

**Using socio-technical thinking to explore the
implementation of Electronic Patient Records into NHS
secondary care organisations**

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Abstract

Background: Electronic Patient Records (EPRs) are being introduced into many healthcare organisations around the world. In the UK, EPRs are seen as one mechanism through which the NHS can become safer and more efficient. The policy and financial support for NHS hospitals to implement these systems, implies a strong evidence base supporting the rationale that electronic records improve health outcomes and quality of care. In reality, there is limited evidence to support this, with a lack of understanding as to the best approaches to and the benefits, barriers and impact of implementing EPRs; particularly within the NHS. In this thesis, the implementation of EPRs into NHS secondary care organisations is explored.

Methods: A range of methods were used to explore the implementation of EPRs into NHS secondary care organisations. A policy analysis studied national NHS IT policy documents and evaluations of national NHS IT policy between 1998 and 2015 to investigate whether progress has been made in relation to implementing EPRs into NHS secondary care organisations. A mixed methods approach was adopted to explore the approaches to and challenges and benefits of implementing EPRs in NHS trusts throughout England; this comprised an online survey and semi-structured interviews with chief information officers. Lastly, qualitative interviews explored NHS staffs' perceptions and experiences of the benefits, barriers and disadvantages of implementing a maternity information system into a single maternity unit.

Results: There has been little progress in implementing EPRs in secondary care since 1998, the reasons for which are multifaceted and include a paucity of guidance surrounding the optimum approaches to implementing EPRs with a range of additional social and technical factors. Proposed benefits of EPRs largely related to improved: information availability, accessibility, transfer and legibility; with a limited number of efficiency and patient safety benefits also reported.

Conclusions: This thesis adds to a limited UK evidence base and provides a greater understanding of the approaches to and various social and technical factors associated with implementing EPRs into NHS secondary care organisations.

Contents

- Abstract 3
- List of figures 8
- List of tables..... 9
- Acknowledgements 11
- Authors Declaration..... 12
- Chapter 1. Background..... 13
 - 1.1. Information Technology and Healthcare..... 13
 - 1.2. Review of the literature:..... 16
 - 1.2.1. What are the benefits of implementing EPRs?..... 17
 - 1.2.2. Barriers to implementing and using EPRs?..... 22
 - 1.2.3. What are the disadvantages of implementing EPRs?..... 25
 - 1.2.4. Summary:..... 30
 - 1.3. Rationale and aims: 30
 - 1.4. Theoretical underpinnings..... 33
 - 1.4.1. Methodology: Pragmatism and health services research 33
 - 1.4.2. The socio-technical approach..... 34
 - 1.4.3. Applying socio-technical thinking to the thesis 38
 - 1.4.4. Other theories relevant to the thesis 39
 - 1.5. Chapter Outline: 40
- Chapter 2. An exploration of national NHS IT policy between 1998 and 2015: methods and analytic plan 41
 - 2.1. Rational and research questions 41
 - 2.2. Background..... 43
 - 2.3. An overview of policy analysis..... 47
 - 2.4. Methodology 48
 - 2.4.1. Selection of documents:..... 48
 - 2.4.2. Identifying documents..... 49
 - 2.5. Ethical considerations:..... 49
 - 2.6. Analytic Plan: 49
 - 2.6.1. Thematic analysis..... 50

Chapter 3.	An exploration of national NHS IT policy between 1998-2015: results and discussion	.54
3.1.	Results	54
3.1.1.	Descriptive information:	55
3.1.2.	How do documents define electronic records and have these definitions changed over time?	64
3.1.3.	What were national policies aiming to achieve by implementing electronic records and is there evidence that these aims are recurring?	67
3.1.4.	Progress in implementing EPRs between 1998 and 2015	70
3.1.5.	Recommendations	90
3.2.	Discussion:	99
3.2.1.	Findings:	99
3.3.	Strengths and weaknesses:	105
3.4.	Recommendations:	106
3.5.	Conclusions:	108
Chapter 4.	Investigating the implementation of Electronic Patient Record (EPR) systems into NHS trusts: methods and analytic plan	108
4.1.	Rationale, Aims and Objectives	109
4.2.	Methodology	110
4.2.1.	Mixed methods research:	110
4.2.2.	Quality and reporting standards in mixed methods research	111
4.2.3.	Why mixed methods?	112
4.2.4.	Study Design	114
4.2.5.	Inclusion Criteria	114
4.2.6.	Quantitative Method: Survey	114
4.2.7.	Qualitative Method: Interviews	116
4.3.	Ethical Considerations	117
4.4.	Analytic Strategy	118
4.4.1.	Statistical Analysis of Survey data	118
4.5.	Interview data	119
4.5.1.	Thematic analysis:	119
4.5.2.	Integration and presentation of survey and interview data	122
4.5.3.	Reflexivity	123
Chapter 5.	Investigating the implementation of EPRs into NHS trusts: results and discussion	124

- 5.1. Terminology used within the survey and interviews..... 124
 - 5.1.1. EPR functionality..... 124
 - 5.1.2. Hardware strategies 125
 - 5.1.3. Solution Strategies..... 126
- 5.2. Results: 127
 - 5.2.1. Participants 127
 - 5.2.2. Defining an Electronic Patient Record 130
 - 5.2.3. A Paperless NHS? 131
 - 5.2.4. The current status of EPR systems: 133
 - 5.2.5. The approaches and systems used by trusts when implementing an EPR:..... 134
 - 5.2.6. Clinician involvement in trusts EPR projects 139
 - 5.2.7. The benefits of implementing EPRs:..... 140
 - 5.2.8. Challenges of implementing EPRs: 142
- 5.3. Discussion: 147
 - 5.3.1. Findings:..... 147
 - 5.3.2. Strengths and weaknesses 154
 - 5.3.3. Reflexivity 155
 - 5.3.4. Recommendations:..... 156
 - 5.3.5. Conclusions..... 158
- Chapter 6. Qualitative interview study exploring the implementation of a maternity information system: methods and analytic plan 159
 - 6.1. Rationale and aims: 159
 - 6.2. Normalisation Process theory (NPT)..... 160
 - 6.3. Methodology 163
 - 6.3.1. Study Design 163
 - 6.3.2. Sampling Strategy 164
 - 6.3.3. Inclusion Criteria 165
 - 6.3.4. Recruitment 165
 - 6.3.5. Interview design and content..... 166
 - 6.4. Ethical Considerations 167
 - 6.5. Analytic Plan 168
- Chapter 7. Qualitative interview study exploring the implementation of a maternity information system: Results and Discussion 172
 - 7.1. Context: 172

7.2.	Results.....	174
7.2.1.	Participants	174
7.2.2.	Using NPT as a framework to interpret the study's findings	175
7.3.	Discussion:	196
7.3.1.	Findings:	196
7.3.2.	Strengths and weaknesses.....	205
7.3.3.	Reflexivity.....	206
7.3.4.	Recommendations	207
7.3.5.	Conclusions	209
Chapter 8.	General Discussion.....	210
8.1.	Key findings:.....	210
8.1.1.	Has NHS national IT policy made progress in implementing EPRs between 1998 and 2015?	211
8.1.2.	The current status of and approaches to EPR implementation in NHS secondary care organisations.....	212
8.1.3.	What are the benefits, barriers and disadvantages of implementing EPRs?.....	214
8.1.4.	Defining EPRs:	220
8.1.5.	Summary of key findings:.....	221
8.2.	Strengths and weaknesses.....	221
8.3.	Recommendations:	226
8.4.	Impact:	229
8.5.	Conclusions:	230
	Abbreviations	279
	References	281

List of figures

Figure 1: relationship between EHR and EPR adapted from Information for Health (NHS Executive 1998, p.23)..... 15

Figure 2: Timeline of NHS IT policy between 1998 and 2015 63

Figure 3: The changing use of terminology 64

Figure 4: Path to IDCRs adapted from Safer Hospitals Safer Wards (NHS England 2013 p. 15)..... 68

Figure 5: Key pieces of infrastructure which have seen success and that are crucial to implementing electronic records 86

Figure 6: Example of thematic map used within the thematic analysis..... 121

Figure 7: Participant flow 128

Figure 8: Trusts responses to the devices used and their perceived or experienced usefulness 136

Figure 9: Spider diagram for barriers theme 170

Figure 10: User centered design process adapted from Bevan & Curson (1998)..... 209

List of tables

Table 1 Barriers to implementing and using EPRs	24
Table 2 an example of a thematic table used to analyse evaluations of national policy	52
Table 3 Descriptive information for national NHS IT policy documents meeting the study's inclusion criteria	59
Table 4 Descriptive information for policy evaluations meeting the study's inclusion criteria .	61
Table 5 Definitions of EHR, EPRs and associated terms within NHS IT policy documents ...	66
Table 6 Macro, Meso and Micro factors that have affected EPR progress between 1998 and 2015	72
Table 7 the number of systems delivered in each of the three regions within England and the value of contracts during NPIIT according to review between 2011 and 2013.....	73
Table 8 Justification for combining qualitative and quantitative methods (adapted from Bryman, 2006)	113
Table 9 Example of tables used within the thematic analysis	121
Table 10 Core functionality of an EPR	125
Table 11 Demographics for survey and interview participants	129
Table 12 whether trusts believe they will be paperless by 2018 and whether they have an EPR in place.....	131
Table 13 open responses to the survey question, "if you will not be paperless by 2018, what is your plan for achieving this aim?"	132
Table 14 Number and proportions of trusts EPR functionality	133
Table 15 Responses to the open survey question 'when will your trusts EPR be authorised as a definitive record, so the paper will no longer be used or required?'	134
Table 16 The systems being used by trusts to deliver their EPR.....	138
Table 17 Influences to the implementation of EPR systems.....	153
Table 18 NPT mechanisms as described by Gallacher et al., 2011.....	161
Table 19 Use of NPT in developing complex interventions (Murray et al., 2010).....	163
Table 20 Example of a thematic table used for the analysis.....	169
Table 21 Participant characteristics	175
Table 22 Macro, meso and micro influences on the implementation of a maternity information system	203
Table 23 Summary of key findings	211

Table 24 Benefits identified from chapters 5 and 7 during qualitative interviews with CIOs and NHS staff..... 216

Table 25 Factors affecting the implementation of electronic records..... 217

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Authors Declaration

I confirm that the research presented in this thesis is my own work and has not been submitted for an award elsewhere. To the best of my knowledge, the thesis contains no material that has been published elsewhere by another person, with the exception of information that is referenced within the text. Parts of this thesis that have been accepted for publication or are under review in peer-reviewed journals include:

Clarke, A, Adamson, J, Sheard, L, Cairns, P, Watt, I & Wright J. (2015) Implementing electronic patient record systems. (EPRs) into England's acute, mental health and community care trusts: a mixed methods study. *BMC Medical Informatics and Decision Making*. 15: 85.

