they should instead be seen as a starting point for future research. Each consideration was discussed in detail, drawing on the literature, study findings and established theoretical frameworks where appropriate.

The final chapter provides a conclusion to the research, including a reflection on learning by the author.

Chapter 9: Conclusion

This concluding chapter outlines the weaknesses and the limitations of the research conducted and identifies areas for future study along with a summary of the research. A reflection on the research process concludes the chapter.

9.1 Introduction

While all research, to some degree, will suffer from limitations, this chapter outlines the weaknesses experienced during this research. Initially conducted to investigate the unintended consequences of EHR adoption on nurses' documentation practice, instead this study highlighted the deficits in knowledge surrounding the subject. While a substantial amount of research available focuses on EHR and CPOE adoption, less is understood about the effect on nurses' documentation practices. To complicate things further, there appeared to be confusion in the literature surrounding terminology, with several authors noting the same points as either challenges or consequences. For example, disruption to work-flow was found to be both a challenge (Dowding *et al.* 2014) and a NUC (Gephart *et al.* 2015). As a more robust index of NUCs associated with nurses' documentation practices was unobtainable, the researcher referred to known NUCs associated with EHR adoption such as patient safety (Harrison *et al.* 2007, Jones *et al.* 2011, Middleton *et al.* 2013) and referred to Ash *et al.* (2009) nine consequences of CPOE adoption throughout as substitutes.

Challenges arising from adoption, such as terminal availability, were seen as precipitating workarounds, which could in turn facilitate NUCs. To represent this the study focused on uncovering perceived challenges from a nursing cohort. Although this proved problematic, it also provided valuable learning in that it highlighted how little is known about the effect of EHR adoption on nurses' documentation practices. Therefore, one of the most significant lessons learned is that we should address this knowledge deficit in future studies.

9.2 Highlights for future implementations

Although a definitive list of NUCs relating to nurses' documentation was absent, drawing on the collected knowledge of earlier adopter's lessons were learned. Based on these lessons (from both the literature and the nurses' narratives) the researcher was able to construct five broad considerations that could be helpful for future implementers, cognisant of nurses' documentation practices. These are outlined below:

1. Consider the potential for NUCs associated with EHR adoption and the effect on nurses' documentation practices.
2. Consider how system choices (hardware and software) can promote or inhibit best practice in documentation.
3. Consider ways to make electronic data entry easier by addressing known challenges and workarounds.
4. Consider exploring the individual usability challenges associated with clinical area and type of service provided, specifically the inpatient (general) environment, allowing for the heterogeneity of the nursing profession.
5. Consider the opinions and perspectives of a wider spectrum of nurses early in the developing stages to ensure nurses documentation needs are met, to promote clinical engagement and to reduce stress associated with the change process.

9.3 Limitations and future research

Along with the limitations generally associated with qualitative research, significantly time constraints and personal bias (discussed in detail in chapter 4), gaining access to a sample was problematic. For the results to be valid, it was important to speak to end-users. That meant finding a gap in the busyness of the clinical environment to set aside time to conduct interviews was no easy feat. It required the researcher to stay on-site for protracted periods of time, to 'catch' nurses willing to be interviewed. As a result, the interview process was extended, however, it did provide a rich data source upon which to base findings and provided a unique insight into the working day of a cross-

section of nurses. Tackling such a large topic with a single researcher was also problematic. Conscious of time and financial constraints, reviewing such a large amount of data was difficult. Other limitations include:

- The findings represent the attitudes of a small sample of nurses. Applicability of findings should therefore be viewed with caution pending further investigation.
- The initial interview was limited to 20 minutes to facilitate nurses leaving the clinical area. A better approach would have been to remove any time constraints, however, this was not possible.
- Due to time constraints a second interview was not possible with all subjects.
- Participants' selection was primarily based on snowball sampling, and as such, cannot be considered a random sample.
- Challenges discussed reflect the nurses' recall of the specific obstacles they encountered since they began to use an electronic system rather than at specific stages such as initial or full implementation.
- As only three sites were included, future studies should expand on this number, to truly represent the nurses' perspective.

Future studies might consider a quantitative component, however, this approach is not without drawbacks. While it might gain greater participant numbers, it may also lack the detail required. In addition, it may be beneficial for future research to focus on the inpatient (general) environment to address gaps in knowledge surrounding the needs of this cohort. In addition, identifying the potential NUCs associated with adoption should also be a priority.

9.4 Summary of research

Table 11 represents a summary of what was known about the subject and what new learning has occurred.