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Chapter 1. Background

This chapter provides background information for the thesis, which aims to explore the implementation of Electronic Patient Records (EPRs) into NHS secondary care organisations. An overview of information technology (IT) in healthcare is provided with a review of literature focussing on evidence relating to the benefits, barriers and disadvantages of implementing EPRs into NHS secondary care organisations. The rationale, which outlines the policy context of implementing EPRs into the NHS and the research questions for the thesis as a whole are then presented. Sociotechnical thinking, an approach that considers the complexity of how people, technology and organisations within healthcare interact and which argues for equal consideration of social and technical issues when implementing technology in healthcare (Coiera, 2004) is then outlined. A description of how the sociotechnical approach has been applied to this thesis, through three empirical chapters exploring the implementation of EPRs from the macro (national policy and wider social norms and expectations), meso (organisational processes and routines) and micro (particular experiences of professionals) perspectives is then discussed. This is followed by an outline of the remaining chapters.

1.1. Information Technology and Healthcare

Information Technology (IT) is changing the way we live and is becoming something that society is increasingly dependent upon for a variety of daily tasks (Department of Health, 2012). For instance, how we shop and manage our money are tasks, for which we are now often reliant upon IT. Considering that technology has enabled these tasks to be transformed from things that were previously considered labour intensive and complex, to tasks that can now be conducted, quickly, simply and whenever and wherever users have access to technology, it is perhaps unsurprising that IT is often viewed as a tool for transforming the healthcare industry (Kohn et al, 2001; Asch et al., 2004); by improving efficiency, quality and safety (Catwell & Sheikh, 2009), whilst reducing the cost of healthcare (Blumenthal, 2010).

‘e-health’ is a term that was introduced in 1999 by the IT industry and is now considered a buzzword for conveying everything relating to computers and medicine. ‘e-health’ encompasses a range of technologies such as tele-health, clinical decision support, medical apps and health websites (e.g. NHS Choices), with the following definition proposed by Eynsenbach (2001):

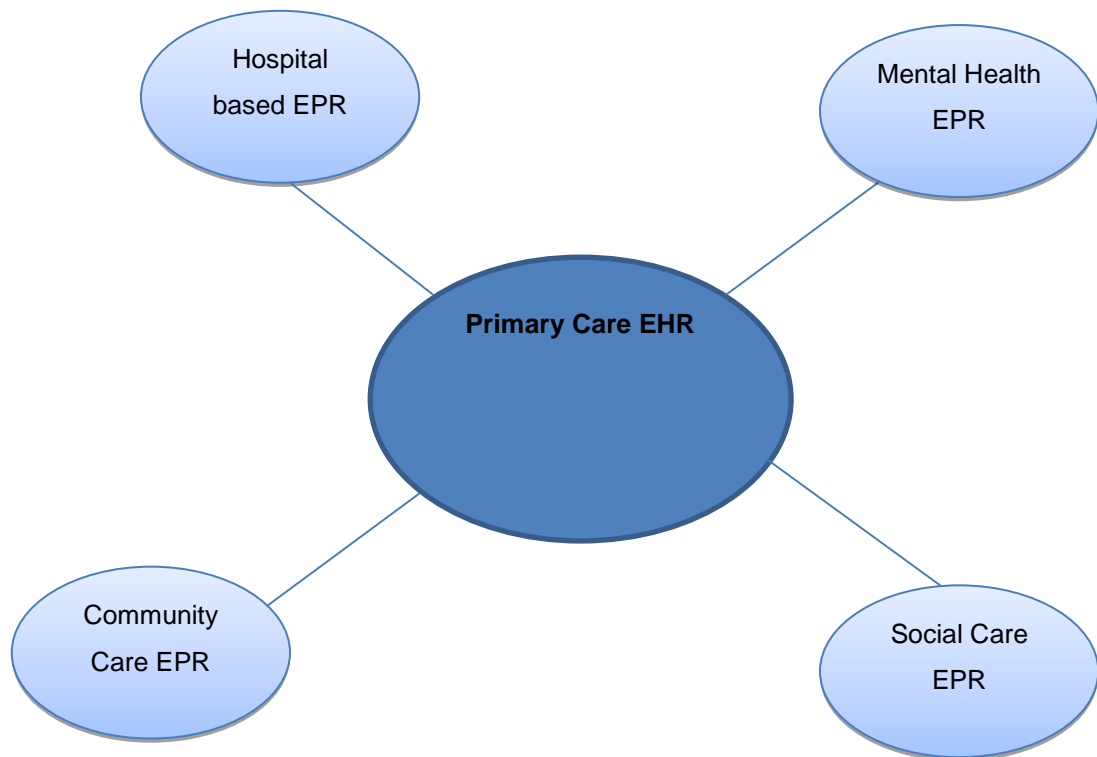
“e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology” (Eysenbach, 2001).

EPRs are considered ‘the cornerstone of e-health’ (Hannan, 1996) and are receiving mounting interest both internationally (Pagliari, Detmer & Singleton, 2007) and domestically, particularly in light of the Secretary of State for Health Jeremy Hunt’s recent call for a ‘paperless NHS by 2018’ (Illman, 2013). It is well documented that the primary motivation to implement these systems stems from expectations that improvements in patient safety and the quality and efficiency of healthcare will ensue (Sujansky, 1998; Bates & Gawande, 2003; Miller & Sim, 2004; McGrath, Arar & Pugh, 2007; Williams & Boren, 2008). EPRs are also being implemented to replace paper records, which have been criticised as having inherent weaknesses including being: illegible, inaccurate, lacking in clinical sensibility, incompatible with specified data standards (Tierney & Hannan, 1992) difficult to store and costly, (Hanan, 1996). Additionally, success in digitising UK primary care, where EPRs have been implemented in the majority of GP practices and pressure for the health and social care system to become integrated has added to the pressure on NHS secondary care organisations to implement these systems (NHS England, 2013).

In spite of the interest surrounding EPRs, there is no universally accepted definition for these systems, with geographical variation in the acronyms used also existing. For instance the U.S.A and continental Europe use the term Electronic Medical Record (EMR) whilst the UK prefers EPR. Furthermore, when searching the literature it became apparent that the terms EMR/EPR and Electronic Health Record (EHR) are often used loosely and interchangeably; despite originally being proposed as separate systems in an early NHS policy document ‘Information for Health: an information strategy for the modern NHS’ (figure 1) (NHS England, 1992). This has led to confusion in the literature as to whether an EMR or an EHR is being reported upon (Garets & Davis, 2006). It would seem important that researchers define the system under study and how they interpret the term EPR/EMR, particularly when considering the varying stages of implementation and usage of these systems into healthcare organisations locally, nationally and internationally and the way that technology is evolving which in turn leads to changes in the functionalities and capabilities of these systems (Garets & Davis, 2006).

The concept of an EPR is explored in more detail throughout the remainder of this thesis (Chapters 2-7). This thesis will use the definition provided by NHS England (NHS Executive, 1998) (figure 1) which considers EPRs to be computer systems that enable patient information to be stored, organised and retrieved (McGrath, Arar & Pugh, 2007) and also provides support to clinicians through functionalities such as: medication and allergy lists, prescribing tools, results retrieval (e.g. laboratory, radiology) and clinical decision support (Bates et al, 2003). In contrast to this, an EHR is considered a longitudinal record of patients' health and healthcare, which combines information about patient contacts and primary healthcare and contains information associated with episodic elements of care held in organisationally bound EPRs (NHS Executive, 1998). NHS England therefore distinguishes between EHRs and EPR/EMRs (figure 1) and so this thesis will also consider them to be separate entities and terms which should not be used interchangeably.

Figure 1: relationship between EHR and EPR adapted from Information for Health (NHS Executive 1998, p.23)



1.2. Review of the literature:

This section aims to provide an overview of the literature relating to the benefits, barriers and disadvantages of implementing EPRs into secondary care organisations. Articles were searched for through the Cochrane library Web of Science and Google Scholar using the following search terms: 'Electronic Medical Record*' OR 'Electronic Patient Record*' OR 'Electronic Health Record*' AND 'Implement*' AND 'hospital*'. Articles in English between 1992, when the concept of an EPR was introduced to the NHS by the 1992 Information and technology policy (Wainwright & Waring, 2000) and 2015 were included. No restrictions on study design were applied, however due to the thesis exploring the implementation of EPRs into secondary care organisations; articles which investigated the implementation of these systems into primary care were excluded.

As previously stated (section 1.1), the interchanging use and lack of universality of the definitions and terms for EHRs and EPRs, made it difficult, in some cases to determine which of these systems were under study, particularly when no definition was provided. To overcome this, only literature where it was clear that EPRs/EMRs and not EHRs or individual departmental systems e.g. standalone e-prescribing or clinical decision support systems, were being explored were reviewed. To accommodate for the interchanging and inconsistent use of the terms EHR and EPR/EMR, when literature that used the term EHR was identified the definitions of the system provided within the study were explored and where EPRs were in fact being examined this literature was included.

The literature search identified 4 systematic reviews. These focussed on either barriers (Boonstra & Broekhuis, 2010) or barriers and facilitators to implementing electronic records (McGinn et al., 2011; Fritz Tilahun & Dugas, 2014; Boonstra, Versluis & Vos, 2014). However these reviews were not exclusive to EPR/EMR literature in secondary care organisations and did not explore benefits to implementation. The evidence regarding benefits, barriers and disadvantages is discussed separately hereafter and is supported by appendices 1, 2 and 3 which comprise summary tables for all reviewed literature. Particular attention has been given to UK literature throughout this review, due to this thesis aiming to explore the implementation of EPRs into NHS secondary care organisations. The distinctive nature of the NHS in terms of its previous history of implementing EPRs (chapters 2-3) and its unique structure and economic and political foundations means the generalisability of literature exploring implementations of EPRs into other healthcare organisations around the world is debatable.

1.2.1. What are the benefits of implementing EPRs?

Benefits are defined by policymakers and those implementing EPRs e.g. hospital IT managers and Chief Information Officers (CIOs) to be *'the measurable improvement from change, which is perceived as positive by one or more stakeholders, and which contributes to organisational (including strategic) objectives'* (Jenner, 2012). However, positive outcomes from systems that may assist clinicians but which do not easily provide NHS organisations with 'hard' quantifiable benefits for trusts or patients are not considered benefits by policymakers. For instance, 'clinicians will be able to read patient notes wherever they have access to them' and 'we'll have a legible record' are not considered benefits', but instead are viewed as capabilities and outcomes of the system respectively. Policymakers and hospital IT managers categorise benefits as 'cash-releasing' 'non-cash releasing' and 'societal', with an example of a benefit to these individuals being *'patients will have a better experience because we will cancel fewer appointments due to lost notes-and the trust will save money on outpatient appointments'* (Personal Communication, Health and Social Care Information Centre, Senior Benefits Manager, September 2015). This appears to conflict with academic literature which does not have an established definition of what benefits relating to EPRs are and instead seems to consider any advantage of the system to clinical practice, policymakers, hospitals and patients to be a benefit. For instance, in an academic context 'making information available and easy to retrieve' would be considered a benefit of implementing EPRs (Sheikh et al., 2011). It could be argued that Jenner's (2012) definition of a benefit, may be useful for organisations and policymakers who need something to enable them to quantify benefits, however the definition may be less useful for determining benefits of clinical importance. For example, having records accessible and available whenever and wherever clinicians require them may not be of direct benefit to organisations, but may be considered useful by clinicians. Taking this into account, benefits in this thesis are considered to be anything which impacts hospitals, IT managers and clinicians positively, as the thesis aims to explore implementation from the perspectives of multiple stakeholders.

Policy states that EPRs have the ability to transform healthcare and bring numerous safety and quality benefits to the NHS and other healthcare organisations around the world (NHS England, 2013). The strength of these claims suggests that there is significant evidence to support them. However, only 5 studies from the UK (Robertson et al., 2010; Sheikh et al., 2011; Waterson, Glenn & Eason, 2011; Takian, Sheikh & Barber, 2012; Meeks et al., 2014) and 13 studies from the US could be identified that focused on benefits of EPRs. This

literature which is summarised in appendix 1 identified a number of varied benefits, which have been categorised under the following themes:

Information availability, reliability and accessibility (Moody et al., 2004; Likourezos et al., 2004; Kossman, 2006; Ovretveit et al., 2007a, b; Williams & Boren, 2008; Robertson et al., 2010; Sheikh et al., 2011; Holden, 2011; Takian, Sheikh & Barber 2012; Chao et al., 2012).

Efficiency; financial and time savings for staff (Thakar & Davis, 2006; Ovretveit et al., 2007a, b; Evans & Stemple, 2008; Robertson et al., 2010; Sheikh et al., 2011; Holden 2011; Waterson, Glenn & Eason, 2011; Silow-Carroll, Edwards & Rodin, 2012; Chao et al., 2013).

Quality and Safety of care (Likourezos et al., 2004; Moody et al., 2004; Kossman 2006; Thakkar et al., 2006 ; Pollak & Lorch, 2007; Ovretveit et al., 2007a, b; Evans & Stemple 2008; De Veer & Francke, 2010; Silow-Carroll, Edwards & Rodin, 2012; Chao et al., 2013; Lee, Kuo & Goodwin., 2013; Meeks et al., 2014).

Improved communication and co-ordination of care between and within health care organisations (Thakar et al., 2006; Ovretveit et al., 2007a, b; Sheikh et al., 2011; Silow-Carroll, Edwards & Rodin, 2012; Chao et al., 2013).

Patient involvement (Silow-Carroll, Edwards & Rodin, 2012).

Organisational and professional learning (Lium, Tjora & Faxvaag et al., 2008; Sheikh et al., 2011).

Qualitative techniques (interviews, observations and documents), surveys and hospital documents have been used to explore the implementation of electronic records (appendix 1). The majority of research in this area is qualitative, with findings limited to perceived attitudes or perceived benefits of electronic records that are expected to emerge in the future, as opposed to 'actual realised' benefits. Literature that has used quantitative methods (surveys or hospital audits and documents) focused on either staffs' perceived attitudes towards electronic records or the effect of these systems on specific outcomes such as mortality. U.S literature that has determined positive effects of electronic records on individual outcomes such as mortality and length of stay (Pollak & Lorch, 2007; Lee Kuo & Goodwin., 2013) has started to emerge; presumably due to the greater success of implementing electronic records into U.S hospitals and longer period of time which these systems have been in use compared

with health care organisations in other countries around the world. Some geographical differences in the benefits reported were also found, with a larger number of US studies (Moody et al., 2004; Likourezos et al., 2004; Thakkar et al., 2006; Pollak & Lorch, 2007; Evans & Stemple 2008; Furukawa 2011; Silow-Carroll, Edwards & Rodin, 2012; Lee, Kuo & Goodwin., 2013) reporting benefits relating to patient outcomes, patient safety and quality of care in comparison to European studies (De Veer & Francke, 2010).

A number of the actual benefits identified within the literature would not be classified as benefits according to official NHS IT policy or business cases, with only a minority of studies both within the UK and wider literature reporting perceived improvements to patient safety and efficiency. Instead the majority of benefits identified related to availability and accessibility of information. This may account for anecdotal perceptions particularly by policymakers and NHS trust IT managers that there is little or no evidence supporting the benefits of these systems and may explain the difficulty these individuals face in producing benefits realisation plans and business cases for IT investment; the content of which is currently reliant on a limited U.S evidence base which has identified positive outcomes (Personal Communication, NHS trust senior EPR benefits manager) as opposed to 'benefits' when using Jenner's (2012) definition of a benefit (section 1.2.1 above).

UK literature that explored the benefits of implementing EPRs into NHS secondary care organisations is summarised below. As previously mentioned (section 1.2) UK literature is discussed in more detail and also in sections 1.2.2 and 1.2.3 as the thesis is concerned with the implementation of electronic records into NHS secondary care organisations.

Robertson et al., 2010 conducted a 'mixed methods longitudinal multisite sociotechnical case study' to describe and evaluate the implementation and adoption of electronic records within five English 'early adopter sites' who were the first hospitals to receive these systems under the National Programme for IT in the NHS (NPfIT); a policy which aimed to implement EPRs throughout health and social care by 2010 (DoH, 2002). For further detail please see chapter 3, section 3.1.1. Semi-structured interviews with stakeholders within each of the five sites (managers, IT implementation teams, Doctors, Nurses, Allied Health Professionals, patients, carers and representatives of the organisations responsible for implementing NPfIT e.g. Strategic Health Authorities) sought to understand expectations, experiences and opinions towards electronic record implementation. Interviews were triangulated with documents and observations from the participating NHS trusts, which represented different regions and

electronic record systems (RiO, Lorenzo and Cerner Millennium) implemented under NPfIT. The study's findings were limited to perceptions that electronic records will enable national and local data sharing. However, interviews also identified that before staff began to use the systems, clinicians' supported the idea of electronic records with this early enthusiasm credited to perceptions of an 'imagined ideal electronic system' which would benefit staff locally. The lack of 'actual' benefits identified in this study is potentially because the study explored early experiences of implementation and presented 'interim results' of early adoption after initial data of a larger longitudinal national evaluation had been completed.

The final results of the longitudinal national evaluation of early adopter hospitals under NPfIT used the same qualitative research methods (431 interviews, 590 hours of observations and 867 documents) as the interim analysis reported by Robertson et al., (2010) to explore the implementation of electronic records into 12 NHS sites (mental health, acute foundation and non-foundation trusts) over a two and a half year period (Sheikh et al., 2011). In addition to reporting a range of barriers to implementation (section 1.2.2) evidence of early benefits to NHS staff were identified. Firstly NHS staff reported that once 'a critical mass of data and users of electronic records was reached' benefits from improved availability and accessibility of information that was retrievable by multiple users, legible and available in real-time were realised. Secondly, although some individual stages of workflows were perceived to be more time consuming (e.g. when additional information not standardly recorded is required) electronic transmission of information were reported to have made some workflows quicker overall. Lastly, the change required to implement electronic record systems was perceived to have provided NHS hospitals and staff with the opportunity for organisational learning and reflection. However, the authors acknowledged that as the study was conducted during the early stages of an electronic record systems implementation and aimed to investigate 'issues and emergent changes as opposed to systematically identifying benefits', the full range of benefits that may result from implementing these systems may not be represented.

In acknowledgement of the limited evidence exploring the implementation of electronic records into mental health settings both within the NHS and globally, Takian, Sheikh and Barber (2012) selected a single mental health hospital from the 12 early adopter sites studied by Sheikh et al., (2011) to undertake a prospective longitudinal and socio-technical case study. 48 semi-structured interviews were conducted with a range of stakeholders (senior managers, IT implementation teams, clinicians and administrative staff) to explore the implementation, local consequences and experiences of adopting a nationally procured electronic record through NPfIT. Prior to the system being implemented the organisation

viewed the electronic record as essential to maintaining the trusts foundation trust status (which provides greater financial independence to the trust) and expected the system to enable health services to be integrated at local and national level. The study also identified a range of clinical benefits experienced during the system's initial implementation. A large proportion of these benefits related to perceptions that the system had improved the quality and safety of care provided by the organisation, through improving the availability, accessibility and legibility of patient information in real-time for staff throughout the hospital and local health community which were believed to have reduced clinical risk while making care safer. Additionally, the system was perceived to have improved the quality, accuracy and security of patient records whilst also benefiting research, improving the quality of care received and the organisations efficiency. However, as with the two previously described studies (Robertson et al., 2010; Sheikh et al., 2011) the benefits identified here are limited to those expected before implementation and perceived during initial implementation of electronic record systems. Furthermore, as stated by the authors, the generalisability of this study's findings to other health care settings should be considered with 'great caution' as the study was a case study within a single mental health acute hospital.

Lastly, Waterson, Glenn and Eason, (2011) aimed to explore the potential impact of introducing EPRs on the hospital or sociotechnical system (working practices, management and patient information). Semi-structured interviews with 27 NHS staff (administrative and nurses) that represented outpatient services at a single NHS hospital explored the current processes for medical records and participants' expectations of EPRs. Additional unstructured interviews with 'experts' (project, medical record and implementation managers) were conducted to obtain an overview of the hospitals' use of IT systems and paper medical records prior to implementation and participants perspectives on the future use of medical records. Rather than directly exploring benefits, the study therefore explored participants' expectations regarding the future of EPRs and the changes needed to ensure their implementation. The positivity expressed by interviewees regarding the potential of EPRs was attributed to issues with paper records and assumptions that electronic records would be: available upon request, easy to retrieve, up-to-date and would reduce storage and handling of large volumes of paper patient records. The study was however conducted with a relatively small sample (n=27) of nurses and administrative staff and so a full range of clinical perspectives was not obtained. Additionally, interviews were conducted with staff at a single acute trust within an outpatient setting, pre-implementation and so benefits identified were

limited to participants' perceptions of what benefits would emerge as opposed to their actual experiences.