Table 11: Research summary points

What was known
• It was established from the literature review that nurses, in general, were positive about using electronic records. • Challenges, such as hardware, software, operational and human factors can threaten usability and perceived ease of use. • Workarounds, as a means of circumventing perceived system/workflow incompatibilities, were highlighted as a likely route to negative outcomes or potential errors. • From the literature reviewed, comparatively little was retrieved about the inpatient (general) setting and the effect on documentation practices.
What this research added
• This study evaluated the narratives of a cross-section of nursing including the general setting, albeit small, from an Irish perspective. • The results indicate that electronic records are generally perceived as beneficial to practice. • Shared direct and indirect challenges to nurses' documentation practice were evident from the narratives, but different cohorts ascribed differing importance to certain challenges. • Although some workarounds were reactions to system shortcomings, others were used because they were available or because they were already established practice. • Information retrieval was seen as being positively influenced by electronic platforms, conversely, most challenges discussed surround data input.

9.5 Dissemination of findings

An abridged version of the findings will be circulated to the nurse informatics specialists in each of the study sites via email. A final copy of the research study will be available to all institutions and interviewees participating, if they wish. The author hopes to publish findings in local conferences and a journal article in a respected journal, such as the Irish Journal of Medical Science. Findings from the literature review were presented at the Royal Academy of Medicine in Ireland (RAMI) Conference 2016, "*A systematic review of the challenges facing nurses' documentation practices arising from EHR adoption*".

9.6 Reflections on the research process

A running theme through the research was learning lessons from experts, how apt then that it concludes reflecting on the personal lessons learned; and lessons were learned. While no researcher is ever truly happy with all aspects of their research, for some it is an inadequate sample size, for others lack of comparative data. In this instance, no single element proved more problematic than another did, but time constraints were a bigger factor than initially anticipated. At each stage of the process from developing a research proposal, to arranging interviews to transcribing and analysing the data. Every stage was drawn out through a combination of under estimation of problem, lack of experience and hubris. That said, although challenging at times, experience was gained.

While initially the research included an observational and chart review, due to time constraints and following feedback during the ethical application process, it was deemed too unwieldly and was not pursued during the research. Instead, the research focused on interviewing staff nurses who were using electronic records as part of their documentation processes. The biggest error in judgement was the broadness of the initial proposal, a point raised early in the journey.

Another difficulty faced was using multiple sites. While this broadened the research base, dealing with three separate organisations also added to the administration

burden. Feedback from the ethics application was very constructive and really did benefit the research. Including multiple perspectives, however, meant that any changes had to go back for approval to the other two institutes. As a result, some excellent advice could not be incorporated into the study. For example, one suggestion was to include the perspectives of nurses not using electronic records to identify their fears surrounding adoption. Initially it was hoped to include an observational and chart review as part of the research, this was discouraged as being too ambitious. In hindsight, this was simply not achievable within the timeframe.

So the question is then would the researcher limit future projects to a single institution? On consideration, the answer is no. While the journey at times was arduous and stressful, it was also extremely beneficial. Capturing the experiences of a cross-section of nurses delivered a broad range of opinions, exposed the researcher to other organisational cultures and expedited the learning curve in relation to many aspects of research.

9.7 Conclusion

This chapter identified weaknesses in the research and identified future areas of research. As part of the concluding chapter, a reflective piece was included to offer an insight into the learning that occurred from the perspective of the researcher. While no recommendations are provided, its purpose is to open a discourse of the complexities surrounding nurses' documentation practices and the potential consequences of EHR adoption. The learning that happened from the research journey did proffer five broad considerations for future implementers to ease the transition from paper to electronic systems.

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Appendices

Appendix A: Overview of literature reviewed

		Hardware Challenges	Software Challenges	Operational Challenges	Human Factors
Carayon *et al.* 2011	Study		**Y**	**Y**	
Colligan *et al.* 2015	Study			**Y**	**Y**
Creswick *et al.* 2012	Study		**Y**		
Cucciniello *et al.* 2015	Study		**Y**	**Y**	
de Veer & Francke 2010	Study		**Y**		
Dowding *et al.* 2015	Study	**Y**	**Y**	**Y**	**Y**
Horte & Visconti 2014	Study		**Y**	**Y**	**Y**
Kent *et al.* 2015	Study		**Y**		
Kohle-Ersher *et al.* 2012	Study	**Y**	**Y**	**Y**	
Mills *et al.* 2015	Study	**Y**			
Read-Brown *et al.* 2013	Study		**Y**		**Y**
Rogers *et al.* 2013	Study		**Y**	**Y**	**Y**
Saleem *et al.* 2015	Study		**Y**	**Y**	
Sockolow *et al.* 2014	Study	**Y**	**Y**	**Y**	
Yeung *et al.* 2012	Study	**Y**		**Y**	
Yontz *et al.* 2015	Study	**Y**	**Y**	**Y**	**Y**
Zadvinskis *et al.* 2014	Study	**Y**	**Y**	**Y**	**Y**
Gephart (2015)	Literature review		**Y**	**Y**	
Huryk (2010)	Literature review			**Y**	**Y**
McGinn *et al.* (2011)	Literature review		**Y**	**Y**	
Nguyen *et al.* (2014)	Literature review			**Y**	
Stevenson *et al.* (2010)	Literature review	**Y**	**Y**		**Y**