Three of the four UK studies discussed identified that following the implementation of an electronic record system, staff did see some, albeit fairly limited benefits to their clinical practice, with the authors concluding that only a limited number of benefits are experienced during the first two years of implementation (Robertson et al., 2010; Sheik et al., 2011; Takian, Sheikh & Barber, 2012). Although these studies were conducted with a range of stakeholders (clinical staff, managers and policymakers) and were theoretically underpinned by sociotechnical thinking a theory widely utilised for studies evaluating technology implementations in healthcare (section 1.3), they were the result of the same longitudinal, national evaluation of early adopter hospitals during NPfIT. Furthermore these studies aimed to feedback and inform the future of NPfIT and its implementation of electronic records and so despite interviewing a range of stakeholders, were perhaps more policy as opposed to clinically orientated. Additionally, NPfIT and its electronic record program encountered vast delays and was negatively portrayed by the media which may have further constrained the number and perceptions of benefits particularly of NHS staff.

Of the UK literature discussed here, benefits were identified before or during initial implementation of electronic records and so the long-term benefits of introducing these systems into the NHS are still unknown. Additionally, none of the UK studies explicitly aimed to identify benefits of implementing electronic records, but rather sought to identify the general impact of implementing these systems. Benefits therefore often emerged as a by-product of this question rather than being the main focus, which may also have restricted the number of benefits identified.

1.2.2. Barriers to implementing and using EPRs?

It is well acknowledged that implementing technology into health care organisations is challenging, with the UK believed to be behind other countries, particularly the U.S (DoH, 2014). Literature has aimed to explore the reasons for this and has identified a range of barriers, or factors that are considered to affect the implementation and use of EPRs. This literature which is summarised in appendix 2 is however predominately U.S based, which is perhaps unsurprising given the number of implementations of EPRs into U.S hospitals in comparison to other countries. Table 1 summarises the various barriers to using and implementing EPRs identified by existing literature. Due to the number of barriers identified, the barriers have been categorised as either social or technical. The majority of barriers

identified were technical and the result of poor system design (e.g. systems are difficult to navigate) and an inability of systems to support clinical practice (e.g. limited functionality). Recent advances in technology that have improved the design and capability of current EPRs would perhaps lead to expectations that literature identifying technological issues to be older. However, despite these technical advances and technical issues being well evidenced, these issues continue to be a frequently cited barrier to EPR implementation (table 1). Additionally a number of the social (e.g. training NHS staff) and technical barriers (e.g. insufficient hardware) are the result of poor implementation and so it could be argued are preventable. Particularly when considering that these issues are well documented within the literature for training and change management are also repeatedly acknowledged as critical to successful implementation by NHS national IT policy, (NHS England, 2013; DoH 2014).

The evidence base on barriers is limited to qualitative interview and survey studies that have been conducted with single staff groups (e.g. nurses) within acute settings, which may explain the limited number of policy and organisational barriers reported. Furthermore only 5 studies (Thakkar & Davis, 2006; Ovretveit et al., 2007a,b; Evans & Stemple, 2008; Williams & Boren, 2008; Silow-Carroll, Edwards & Rodin, 2012) reported financial barriers to implementation, such as difficulties for trusts showing a return of investment in EPR projects and the costs of procuring and implementing these systems. Research studies have predominately surveyed and interviewed clinical staff and have not tended to explore perceptions and experiences of the barriers to implementation from policymakers or NHS IT managers perspectives and so this may account for the limited focus on these issues by the existing literature.

Table 1 Barriers to implementing and using EPRs

Barrier type	Reference
Technical	
Poor design, limited/poor functionality, doesn't meet clinical needs	Moody et al., 2004; Thakkar & Davis, 2006; Overtveit et al., 2007b; Lium, Tjora, Fauxvang, 2008; Sheikh et al., 2011; Takian, Sheikh & Barber, 2012; Silow-Carroll, Edwards & Rodin, 2012;
Downtimes/unable to log on	Moody et al., 2004; Likourezos et al., 2004; Kossman, 2006; Lium, Tjora, Fauxvang, 2008; Furukawa, Ragu & Shao, 2010; Sheikh et al., 2011
Slow and time consuming to use	Moody et al., 2004; Kossman, 2006; Overtveit et al., 2007b; Furukawa, Ragu and Shao, 2010; Holden, 2011; Sheikh et al., 2011; Takian, Sheikh & Barber, 2012; Chao et al., 2013;
Difficult to use/navigate/ cumbersome	Likourezos et al., 2004; Overtveit et al., 2007b; Sheikh et al., 2011; Holden, 2011; Silow-Carroll, Edwards & Rodin, 2012; Takian, Sheikh & Barber, 2012;; Yu et al., 2013
Security and confidentiality	Likourezos et al., 2004; Thakkar et al., 2006; Evans & Stemple, 2008; Chao et al., 2013;; Yu et al., 2013
Connectivity	Sheikh et al., (2011)
Logging in and using multiple systems	Furukawa, Ragu & Shao, 2010; Takian, Sheikh & Barber, 2012; Chao et al., 2013;
Difficulty digitising existing patient record	Waterson, Glenn & Eason, 2011
Lack of integration with other health and care systems	Thakkar et al., 2006; Takian, Sheikh & Barber, 2012
Accuracy of record	Kossman, 2006; Thakkar et al., 2006
Social	
Training	Overtveit et al., 2007a,b; Evans & Stemple, 2008; Robertson et al., 2010; Holden 2011; Sheikh et al., 2011; Silow-Carroll, Edwards & Rodin, 2012; Takian, Sheikh & Barber, 2012
IT literacy	Likouezos et al., 2004; Robertson et al., 2010
Staff resistance/change management	Overtveit et al., 2007b; Evans & Stemple, 2008; Williams & Boren, 2008; Robertson et al., 2010; Waterson, Glenn, Eason, 2011; Takian, Sheikh & Barber, 2012; Silow-Carrol, Edwards & Rodin, 2012; Yu et al., 2013
Varying use of system by staff	Takian, Sheikh & Barber, 2012;
Workarounds to overcome usability issues	Lium, Tjora & Fauxvaug 2008; Robertson et al., 2010; Sheikh et al., 2011;
Staff expectations	Robertson et al, 2010
Staff involvement and engagement in projects	Thakkar et al., 2006; Overtveit et al., 2007b; Robertson et al., 2010; Silow-Carroll, Edwards & Rodin, 2012

Staff attitudes towards EPR	Moody et al., 2004; Lium, Tjora & Fauxvaug, 2008 ; Robertson et al., 2010; De Veer, Francke, 2010
Parallel use of paper and EPR	Moody et al., 2004; Furukawa, Ragu & Shao, 2010;
Not enough (working) hardware/resources, lack of mobile devices	Moody et al., 2004; Furukawa, Robertson et al., 2010; Ragu and Shao, 2010; Kossman, 2006; Lium, Tjora, Fauxvaug, 2008; Holden, 2011; Yu et al., 2013
Speed of implementation	Overtveit et al., 2007a,b; Silow-Carroll, Edwards & Rodin, 2012;
Previous unsuccessful implementations	Ovretveit et al., 2007a,b
Lack of feedback opportunities	Ovretveit et al., 2007b
Poor leadership	Williams & Boren 2008
Organisational culture	Thakkar et al., 2006
Lack of space to use computers	Moody et al., 2004; Furukawa, Raghu & Shao 2010; Yu et al., 2013
Return of investment, cost of system and implementation, financial disagreements	Thakkar et al., 2006; Ovretveit et al., 2007a,b; Evans & Stemple, 2008; Williams & Boren, 2008; Silow-Carroll, Edwards & Rodin, 2012
Delays, contract tensions, uncertainty of programs future, engagement of staff affected by policy issues, top down approach, lack of common vision	Waterson, Glenn & Eason, 2011; Robertson et al, 2010; Sheikh et al., 2011

UK literature is limited and consists of three qualitative studies; Robertson et al., 2010; Waterson, Glenn and Eason, 2011; Takian, Sheikh & Barber 2012. The study designs and individual limitations of these studies have been previously described in section 1.2.2. As these studies explored implementation of EPRs during NPfIT a number of the barriers they identified were a result of and largely applicable to that policy; contract issues, delays to delivering systems, top-down approach to implementation, policy management and uncertainty over the future and vision of NPfIT (Robertson et al., 2010; Waterson, Glenn & Eason, 2011). However barriers that were more generalisable to current implementations within the NHS were reported and were predominately technical (e.g. system downtimes, limited functionality, usability issues) and social (e.g. change management, training computer literacy).

1.2.3. What are the disadvantages of implementing EPRs?

Compared with the attention given to exploring and promoting the benefits of EPRs within the literature and NHS policy respectively, little research has reported on the disadvantages of implementing EPRs. This is surprising given that introducing EPRs requires organisation-

wide change and clinicians to alter their practice and so some disadvantages or negative outcomes would be expected and potentially considered inevitable, even if only on a short term basis. Here, disadvantages are considered to be any adverse consequences that have directly resulted from the implementation of EPRs and comprised any negative effects on clinical practice, patient safety, staff time or costs.

Literature that has determined negative effects of implementing electronic records was once again mainly U.S based (Nowinski et al., 2007; Furukawa, Raghu & Shao, 2010; Holden, 2011; Mathison & Chamberlain, 2011; Kennebeck et al., 2012; Lee et al., 2013; Menon et al., 2014), with little evidence from elsewhere. A small number of studies from outside the U.S included: UK (Morrison et al., 2008; Meeks et al., 2014), South Korea (Kossman, 2006), China (Chao et al., 2013) and Australia (Yu et al., 2013).

Of this literature, the main disadvantages related to systems adding time and creating extra work for clinicians by increasing: time spent recording patient information (Holden, 2011; Yu et al., 2013), administrative burden, clinic hours (Mathison & Chamberlain, 2011) and the perceived increased complexity of some tasks, e.g. ordering medications and retrieving documents (Kossman, 2006; Holden, 2011). Switching between different computers and electronic departmental systems, difficulties navigating and retrieving information and EPR system down times were also reported to reduce efficiency and create added time pressures for staff (Kossman, 2006; Holden, 2011; Chao et al., 2013). EPRs were also deemed to have reduced the amount of time that staff are able to spend with patients due to the aforementioned added time pressures and perceptions that EPRs were physically taking staff away from the bedside (Kossman, 2006; Holden, 2011). Lastly, Mathison & Chamberlain (2011) reported negative effects of an EPR on patient flow within an Emergency Department, where an EPR was reported to have increased the time it takes for patients to see clinicians, on days with high volumes of patients.

Additionally, Menon et al., (2014) reported that EPRs increased risks to patient safety, with these risks attributed to a range of factors including incomplete or unavailable information and system downtimes. EPRs were also found to have detrimental effects on quality of care (Kossman, 2006; Nowinski et al., 2007; Kennebeck et al., 2012; Lee et al., 2013) such as increased length of stay (Kennebeck et al., 2012), re-hospitalisation (Lee et al., 2013) and time-to-doctor (Kennebeck et al., 2012). EPRs were also associated with high implementation and maintenance costs (Chao et al., 2013) and were reported to have negatively affected

staff communication (Kossman, 2006) and interaction during ward rounds (Morison et al., 2008).

Due to the limited number of UK studies that have explored the potential disadvantages of implementing EPRs, literature that was considered to be most representative of the various disadvantages reported and which used a range of study designs is discussed alongside the UK evidence:

Kennebeck et al., (2012) aimed to quantify the effect of EPR implementation on patient flow metrics (length of stay, time to medical provider) and provider productivity (number of patients and clinical hours worked) during and after implementation of an EPR into an Emergency Department (ED) at a single U.S hospital. To alleviate potential disruption an 'overflow clinic for low risk patients' and increased Doctor and Nurse staffing levels were introduced for two weeks after the system was implemented. Despite these measures, patient metrics were negatively affected during the EPRs implementation, with time to physician, the number of patients leaving the ED untreated and length of stay all increasing, while physician efficiency (patients seen per hour) decreased. However, the 'metrics' used to determine the impact of an EPR on an ED department and its productivity in this study were relatively crude estimates such as 'clinic hours worked' and 'time to medical provider', which could have been affected by a range of other factors aside from the EHR such as the complexity of presenting patients conditions and the number of Junior or new staff members at any given time. What is more, although the usefulness of the overflow clinic was questioned by the authors, as it was stated that the clinic was not used appropriately during the systems implementation, the impact of the clinic and having increased staff on the study's findings is unclear and it could be argued that the negative effects determined here could have been conservative and may therefore be seen to greater extents in other implementations if these precautionary measures are not in place. The authors also claim that because no other interventions were taking place apart from the EHR that the negative effects reported are directly attributable to the EHR's implementation, however the lack of statistical adjustment for potential confounding factors and the observational design of the study mean that causality cannot be definitively determined in this study.

Over the last decade, a body of evidence has emerged stating that HIT can have a negative impact upon patient safety. This literature is predominately U.S based and focusses on the effects of HIT generally (Perry et al., 2005; Weiner et al., 2007; Magrabi et al., 2011; Sittig

and Singh, 2011) or of individual systems such as Computerised Physician Order Entry, clinical decision support and Picture Archiving and Communication Systems (Koppel et al., 2005; Hannuscak et al., 2009; Harrington, Kennerly & Johnson, 2011; Wetterneck et al., 2011; Magrabi et al., 2011) rather than EPRs (Ash, Berg & Coiera, 2004; Menon, et al, 2015). In light of these concerns and the perceived methodological and conceptual gaps in defining and measuring HIT safety, Singh and Sittig proposed the HIT-related patient safety framework (Singh & Sittig, 2015). However, the heterogeneous nature of EPR implementations in terms of the progress made by healthcare organisations and the systems being implemented has led to EPR specific patient safety concerns. Sittig and Singh (2012) have also therefore proposed a framework for the development of EHR specific patient safety goals. Both frameworks suggest a 3-phase approach for measuring and monitoring patient safety concerns, which categorises concerns as those which are specific to technology (e.g. technology is unsafe, malfunctioning or unavailable) or which result from incorrect use of technology. In its final phase, the framework considers the use of technology to monitor risks, health care processes and outcomes and for identifying concerns before a patient is harmed. The necessity of this framework given the literature that has emerged which suggests that HIT and EPRs may pose a risk to patient safety would seem beneficial, as the framework if used should help to bring attention to the potential risks that these systems may bring. However, the current utility of the frameworks' third phase particularly in the UK, where systems are potentially not at the level of maturity required to enable risks to be monitored and harms anticipated is debatable.

Despite the potential risks of implementing HIT to patient safety being well documented within the U.S, UK literature is only just starting to emerge (Meeks et al., 2014; Magrabi et al., 2015). Furthermore, only one study could be identified which specifically focussed on the impact of EPRs on patient safety within the NHS (Meeks et al., 2014):

Meeks et al., (2014) examined the applicability of two conceptual models (Sittig & Singh 2010; 2011) to understand the safety implications of implementing EPRs into the NHS. The conceptual models studied preceded those which have been previously described (Sittig & Singh 2013; 2015) and were adapted from four previous models (Henriksen, Kaye & Morisseay, 1993; Vincent et al., 1998; Carayon et al., 2006; Harrison, Koppel & Bar-lev, 2007) to create an 8 dimensional sociotechnical model for studying safety and effectiveness of HIT throughout its design, development, implementation, use and evaluation. The 8 dimensions represent independent domains of an EPR-enabled healthcare system: hardware and software; clinical context; human-computer interface; people; workflow and communication;

internal organisation policies; procedures and culture; external rules and regulations; system measurement and monitoring. In recognition of the models inability to describe the intersection between EPRs and patient safety, the previously described three-phase model proposed by Sitting & Singh (2012) was also used by Meeks et al., (2014). In addition to testing the applicability of the two models, Meeks et al., (2014) also used the models to organise and interpret EPR-related patient safety concerns that emerged during the interviews that were part of the previously described longitudinal, sociotechnical evaluation of implementation and adoption of EPRs into the NHS (Robertson et al., 2010; Sheikh et al., 2011). After initially indexing patient safety concerns using the 8 dimensions of Sitting & Singh's (2010; 2011) model, interview data were arranged and presented according to the three-phases of patient safety related EPR concerns (Sittig & Singh 2012). Phase one patient safety concerns identified were specific to technology and included: insufficient back up procedures, problems with EPR availability, lack of basic functionality, undeveloped or non-standardised clinical content, data security and confidentiality concerns and perceptions that the user interface was error prone. Phase two concerns were those that related to the unsafe use of technology or changes in workflow such as: problems accessing clinical information, parallel use of paper and EPR, order entry issues and poor training leading to improper EPR use. However, only one of the 49 interviewees reporting patient safety concerns addressed the phase 3 use of the EPR to monitor and identify safety concerns before a patient is harmed. The range of patient safety concerns that were identified by Meeks et al (2014), provides a detailed understanding of the ways in which EPRs can put patient safety at risk, however the use of qualitative methods means that the extent and impact of these risks are unknown. Furthermore, interviewees were not directly asked to relate any patient safety concerns during interviews, which may mean that the full range of concerns were not identified. However, the fact that 49 participants spontaneously raised patient safety concerns, suggests that this is an issue which warrants further investigation.

Literature reporting disadvantages of EPRs has started to emerge over the last five years, however this evidence is predominately U.S based and qualitative, with the impact of these issues on NHS hospitals unclear. Additionally, there are comparatively fewer studies exploring disadvantages than benefits (appendices 1 and 3), with the evidence reporting disadvantages less frequently cited, despite concerns to patient safety being reported. This suggests a potential reporting bias towards benefits, reflected by the singularly positive depiction of these systems within UK policy. Whilst there may be benefits to these systems, the suggestion that these systems may not necessarily bring time savings to the extent that

was expected and may result in new and added risks to patient safety, warrants greater investigation and acknowledgement within academic literature and NHS IT policy.

1.2.4. Summary:

The majority of literature which has explored the benefits, barriers and disadvantages of implementing EPRs, within the NHS and elsewhere has used surveys or qualitative methods. The limited quantitative and high quality evidence in this area is surprising given the investment into these systems and their use in clinical practice. Existing literature has largely focussed on implementations within acute settings and has captured the perspectives of single stakeholders with the focus being on clinicians. These systems are however being implemented into all health and social care settings, with implementation influenced by and affecting not only frontline staff but policymakers and IT managers. Research which explores the perspectives of all stakeholder groups and which investigates implementation into various healthcare settings is therefore needed.

The UK literature is limited further, with the majority of studies being based on data from a single, multisite, qualitative sociotechnical case study that explored the effects of early EPR implementation during NPfIT. Although these studies provide a UK evidence base, which is theoretically underpinned and which explores the perspectives of multiple stakeholders at a number of NHS sites, additional UK evidence is needed, particularly considering the different policy context that EPRs are now being implemented under with the NHS aiming to be paperless by 2020. Furthermore, existing UK evidence did not explicitly aim to explore the benefits or patient safety concerns associated with implementing EPRs and so the full extent of these issues may not be represented. In light of recent evidence reporting that EPRs may bring risks to patient safety, UK evidence which explores these concerns further and which aims to quantify the impact and level of these risks is important. If hospitals and policymakers are to justify the investment being made into these systems, literature that identifies and provides evidence for actual, experienced and quantifiable benefits such as efficiency, quality and safety is essential.

1.3. Rationale and aims:

HIT is being introduced into healthcare organisations around the world and is considered to have the potential to improve health and yield various quality and safety benefits whilst reducing costs and promoting patient's involvement with their care (Blumenthal, 2010). In the UK, with concerns that the NHS is no longer sustainable in its current form, ways to

streamline health services and make the NHS more efficient have been proposed, with EPRs seen as one mechanism by which the NHS can achieve this. For example, NHS IT policy claims that EPRs have the potential to ‘improve health and transform the quality and cost of health and care services’ (DoH, 2014).

The policy and financial pressure on NHS hospitals to implement EPRs (NHS England, 2013; DoH, 2014), implies there is a strong evidence base supporting the notion that these systems can improve health outcomes and the quality of care. In reality the literature surrounding EPRs is mainly U.S based and so its relevance to the UK is uncertain. The literature review (section 1.2) identified a number of additional gaps in EPR research that need to be addressed. Firstly, the literature has identified only a limited number of benefits of implementing EPRs that have been ‘realised’, which largely relate to improved accessibility and availability of patient information; something which may not be considered a formal benefit by those responsible for implementing these systems (e.g. policymakers and NHS trust managers) (section 1.2). Evidence exploring objective advantages of EPRs (e.g. patient safety, efficiency and quality of care) is limited, with these often cited as benefits that are expected in the future once EPRs have been ‘fully’ implemented. UK evidence highlighting the benefits of these systems is therefore required. If trusts and policymakers are to show a return of investment and justify their political and financial commitment to implementing EPRs.