Appendix B: Research studies

Country	Author	Sample	Methodology	Purpose	Record Type	Stage	Summary of main points
USA	Carayon *et al.* 2011	121 and 161 ICU nurses	Survey questionnaire (3 months and 12 months).	Understand ICU nurses' acceptance of EHR and design, implementation factors.	EHR	Post	• Acceptance of system improved over time. • Usability was a major factor in acceptance. • Less time spent interpreting orders.
USA	Colligan *et al.* 2015	63 pediatric nurses. Administered survey	Socio-technical approach using NASA – Task Load Index (TLX) - Case Study.	Assess changes in cognitive workload associated with adoption.	EHR	Post	• One-size-fits-all not an appropriate strategy within nursing. • Ignoring clinical human factors may result in decreased patient safety.
Australia	Creswick *et al.* 2011	11 nurses	Interview (n=4), focus group (n=7), socio-technical framework.	Explore if ICT improved information access and impact on nurses' work.	CIS	Post	• Improved communication between MDT. • Made it easier to access information. • Reinforced the nurses' role and increased autonomy.
Scotland	Cucciniello *et al.* 2015	Multiple stakeholders including nursing.	Observations and interview (Semi-structured). Actor Network Theory (ANT).	To examine the sociological and technological factors the impact EMR acceptance.	EMR	Post	• Implementation is a long-term project, engaging in on-going assessment is important. Ongoing assessment • Age was a factor in acceptance • Nurses reported that legibility improved (doctor's notes) which lead to increase confidence with delivering care.
Holland	de Veer & Francke 2010	Nurses - Cross-sectional – all specialties	Qualitative study – postal survey of 685 nurses	Explore nurses' perceptions and determinants of EHR usefulness.	EPR	Post	• Consider characteristics of nursing work in order to avoid or limit opposition and disruption during implementation and beyond. • Nurses already using electronic records (or experience of) display more favorable attitudes compared to first time users.

Country	Author	Sample	Methodology	Purpose	Record Type	Stage	Summary of main points
USA	Dowding *et al.* 2015	28 nurses: Medical/surgical units	Non-participant observation and semi-structured interviews.	To explore how nurse's use EHR in practice	HER	Post	• System well received after a time – benefits (once realised) outweighed drawbacks. • Adoption changed elements of nursing practice – how and when nurses documented information.
USA	Horte & Visconti 2014	10 Interventional radiology nurses in one institution.	Descriptive analysis – based on interviews	Describe the impact of EMR on nursing care in Interventional Radiology.	EMR	Post	• New system enhanced communication and information transfer. • Previous computer use (professional and personal) was positively correlated with implementation. • Different outcomes for settings and acceptance grew over time.
Australia	Kent *et al.* 2015	52 medical and surgical nurses. Semi-structured focus groups x 4	Qualitative - Case Study Theoretical Domains Framework (TDF)	Explore nurses' reactions to new health information technology in acute healthcare.	EMR	Post	• Technology can assist coordination of patient care. • Perception of nursing to ICT was influenced by past experience. • Early involvement of nursing in adoption process is beneficial.
USA	Kohle-Ersher *et al.* 2012	20 nurses	Qualitative study - 48-bed telemetry unit.	Evaluate barriers that nurses, nurse's aide/clinical technicians experience for electronic POC documentation.	EHR	Post	• Most respondents agreed that EHRs improve patient care. • Whether computerised charting decreases the workload was not so clear cut.