Secondly, literature showing disadvantages or negative outcomes of implementing EPRs on efficiency and patient safety has started to emerge. However, this literature is sparse, poorly cited and again largely US based. Given that the literature and national NHS IT policy focus on reporting and evidencing the benefits of these systems, research that explores any potential disadvantages of these systems is needed.

Although the benefits of implementing EPRs are clear in theory, introducing these systems into healthcare organisations has proven difficult, particularly within the UK; where the goal of ‘electronic records for all’ was first proposed in 1998 by the NHS IT strategy Information for Health (NHS Executive, 1998). Despite the vast financial implications of failing to implement these systems, highlighted by total UK investment into NHS IT estimated at £10 billion since 2002 (NHS England, 2013; National Audit Office, 2013), no UK research has explored the approaches to implementing EPRs and currently no best route to implementing EPRs exists (NHS England, 2013). Furthermore, although the National Institute for Clinical Excellence

(NICE) provides extensive guidance for a range of electronic devices (e.g. catheters, computerised cognitive behavioural therapy) and has sections dedicated to the appraisal of medical technologies, no guidance for hospitals implementing EPRs has been issued by the organisation. This is surprising considering these systems are being implemented not only to replace paper but to assist clinical decision making and support a range of clinical processes (e.g. prescribing). Additionally unlike other health technologies, where the consequences of technical issues such as system downtimes or inaccuracies would impact on patient or speciality, technical faults or issues resulting from the misuse of EPRs have the potential to effect entire health organisations and healthcare communities. For example, if an EPR were to 'crash' patient information would potentially be unavailable to an entire hospital. It is unlikely that a 'gold standard' for implementing EPRs that would be appropriate to all NHS trusts will be established due to the varying socio-political contexts into which these systems are being applied. However, research that explores the different approaches to implementation is needed, to ensure NHS trusts are making informed decisions and basing their EPR strategies on UK evidence.

Rather than producing formulae for successful implementation, which as previously described may not be possible or useful due to the heterogeneity of EPR implementation; this thesis will explore the implementation of EPRs into NHS secondary care organisations, with a specific focus on benefits, barriers and disadvantages to implementation. In light of the lack of universally accepted definition of an EPR (section 1.1) how the term EPR is interpreted and identified by different stakeholders is also explored throughout the thesis. These aims are addressed through a policy analysis (chapters 2-3); a mixed methods study which is comprised of a national survey and qualitative interviews (chapters 4-5) and a qualitative interview study (chapters 6-7). The aims of the thesis are outlined below:

- Explore what progress has been made in implementing EPRs into NHS secondary care organisations between 1998 and 2015, according to national NHS IT policy and evaluations of national policy (policy analysis, chapters 2-3).
- Describe the current status of EPR systems and the different approaches to implementation adopted by NHS acute, mental health and community care trusts in England. Additionally explore the benefits and challenges associated with implementation (mixed methods study, chapters 4-5).
- Explore the benefits, barriers and disadvantages of implementing a maternity information system into a single maternity unit and assess the extent that the system

has been embedded or 'normalised' into routine practice (qualitative interview study, chapters, 6-7).

- Explore how EPRs are defined (chapters 3, 5 and 8).

1.4. Theoretical underpinnings

1.4.1. Methodology: Pragmatism and health services research

This thesis constitutes health services research (HSR), as it aims to provide feedback to an acute trust implementing an EPR, with the aim that this information will facilitate and inform the hospitals EPR roll-out which is scheduled to take place in 2016. The focus here is therefore not to solely reflect the interests of academics (Stryer et al., 2000), but to also identify areas in which research is most likely to improve service delivery and an organisation (Lomas et al., 2003).

The authors' philosophical position and that of the thesis, is underpinned by pragmatism. Research methods were therefore selected based upon whether they were the best means to answer the research questions and so were not constrained to methods which sit within a specific philosophical or epistemological position (Seale, 1999). It has been suggested that a researcher's ability to select and use the most appropriate research methods for their suggested research questions may be undermined by those who have purist beliefs of a methods epistemological origins (Ritchie and Lewis, 2003). For instance, positivists are more likely to select quantitative methods as these approaches correspond with their empirically based beliefs. It has also been stated that a healthier relationship should be established between philosophy and pragmatism, (Bryman, 1988; Silverman, 1993), with quantitative and qualitative methods viewed to be part of a research toolkit which can be used in different research contexts to address different questions (Ritchie and Lewis, 2003). This thesis despite predominately using qualitative research methods where appropriate has also used quantitative methods to gain a greater understanding of the research question (chapter 4-5). Rather than justify and describe the methods used within the thesis here, they are discussed within the chapters to which they apply.

1.4.2. The socio-technical approach

“If healthcare is to evolve at a pace that will meet the needs of society it will need to embrace this science of socio-technical design, but ultimately it is our culture’s beliefs and values that shape what we will create and what we dream (Coiera, 2004)”.

The socio-technical approach originated during the 1940s in the British coal mining industry, when research which sought to evaluate why miners’ productivity had not increased in line with the industry’s mechanisation, proposed that for productivity to increase, the technical aspects and social needs and working conditions of miners needed consideration (Trist, 1981; Fox & William, 1995). The approach was later incorporated into the ETHICS (Effective Technical and Human Implementation of Computer Based Systems) methodology which assisted the technical and organisational redesign of a range of new systems within banks, hospitals and the British Navy (Mumford, 1991). Since it was first proposed for use within the NHS in 1991, during the resource management initiative (RMI) which encouraged hospitals to develop organisation wide computer systems (Wainwright & Waring, 2000), the approach has been used extensively in studies exploring EHR and EPR implementation (Berg., 1998; Aarts, Doorewaard & Berg, 2004; Greenhalgh et al., 2010; Robertson et al., 2010; Sheikh et al., 2011; Takian, Sheikh & Barber, 2012; Greenhalgh, Stones & Swinglehurst, 2013).

The NHS is a complex adaptive system built upon numerous social networks and relationships that are often faced with change, developments in government policy and new interventions or technologies. The fact that healthcare systems are so dependent upon these ‘complex human organisational structures’ has made them ideal for socio-technical analysis (Berg, 2004). What is more, technology is now seen as vital in the creation of a sustainable, efficient health service that can cope with the demands of an ageing population and financial constraints. However, every IT intervention appears to cause an unanticipated consequence, which worryingly can include errors or incidents that negatively impact upon patient care (Ash, Berg & Coiera, 2004). The discrepancy between the potential of EPRs and documented reality has left many researchers, policymakers and health care professionals asking, *‘why are people not embracing the technology and why has it not been delivered more convincingly on the anticipated returns of investment?’* (Avgar, Litwin & Pronovost, 2012). The failure of these systems to live up to expectations has been attributed to the emphasis on technological factors and absence of conceptual and methodological attention on the human/social factors (Avgar, Litwin & Pronovost, 2012); with academic literature also receiving criticism for being too technologically focused (De Lusignan & Aarts, 2008), reflected in the number of technical barriers to implementing and using EPRs cited within the

literature (section 1.2.2.). In recognition of the fact that IT implementations rarely fail as a result of technical issues alone, socio-technical thinking aims to give equal weight to social and technical issues (Coiera, 2004) and aims to understand how human and social influences affect the performance of technical systems (Bostrom & Heinen 1977).

Berg's (1999) paper has been used to provide a more in-depth explanation of how the socio-technical approach can be applied to the introduction of EPRs in healthcare:

'Healthcare practices are seen as heterogeneous networks'

The socio-technical approach considers work practices to be made up of a number of interrelating networks, which are dependent on one another (Berg, 1999). For instance, if one element of these networks (e.g. a referral form) is taken away, then that work practice can no longer be carried out as normal (Berg, 1996). The elements that constitute these networks are not viewed as isolated objects but rather 'things' that attain characteristics, roles and tasks that are specific to being a part of that network (Latour 1987 in Berg, 1999). Conversely, if something new is introduced, the implications of this have repercussions for all within that practice. For example, if a new EPR system is implemented, the impact of this is felt throughout an entire healthcare organisation. Socio-technical thinking also proposes that the implications of having introduced EPRs are not pre-determined as they are dependent upon the specific nature and socio-political context of the network they are introduced within (Berg et al; 1999). For example, introducing an EPR into one hospital would have different ramifications and would present different benefits or issues if the same EPR system was implemented into another hospital. As although all NHS trusts hire the same professional groups (consultants, junior doctors, nurses, healthcare assistants) each nurse and doctor irrespective of their job title performs their role differently and works for trusts of different sizes and financial situations. The approach therefore provides insight into why well-intentioned system designs are sometimes rejected by users or why implementations are unsuccessful (Coiera, 2006) and can be used to explore why an implementation strategy may work in one organisation but fail in another (De Lusignan & Aarts, 2008). The approach therefore does not aim to identify a list of universal factors that need to be considered and 'dealt with' when implementing EPRs. As the approach believes that the factors that emerge are dependent on the specific network that the technology is being introduced into (Berg, 1999).

In accordance with this, the thesis does not aim to be prescriptive and produce a list of benefits, barriers and challenges that will affect all NHS organisations that are implementing EPRs. Instead, the variation between NHS organisations is acknowledged and the thesis aims to reflect the experiences of NHS trusts and NHS policy to date of implementing EPRs and recognises that the benefits, or factors identified within the empirical chapters that are believed to have resulted from or influenced EPR implementation, will be experienced to varying extents by different NHS organisations, policymakers and staff.

'The nature of health care work'

Socio-technical thinking also challenges the view that work is a series of 'discrete tasks for individuals' and instead highlights the importance of considering 'cooperative work processes' (Berg, 1999). The approach rejects the idea that collaboration involves individuals using an EPR system independently for solitary tasks that are completed before the next user (Luff, Heath & Greatbatch., 1992) and also disputes the idea that work practices can be captured within formal models such as pre-determined work flows or clinical pathways (Gerson & Star, 1986; Suchman, 1987). Whilst these models can be useful, Berg (1999) argues that they are only 'highly incomplete, summarised and rigid depictions of work practices', which illustrate the 'messiness' of work practices and suggest that 'structure' and 'rationality' are required to eradicate variability in practice. This is particularly relevant to healthcare which is considered to have adopted a 'more is better' approach when it comes to imposing structure, policies and protocols upon practice (Berg, 1999). However, the usefulness and impact of imposing so much pre-determined structure on practice has been questioned (Berg, 1999), in light of increasing evidence that too much structure can obstruct work and add to the burden on healthcare professionals (Symon, Long & Ellis 1996; Berg & Goorman, 1999).

'Empirical orientation, with emphasis on qualitative methods'

Socio-technical thinking also argues that to evaluate EPR implementations in-depth empirical studies that explore the work practices into which the technology is being introduced are needed. Studies that aim for universality and generalisability are therefore not considered suitable (Berg, 1999), as they are believed to result in 'one size fits all solutions' or stifling, rigid frameworks (Hanseth, Monteiro & Hatling, 1992); which would not account for the variation between NHS hospitals. The approach suggests that research should involve users and should utilise qualitative research methods, to enable the broad socio-cultural and political implications associated with introducing EPR into healthcare organisations to be explored (Berg, 1999). Whilst, Berg (1999) recommends that participant observation should

be used during socio-technical evaluations to capture the interrelations between healthcare professionals and technology, this method is not always feasible or appropriate for all research questions. Furthermore, others have suggested that to gain an understanding of the complex change that occurs during the introduction of technology, evaluations should be explored quantitatively and qualitatively (Greenhalgh et al., 2010).

This thesis has predominately used qualitative interviews but where appropriate other methods such as a national survey (chapters 4-5) and document analysis (chapters 2-3) have also been adopted. Whilst socio-technical thinking's endorsement of qualitative methods was a factor contributing to the selection of these methods, the research question, feasibility and skills of the researcher were also influential. Justifications for the methods used within this thesis are provided within each of the three empirical studies methods chapters (chapters, 2,4 and 6).

As previously mentioned, socio-technical thinking and HSR advocate the involvement of a range of stakeholders in the research process to ensure research reflects the needs of those most closely related to service delivery (Berg et al., 1999; Vella et al., 2000). In accordance with this a number of key informants have been consulted throughout this PhD and have helped to ensure that the thesis not only addresses gaps in the literature but answers questions of direct importance to those involved in EPR implementation. The key informants which comprised two Chief Information Officers (CIOs), an employee of an EPR solutions provider and representatives from NHS England and the Health and Social Care Information Centre (HSCIC) have been involved at different stages of the thesis and have informed the development of research questions, the design of empirical chapters (chapters 4-7) and the creation of definitions for key terminology used within chapter 4. More specific details of the involvement of key informants are discussed in relevant chapters.

This thesis aimed to provide feedback to an acute NHS foundation trust that originally planned to replace paper records and introduce an EPR by 2016. Regular meetings were held with the trusts Chief Information Officer (CIO) and members of the hospitals EPR benefits and implementation team throughout all stages of this PhD, to ensure that the studies within not only addressed gaps in the literature but provided useful and usable information for the trust throughout its EPR implementation. The trust's CIO also became a key informant for chapters 4 and 5, facilitating the design of interview and survey content. Additionally, following delays to the trust's EPR project which meant that a study aiming to

evaluate the implementation of an EPR into general surgery at the trust could not be undertaken, the CIO alerted me to the opportunity to evaluate the implementation of a maternity information system (chapters 6-7), with this system and the study's findings to provide feedback ahead of the trusts hospital wide EPR roll out; which is now scheduled to commence in 2016.

1.4.3. Applying socio-technical thinking to the thesis

The main inspiration for using socio-technical thinking to underpin this thesis came from Greenhalgh et al's (2010) paper which explored the adoption and non-adoption of shared electronic summary care records in England. Greenhalgh et al., (2010) suggested that technology should be studied at the macro, meso and micro levels (Trist, 1978) and subsequently used these levels of influence to identify a range of benefits and barriers to adopting summary care records in the NHS. Greenhalgh et al., (2010) proposed the following definitions for each of the interrelated levels:

Macro level influences are national and regional policies and priorities and wider social norms such as the economic climate, technological developments and professional norms and standards.

Meso level influences refer to organisational processes and routines such as job descriptions, training, IT systems and in-house knowledge.

Micro level influences include particular experiences of patients and professionals. For example peoples identities, roles and skills.

The use of socio-technical thinking and consideration of the macro, meso and micro influences on EPR implementation in this thesis is undertaken in two ways. Firstly, the three studies which aim to explore the implementation of EPRs into NHS secondary care organisations, represent the three levels of socio-technical thinking. As implementation is explored from the macro level through a policy analysis of national NHS IT policy documents (chapters 2-3), the meso or organisational level by surveying and interviewing those responsible for implementing EPRs into NHS acute, mental health and social care organisations (chapters 4-5) and the micro level by exploring NHS staff's perceptions and experiences of a maternity information system's implementation (chapters 6-7). Secondly, it is anticipated that each study will identify various influences to implementation, which will be mapped and discussed within each of the thesis' empirical chapters according to the macro,

meso and micro levels. The general discussion chapter (chapter 8), will then bring together the various macro, meso and micro influences that have been identified throughout the thesis. However, as previously discussed the implications of implementing technology cannot be pre-determined as they are dependent on the specific socio-political context into which they are being introduced (Berg, et al., 1999). The aim here is therefore not to produce formulae for successful implementation, which would not be possible or useful due to the heterogeneity of EPR implementation. Instead, the thesis aims to reflect the experiences of NHS organisations and national NHS policy in implementing these systems to provide insight into some of the issues and benefits currently being experienced; which may or may not be experienced by other NHS organisations. However, it is believed that by evaluating implementation from the three levels of influence using quantitative and qualitative methods, an in-depth and contextualised picture of EPR implementation and the complex change that ensues will be ascertained.

1.4.4. Other theories relevant to the thesis

In addition to socio-technical thinking it is important to acknowledge other key theories that are often used in studies of information technology and health care, such as 'the technology acceptance model' (Davis, 1989 & Davis et al., 1989) and diffusion of innovations (Rogers, 2003). Whilst these theories were explored during the earlier thinking behind this thesis, their focus on adoption and usage of technology means they are not as relevant to this thesis. Actor-Network Theory has also been advocated for studies seeking to evaluate complex IT systems in healthcare organisations and is a theory that draws on the socio-technical perspective (Cresswell, Worth & Sheikh, 2010). However the theory aims to explore how the introduction of technology affects power and social relationships (Cresswell, Worth & Sheikh, 2010) within a healthcare setting and so was not considered appropriate for use here.

Although it does not underpin the thesis as a whole, Normalisation Process Theory (NPT) is drawn upon in chapters 6 and 7. The theory is widely used in studies evaluating the implementation of technology in healthcare to understand the factors that promote and inhibit a technology from being embedded into practice (Mair et al., 2008). Additionally, the theory gives insight into the micro (individual) perspective of implementation by exploring how people make sense of a practice, participate in it and evaluate what they do (May et al., 2011). The theory was therefore considered a useful way of exploring the benefits, barriers and disadvantages of implementing a maternity information system from the perspective of

healthcare professionals, whilst also facilitating the thesis' exploration of EPR implementation at the micro (individual) level. Further details of NPT and how it has been used in the design and interpretation of the study's findings is discussed in chapters 6 and 7.

1.5. Chapter Outline:

This thesis consists of 7 additional chapters which aim to address the previously described research questions. For each of the empirical studies, socio-technical thinking is applied during the results and/or discussion chapters to identify the macro, meso and micro levels of influence on EPR implementation:

Chapters 2 introduces a policy analysis which explores from the macro (national policy) perspective what progress has been made in implementing EPR s into NHS secondary care organisations between 1998 and 2015. The methodology for the study is described here and explains how national NHS IT policy documents and evaluations of national policy were selected, identified and analysed. The results and discussion for the study are presented in **chapter 3**, where the results are discussed alongside existing literature and current NHS IT policy.

A mixed methods study comprising a national survey and semi-structured interviews exploring the status of EPR implementation and the benefits and barriers associated with implementing EPRs within secondary care organisations is presented in **chapter 4**. This study largely explores meso level influences to EPR implementation. Survey data quantifies trust level progress whilst interviews capture the perspectives of those responsible for introducing EPRs. The results and discussion for this study are then presented in **chapter 5**.

A qualitative interview study which explores NHS staff's perceptions and experiences of the benefits, barriers and disadvantages to implementing a maternity information system is presented in **chapter 6**. Normalisation Process Theory (NPT) informed the interview schedule and also provided a framework for structuring and enabling greater interpretation of the study's findings, which are presented in **chapter 7**.

The findings for the thesis are collated in **chapter 8** which considers the key findings before considering the challenges, recommendations, impact and strengths and limitations of the thesis as a whole, these issues are also discussed separately within each of the thesis' empirical chapters (chapters 3,5 and 7).

Chapter 2. An exploration of national NHS IT policy between 1998 and 2015: methods and analytic plan

The chapter presents the rationale and methodology for a policy analysis which has explored national NHS IT policy documents and evaluations of national policy to establish what progress has been made in implementing EPRs into secondary care organisations between 1998 and 2015. Policy prior to 1998 was not included in the analysis due to these documents not being available or accessible online (see section 2.4). In light of the lack of understanding as to what functionality, systems and usage are considered to be an EPR (chapter 1), how policy documents define these systems is also explored. The chapter begins by outlining the rationale and research questions for the study. Contextual background is then provided and describes the history of NHS IT and key policy between 1968, when computers were first introduced into the NHS and 1992, when the Information for Health policy was published. The methods section follows and begins with an overview of policy analysis where challenges of using this method are also considered. The study design and strategies for searching, accessing and selecting documents for inclusion in the study are then outlined. The chapter concludes with the analytic plan, which describes how documents were analysed thematically.

For the purpose of this study national NHS IT policy refers to documents published by NHS England or the Department of Health (DoH) which outline the aims of and provide guidance for NHS IT in general. For example, ‘Safer hospitals, Safer Wards: achieving an Integrated Digital Care Record (NHS England, 2013). Here, evaluations of national policy refer to documents which were commissioned by the government or DoH to report on the progress of national policy in achieving its aims. More specific inclusion and exclusion criteria for documents in the study are provided in section 2.4.1.

2.1. Rational and research questions

Current national NHS IT policy proposes that digitising the NHS, can improve patients’ health and quality of life whilst reducing the cost of healthcare services (DoH, 2014). However, previous national NHS IT projects have often been viewed with skepticism and have been portrayed negatively by the media. For instance, an article by the Financial Times, quoted a UK parliamentary watchdog to have described the National Programme

for IT in the NHS (NPfIT) as “*one of the worst and most expensive contracting fiascos in the history of the public sector*” (Mance, 2013). The limited success of IT projects is however not an issue exclusive to the NHS, as there are numerous examples of other IT project failures throughout both the public and private sectors. For instance, the e-borders system, Air Traffic Control, the Department of Social Security and the Department of Work and Pensions Child Support Agency all experienced failures; despite investments of approximately £224million, £1 billion, £300 million and £450 million respectively (Kreps & Richardson 2007; Ball & Pegg, 2014).