Country	Author	Sample	Methodology	Purpose	Record Type	Stage	Summary of main points
Australia	Mills *et al.* 2015	110 nurses – specialist areas	Quantitative - Case Study	Discuss nurses' attitudes (pre and post) EMR implementation.	EMR	Pre and Post	• More collaboration between administrators and clinical needed. • Specialist nurses would access information more if easier. • Consolidated patient information benefits care-decision making.
USA	Read-Brown *et al.* 2013	Nursing documentation in an ophthalmology department.	Time in motion study – 259 surgical procedures observed.	To examine documentation time during implementation of an EHR operating room management system.	EHR	Post	• Initially EHR adoption increased documentation time – improved over time, but not as quickly as paper charting. • No improvement in turnaround time.
USA	Rogers *et al.* 2013	12 nurses – medical/surgical	Human factors approach. Qualitative study	Using a human factors approach discuss barriers and facilitators to electronic record use.	NIS	Post	• Nurses did not know who else was looking at their notes (surveillance) and also did information go to clinician without telephone calls. • Worksheets did not match how examinations are conducted (increased scrolling).
USA	Saleem *et al.* 2015	Specialist 88 (61 interviews and observations) including nursing.	Socio-technical theory. Rapid ethnography - interviews and observations - case Study	Evaluation of commercial CIS for ICU and recovery rooms.	Clinical information system	Post	• Integration with other systems and reduced need for manual entry of data i.e. vital signs (automation). Promoted adoption by making data entry easier. Work process. • Dedicated facilitator supported implementation and reduced resistance to change.
USA	Sockolow *et al.* 2014	12 Nurses	Empirical study involving 12 nurses (purposive selection) using semi-structured interview	Develop empirical data on how nurses use NIS and identify challenges and facilitators.	NIS	Post	• Understanding the effect of electronic recording on nurse's work practices will inform better strategies in future projects.

Country	Author	Sample	Methodology	Purpose	Record Type	Stage	Summary of main points
Canada	Yeung *et al.* 2012	24 medical nurses	Ethnographic analyses (qualitative) and time–motion study	To compare vital sign collection (paper versus electronic comparison).	Paper and electronic recording	Not documented	• Understanding clinical workflow and environment can enhance documentation practices – using either paper or electronic systems. • Location of terminal influenced documentation.
USA	Yontz *et al.* 2015	80 Perioperative nurses in one institution.	Descriptive - online survey	Identify peri-operative nurses' attitudes toward an EHR	EHR	Post	• Important to identify barriers from nursing perspective. • EMR beneficial to nursing. • Did not eliminate nursing positions.
USA	Zadvinskis *et al.* 2014	10 nurses (area not specified)	Phenomenological study	Explore nurses' perception of health IT (EHR)	EHR	Post	• Adoption must be congruent with nurse's work • Address security issues with multi-person charting. • Usability is a determining factor in success and acceptance of IT.

Appendix C: Literature reviews

Author	Year	Type of Review	Number of articles and databases	Setting	Summary of main points
Gephart *et al.*	2015	Systematic Literature Review	(2009 – 2014) 5 articles: CINAHL and PubMed databases.	Nursing	• Unintended consequences: changes to workflow, adapt (nursing practice) to overcome limitations of the system, problems accessing system. But even so, would not revert back to paper systems.
Huryk	2010	Literature Review	(2004-2009) 13 articles: PubMed, CINAHL, Medline	Nursing	• Poor system design – system slowdown and downtime. System issues • Nurses with little or no computer experience must be given more training and encouragement to assist transition. Previous experience with computers. • Systems that complimented workflow and documentation where more readily accepted.
McGinn *et al.*	2011	Systematic literature review	(1999-2009) 60 articles: PubMed, EMBASE, CINAHL, Business Source Premier, Science Citation Index, Social Sciences Citation Index, Cochrane Library, ABI/Inform, and PsychINFO	Mixed healthcare professionals including nursing	• Nurses felt increased time spent interacting resulted in less time spent with patients, which lowered job satisfaction (this changed over time). • When systems where perceived as easy to use and complimented work processes resistance to change reduced.
Nguyen *et al.*	2014	Systematic Literature Review	(2001-2011) 56 articles: Scopus, Embass, Informit, MedLine, Proquest Health, Medical Complete	Doctors and nurses	• Changes to workflow and disruption to workflow seen as a barrier. • Adequate and effective training was positively correlated with adoption Training
Stevenson *et al.*	2010	Literature Review –	(2000-2009). 5 articles: MedLine, Cinahl	Nursing in acute/inpatient setting.	• Time consumption was a reoccurring theme: time waiting on a computer, time logging, down time and tech support. Increased time spent by nursing on non-patient care • Appropriateness of EPRs to nursing practice – capture tacit, the therapeutic relationship missing from EPR. Fit between system and nursing process • Fear of overreliance on technology (deskilling)

Appendix D: Recruitment poster

Call for Nursing Participants

As part of the MSc Health Informatics, Trinity College, Dublin, I am conducting a research study:

To understand the consequences electronic records have on nurses' documentation practices

You are eligible for this study if you are:

- A registered nurse working in the acute care sector in Ireland.
- Currently using electronic records to document patient care.
- Have previous experience using paper-based nursing records.

Purpose

The purpose of this research study is to articulate the nurses' experience of using electronic records to document patient care; and explore what lessons learned can be applied to future projects.

Methodology

- Face-to-face interviews will be conducted to discuss the nurses experience of utilising electronic records to document patient care.
- Each interview will last approximately 20 minutes; times and dates will be arranged to suit participants and clinical areas.

If you are interested in learning more about this study, please contact (Researcher) Sinead Impey, RGN, at **impeys@tcd.ie**.

Appendix E: Semi-structure questionnaire Framework

What are the unintended consequences of electronic record adoption on nurses' documentation practices, and what lessons learned can we derive for a national EHR project?

Goals of the study:

1. *Using a phenomenological approach explore electronic record adoption from a nursing perspective.*
2. *Raise awareness of the potential for unintended consequences associated with adoption on nurses' documentation practices.*
3. *Identify nursing-specific considerations that should be addressed when considering a national EHR for Ireland.*

This research is being conducted as part of an MSc Health Informatics, Trinity College, Dublin.

Prior to answering any questions, please note:

- No institutional or personal information is required except for clinical area and years qualified.
- By answering these questions, consent is implied.
- You are free to withdraw from the study at any time, refuse to answer any or all questions if you wish.
- If you have any questions, please contact the author.

Demographics

Clinical area	
Day-care	
Specialist areas	
General/Surgical ward	

Years qualified	
Newly qualified	
0-1 years	
2-3 years	
4-5 years	
5-10 years	
>10 years	

1 | Page

Please answer the following questions based on your experience:

1. Can you discuss what is your experience of using electronic records to document patient care?

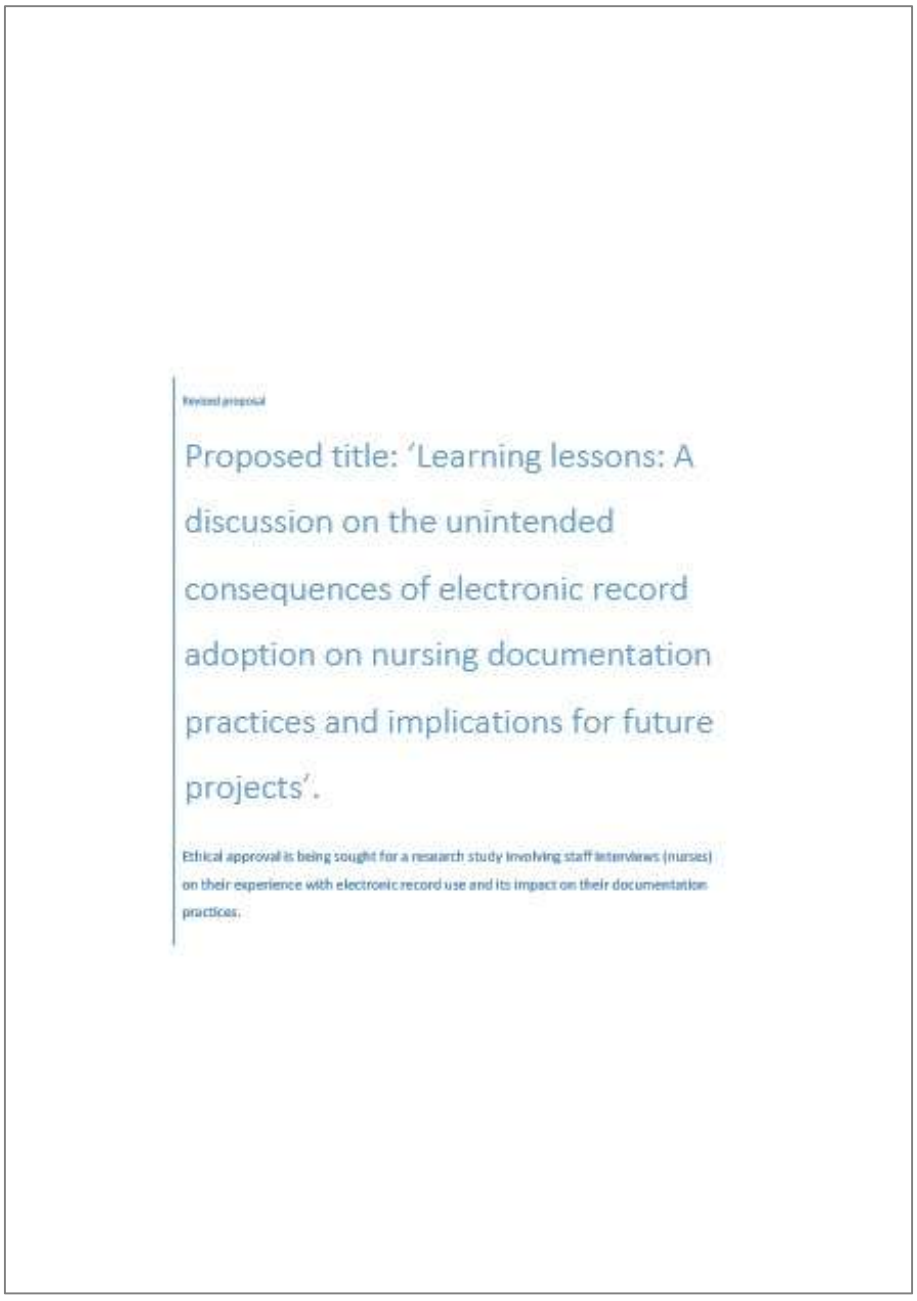
2. Can you describe how does this (electronic system) compare with paper-based systems that you have used previously?

3. Based on your experience what advice would you give an organization that was considering implementing an electronic system in order to smooth the transition for its nursing staff?

4. If given the choice, would you return to a paper-based system?

Thank you for taking the time to participate in this research,
would you be interested in taking part in a follow-up interview to review your answers.

Appendix F: Research proposal



Revised proposal

Proposed title: 'Learning lessons: A discussion on the unintended consequences of electronic record adoption on nursing documentation practices and implications for future projects'.

Ethical approval is being sought for a research study involving staff interviews (nurses) on their experience with electronic record use and its impact on their documentation practices.

Introduction

Electronic records hold great promise for healthcare service delivery, patient safety and decreased costs (Piscotty et al. 2015, Zadvinskis et al. 2014), along with providing traceability of nursing care (Kent et al. 2015). As with all changes, technology transitions can be a complex and unpredictable undertaking (Jensen 2007). A fundamental factor in determining success or failure, according to Holden & Karsh (2010) is individual end-user's acceptance. A point reiterated in several other studies (Greenhalgh et al. 2013, Carnicero & Rojas 2010, Boonstra & Broekhus 2010). According to Kirkendall et al. (2013) nurses', compared with other end-user groups, displayed more concern about the transition from paper to electronic recording. The hypothesis being that this could be a result of nursing's heavy reliance and use of medical records to direct and document patient care and therefore are more affected by the change (Kirdendall et al. 2013). As the nursing profession constitutes the largest number of staff in healthcare (Dowding et al. 2015) with a large portion of the time consumed with documentation related tasks (Westbroke et al. 2011); understanding the consequences arising from electronic record adoption – both positive and negative - from their perspective is important. Understanding their unique challenges allows implementers to mitigate any potential negative effects and promote the positive aspects of adoption, earlier in the change process.

For this MSc thesis, I wish to investigate the Irish nurses experience of electronic record adoption on their documentation practices and develop an understanding the unintended consequences (positive and negative). I want to explore whether nurses (who use electronic records) perceive them as useful or a hindrance to documentation; would they revert back to paper? And how we can use this information to ease the transition from paper to electronic records in future projects. The thesis is not intended as a critique of individual systems but rather a general discussion on obstacles and advantages of adoption. While specific functionalities will no doubt be referred to, it is envisioned that this will be in terms of their ability to help or hinder documentation practice.

This idea was precipitated by the recent discourse surrounding the implementation of a national electronic health record (EHR).

An initial literature review, using a meta-narrative approach, was conducted to *disseminate and synthesis pre-existing data on the challenges and advantages experienced by a nursing cohort, arising from electronic record adoption, to their documentation practices.* The following table broadly outlines the main themes identified.

Direct Challenges	Indirect Challenges
Issues arising from location and availability of terminal	Human factor issues (such as increased cognitive workload, stress)
System usability issues (such as workflow versus screen flow)	Technical support issues (such as premature withdrawal of increased technical support, dual role of super-users)
Operational issues (such as too many clicks/scrolling leading to additional steps in documentation process)	Training and education issues (such as addressing a mixed of computer literacy levels between staff, introducing new staff to system)

While the literature documented a range of challenges - for example, Rogers et al. (2013) found that usability shortcomings, such as complicated menu structure, increased documentation time. Sockolow et al. (2014) raised the point that although bedside charting made patient education easier, terminals not located at a desk removed a respite for nurses. The literature, however, also noted how adoption benefited nursing practice. For example, the nurses in a study Rogers et al. (2013) reported that some functionality - such as result 'alerts', and visual clues to a patient's condition, and rapid access to information - assisted their practice and efficiency. Carayon et al. (2011) found that nurses spent less time interpreting orders. Whereas Zadvinskis et al. (2015) noted improved communication between team members, although they cautioned that this benefit was only realised when all members co-operate with use. Kent et al. (2015) describe how adoption promoted safe and streamlined continuation of care between departments or teams. Whereas, Creswick et al. (2011) note that along with improved communication and patient safety, adoption also reinforced the nurses' role and increased autonomy.

In accordance with Technology Acceptance Model (TAM) when faced with a new technology users draw on a number of factors to influence whether the system will be accepted or rejected. Drawing on two established models, Davis et al. (1989) constructed the Technology Acceptance Model (TAM). This model describes how perceived usefulness (PU) and perceived ease-of-use (PEOU) of new technology affects how users come to accept or reject a new system. This model has been widely used in healthcare research. While understanding the obstacles and advantages of electronic record adoption is important, ascertaining the perceived usefulness of electronic records to nursing, could provide new insights for future implementation projects.

Therefore, a study, drawing on Davis et al. (1989) TAM model, aims to answer the research questions: *"What learning can we apply from previous electronic record implementations to mitigate the unintended consequences of adoption in future projects?"*

Initially, the research proposed was to be conducted in two parts. However, to extract the most beneficial information in the limited time available, permission is being sought to interview general ward (medical and surgical) nurses on their perception of usefulness electronic records affords nursing. Participants will be asked to discuss their experience of utilizing electronic records in the Irish healthcare setting - what they like, what they don't like and whether they would return to a paper-based system.

While this is not a critique of specific software systems, it is expected that by highlighting elements nurses like/dislike about system functionality (hardware and software) and how it impacts their practice, aspects of usability that are compatible or incompatible with nursing practices will emerge. In addition, rather than providing a definitive answer, this research should be viewed as an initial step toward understanding the effect (positive and negative) electronic records have on nursing.

Prior to interview, all prospective interviewees will be fully informed about purpose of the study. The researcher will ensure informed consent is obtained from all participants before interview commences. Participants will be informed that they can withdraw from the study at any time, refuse to answer any or all questions if they wish during or post interview.

Research Question

The research question is: *"What learning can we apply from previous electronic record implementations to mitigate the unintended consequences of adoption in future projects?"*

This question contains two main elements, essentially:

- Do electronic records help or hinder nurses' documentation practices?
- What lessons learned can we apply to future implementation projects?

Aims and Objectives of the Study

The aim of the study is:

To identify unintended consequences that should be considered when implementing a national EHR in order to minimize disruptions to nursing – by drawing the literature and the experience of the Irish nurse.

Research methodology/research design

Semi-structured interview with staff nurses, using Davis et al. (1989) Technology Acceptance Model (TAM) as a theoretical framework.

Recruitment

Information posters (call for participation) will be used as a recruitment tool for staff nurses who currently use electronic records in their daily practice. Purposeful sampling may be used if response is deemed too low. Ideally a sample size of 10 nurses is sought.

Inclusion/exclusion criteria

Only nurses who use electronic records in their daily practice will be included. No patient or staff information will be captured. No institution will be identified, other than generic terms such as a 'large

teaching hospital', 'healthcare facility', 'Hospital in the Republic of Ireland', or 'day-case', 'emergency department' if required.

Ethical considerations

Ethical approval will be sought from Trinity College, Dublin. Permission from individual institutions will also be sought.

Confidentiality issues

No individual institution, patient or staff member will be identified. Wards will be identified as either medical or surgical and if appropriate nurses will be identified as Nurse A medical/surgical ward. All data captured as part of the research will not be attached to any one institution or staff member. Any voice recorded material (from interviews) or electronic data will be destroyed at the end of the study. As this is a research study for a MSc, a TCD appointed supervisor will review all information prior to submission. This option is available to individual institutions if requested. There will be no comparison between institutions in terms of work practices. The purpose of the study is to capture the nurses' views on using electronic records, it is not a critique of individual systems or individual organizations culture or work practices.

Timescales

As this research forms part of an MSc and the research is in full-time employment, time is limited with final thesis due in July 2016. No interviews or other research will be conducted until ethical approval and permission is granted – from all institutions and TCD.

Facilities required from each institution

Assistance will be sought from the organisation with arranging interviews (times and dates), also a private space to conduct the interviews will be sought.

Appendix G: Ethical approval letter from TCD

Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

School of Computer Science and Statistics
O'Reilly Institute
Trinity College Dublin
Dublin 2, Ireland

Dr. Carl Vogel, FTCD
Research Ethics Committee
Telephone: 353 1 608 1538
Facsimile: 353 1 677 2204
e-mail: vogel@scss.tcd.ie

Ref: REA 34/16

March 16, 2016

Sinead Impey
TCD MSc Candidate: Health Informatics

Dear Ms. Impey,

I write on behalf of the Research Ethics Committee of the School of Computer Science and Statistics in connection with your application for research ethics approval for a project entitled "Learning lessons: a discussion on the unintended consequences of electronic record adoption on nursing documentation practices & implementation for future projects".

On March 14, 20126 we wrote to you via email to express the approval of the revised application that you submitted.

The purpose of this letter is to confirm the same via post, as per your request.

We wish you every success in your research.

Kind regards,

Carl Vogel
(on behalf of the SCSS Research Ethics Committee)

cc: Committee Files

Appendix H: Example of inductive themes, formulated meanings and related participant quotes for Question 1

	Main themes	Sub-themes	Formulated meanings (Brief overview)	Examples from the nurses' narrative
Perceived challenges	**Direct/external challenges**	Inadequate number of terminals	Competition between nurses for an available terminal can lead to delayed data entry.	*"Access can be problematic, there is more nurses than terminals, you have to haggle to get to the computers." (CS5:16-18)*
		Interruptions by non-nursing users	Availability is not only affected by number of terminals employed but also by increased number of users at specific times (peak times).	*"You see the problem is, sometimes, you want to document and the doctor will be sitting there doing his own notes ..." (BI8:16-19)*
		Location challenges	Implementers must consider the environment within which systems are utilised and how nurses interact with the technology.	*"… because our computer is placed so far away from the patient, you can't turn around and ask a personal question ..." (AO3:27-24)*
		Technical challenges	Technical issues can promote frustration at the system, and increase documentation time. Password issues can promote dissatisfaction with the system if changes are difficult and numerous.	*"It freezes or slows down and you have to restart the system again and you might lose you documentation ..." (BG2:63-66)* *"It makes you change your password often and its really frustrating." (BI4:25-26)*
	Indirect/ internal challenges	Time constraints on learning	The initial implementation phase could present time challenges for staff and also the time constraints of the clinical environment and the impact of learning a new system on users.	*"… getting to know the system. We got some basic training on it, but there is so many features ..." (AO1:17-18)*
		Individual traits	Individual computer literacy skills and experience will impact training time required.	*"Others were more computer literate but not me, I needed more training …" (BI8:34-36)*

Appendix I: Example of inductive themes, formulated meanings and related participant quotes for Question 2

	Main themes	Sub-themes	Formulated meanings (Brief overview)	Examples from the nurses' narrative
Workarounds	**Established Pre-implementation**	Interim recording	Nurses used handover sheets to capture patient information at opportune times. Paper persisted throughout the clinical areas to compensate for times when terminal was not readily available but was also a feature of practice before the arrival of an electronic platform.	*"The information is in the system, but is more concise and prioritised in the handover sheet, but the information is in the system." (AO2:36-37)*
		Password workarounds	To compensate for complex protocols or frequent changes required nurses adopted a range of workarounds that included writing passwords on the back of staff ID badges or changing a single digit per time. Not confined to electronic records, but endemic of all electronic platforms in the clinical area.	*"I just change the number, so I have 'blank' as my password and just move up the numbers, I up to number 12 now." (BG2:59-62)*
	Adopted Post-implementation	Copy and Paste	Where available nurses reported using the copy and paste function, but not necessarily to overcome perceived time restraints, although mentioned – rather because it was available.	*"Sometimes when you busy you it's better to copy and paste" (BI1:22-23)*
		Pre-charting	Noted by two respondents as a way of speeding up data input in case they were busy at a later time.	*"We know the patient is defiantly coming to us, we get them into the system, if you have time and you are waiting on a patient. It saves time." (BI2:31-33)*