Although these high profile failures have often resulted in huge financial wastage (Kreps & Richardson, 2007; Flyvbjerg & Budzier, 2011) a culture remains among policymakers that ‘things will be better next time’ (Greenhalgh, et al., 2011). What is more, despite the public nature of these failures and the current policy pressure on NHS Hospitals to implement EPRs (DoH, 2014), to the authors knowledge no literature has aimed to evaluate previous National NHS IT policy over time to explore the reasons behind the limited progress in implementing these systems thus far. Instead, existing evidence has been limited to evaluations of a single policy, ‘NPfIT’ (Hendy et al., 2005, Hendy et al., 2007, Greenhalgh, 2011, Kreps & Richardson, 2007); presumably because of the large costs and negative media attention (Mance, 2013, Syal, 2013, Mathieson, 2011) associated with this policy.

In light of the perceived evidence gap, this study aims to explore whether progress has been made by national NHS IT policy in implementing EPRs into NHS secondary care organisations. By exploring progress over time it is anticipated that insights into whether lessons have been learned can be ascertained, which may prove useful for subsequent policy, which tends to be informed by evaluations of previous policies and so may not look at progress over time. Here, progress will be determined by identifying successes and failures as described within evaluations of NHS IT policy and by looking at what NHS IT policy has aimed to achieve; as if aims have remained the same since 1998 this suggests that limited progress has been made. Additionally, due to there being no universally accepted definition of EPRs (chapter 1), how these systems are defined within NHS IT policy documents is also explored. The study’s research questions are outlined below:

Primary research question:

How has NHS IT policy addressed the implementation of EPRs into NHS secondary care organisations between 1998 and 2015?

Secondary research questions:

- How do national NHS IT policy documents define EPRs and have these definitions changed over time?
- What have been the aims of NHS national IT policy documents and is there evidence that these aims have been recurring since 1998?
- What evidence is provided by evaluations of national NHS IT policy that shows signs of progress being made in implementing EPRs between 1998 and 2015?
- Do National NHS IT policy documents show evidence of adopting the recommendations or conclusions provided in evaluations of national policy?

2.2. Background

Although policy prior to 1998 has not been explored due to the required documents being unavailable online (section 2.4), an overview of key initiatives and NHS IT policy between 1968 (when computers were first introduced into the NHS) and 1992 is provided. This section does not aim to be critical of, or analyse the policies and initiatives it presents, but instead aims to give the reader an understanding of the key contextual information and progress made by policies which pre-date those included in the main analysis; whilst also presenting some of the successes and failures of the period according to academic literature. The information presented in this section was informed predominately by two key pieces of literature (Richards, 2001; Wainwright & Waring, 2000) and an unpublished MSc thesis, written by one of the thesis' key informants (CIO at an acute NHS hospital) (chapter 1, section 1.5)., which to maintain anonymity will be referenced as (unpublished MSc thesis, 2003).

The first major IT policy, known as the NHS Experimental Computer program, was launched in 1968 as part of the then Prime Minister Harold Wilson's White Heat of Technology initiative (Richards, 2001). The program which resulted in the first widespread use of IT within the NHS, (Richards, 2001) aimed to explore whether computers could improve patient care, improve clinical and administrative efficiency and aid management and research (Hayes et al., 2009). The program has been praised for its forward thinking nature with it stated that had the findings of the program been more amenable to evaluation, NHS IT policies may have been different (Hayes et al., 2009). However, the program was criticised as implementation took longer than expected (Hayes et al., 2009)

with the projects' failures being attributed to; uncertainty around the role of computer's within the health service, a lack of uniformity in the technology and a lack of common computing language combining scientific and commercial interests (Richards, 2001).

Subsequently, in 1969, a patient medical record at Kings College Hospital was established, which is now viewed as the forerunner to EPRs. The system was primarily used to give instructions for individual patient care and was the first computer to be used at ward level and by Nurses. Its introduction was unpopular as the majority of clinicians viewed computers as an intrusion to clinical practice. Despite this, 1969-1971 saw a wider use of IT in healthcare with computers installed in hospital laboratories and the creation of the first databases e.g. the world's first mother and baby database which recorded 5,000 annual births in a hospital in Manchester was created (Richards, 2001).

Another predecessor of the EPR was created in 1980 when the Körner steering group was formed, the aim of which was to agree the minimum electronic data set for every in-patient admission. This system was not considered an EPR as the system was mainly administrative and was not universally accepted (Richards, 2001). The Körner Report (1982) followed and called for staff to provide information pertaining to the cost of procedures within their specialty to aid decision making, whilst providing evaluations in budgeting, monitoring, control and performance at managerial level. Concurrently to the Körner report was the Griffiths report (1984), which focused on creating a general management function within the NHS acute sector. A key component of this initiative was the aim of improving information provision, by involving clinicians in a "management budgeting system". Subsequently, regional health authorities developed large systems to supply government with performance indicators. However the initiative was criticised as although hospitals were required to provide vast amounts of information, they received little feedback on their performance (Wainwright & Waring 2000). Additional outputs resulting from the Griffiths report included; development of the NHS-wide technical data model, and the reinvigoration of the Experimental Computer Program to enable new data collection systems (Unpublished MSc thesis, 2003).

The Resource Management Initiative (RMI) was published in 1986 following beliefs that previous initiatives had not met their objectives and had failed to involve clinicians. Central to the RMI was the creation of a database aiding clinicians in the planning and audit of their work, and budget holders in the costing and control of activity. The initiative encouraged hospitals to develop their own organisation-wide computerised information systems;

however, all designs involved collecting basic aggregate patient activity from a patient administration system, (PAS). This also required data collection around resource usage for theatres, diagnostics, pharmacy and nursing (Wainwright & Waring, 2000). As a result of PAS' capacity to record structured electronic data of hospital activity, the Hospital Episodes Statistics database, (HES) was developed in 1987. This required hospitals to provide HES with monthly files on final consultant episode data which are still used by the DOH for central NHS inpatient activity analysis (Unpublished MSc Thesis, 2003).

Another major initiative of the period was the introduction of the NHS internal market in 1989 which aimed to promote competition among providers so as to reap the benefits that markets brought the private sector, e.g. reduced cost and increased efficiency, (CIVITAS, 2010). Furthermore, the failure of the RMI to integrate departmental systems meant that this became a priority. To facilitate this 'integration' the Hospital Information Support System (HISS) was established, which aimed to create fully integrated PAS systems by 2000 through allowing IT applications to communicate and share information by working together (Unpublished MSc Thesis, 2003).

The period 1980-1990, saw a large increase in both the ambition and number of NHS IT initiatives within the UK. The period ultimately strived for an integrated IT system within the NHS, whilst placing a huge burden upon hospital staff by expecting vast amounts of data to be collected and supplied to government and regional authorities, (Wainwright & Waring, 2000). Further problems emerged, as the initiatives which were issued by central government comprised general overarching aims, yet contained a distinct lack of guidance regarding aspects such as design and implementation of the IT systems and solutions they were proposing. This resulted in initiatives being developed in a fragmented fashion by individual hospitals and specialties, at different rates, with different functionalities, thereby contradicting the ambition of an integrated system (Wainwright & Waring, 2000). Furthermore, to be achieved, the strategy required large scale organisational change, which was a concern due to the strategy, being too technology focused thus, ignoring the large scale organisational change and increased staff workload necessary for such a radical modernisation. Ultimately, the initiatives were not met as the NHS at that time did not have the technological maturity to achieve such ambitious targets. (Wainwright & Waring, 2000).

Before the review of RMI had been published, the DoH issued their next major initiative, the 1992, Information Management and Technology (IM&T) strategy. The new strategy outlined five key aims; 1) information will be person based, 2) systems may be integrated, 3) information will be derived from operational systems, 4) information will be secure and confidential, 5) Information will be shared across the NHS (Wainwright & Waring, 2000). Wainwright & Waring (2000) defended the policies progress citing 6 key successes: the NHS number, administrative registers, NHSnet, frameworks for security and confidentiality, a basic language for health and clarity about national standards. However, other de-incentivised individuals have been more critical of the strategy and its 'success'.

Concern for the 1992 IM&T policy occurred from the outset as it was designed on the basis that the RMI had been successful. This was despite the review of RMI not being published and views at the time being that there had been insufficient benefit from previous policies to warrant such an investment. The 1992 IM&T policy was also criticised for being visionary, 'distant' and in contradiction to the rest of the NHS which was focused on achieving short-term goals (Wainwright & Waring, 2000). Additionally the top down management approach adopted by NHS Executives lacked clear objectives for hospitals to follow, resulting in systems being implemented without national guidance. This was exacerbated by the sheer number of major infrastructure projects, which were not prioritised in terms of objectives, goals and benefits, causing hospitals to be 'left' to implement their own systems according to their individual priorities, leaving IT throughout the NHS extremely fragmented (Wainwright & Waring, 2000). Additional problems occurring throughout the strategy included; complex procurement processes, shortage of clinical informatics skills, tension between local implementation and regional policy and a lack of senior, academic and performance management involvement (Bywater 1996, cited in Wainwright & Waring, 2000).

Since the experimental computer programme in 1968 there have been various developments to infrastructure and data collection including the introduction of; PAS, HES, NHS number, NHSnet, national standards and security and confidentiality frameworks. However, the 1992 Information for Health Strategy left NHS IT in a fragmented state, largely due to overly ambitious and ambiguous targets which lacked guidance for trusts to follow when implementing systems. What is more, between 1968-1998 the NHS saw an overwhelming number of initiatives and policies that were implemented into a system where computers were new and not universally accepted by all those working within it. The remainder of this chapter uses qualitative methods to provide a more in-depth

understanding of national NHS IT policy between 1998 and 2015, with a specific focus on progress made in implementing EPR systems into NHS secondary care organisations.

2.3. An overview of policy analysis

Policy analysis was considered the best means for addressing the study's research questions (section 2.1) as the method has been advocated by academics (Parsons, 1995 in Walt et al., 2008) particularly in studies which aim to retrospectively investigate the failures and successes of previous policy (Walt et al., 2008). The method is also useful for studies investigating policy over large periods of time, where information and insights cannot be obtained through interviews or observations (Miller & Alvarado 2005). Furthermore, the use of documents in studies exploring the content of healthcare policy is an attractive prospect given the surplus of documents produced by the British government (Silverman, 2010), which have become more readily available and accessible in recent years through the internet and websites such as gov.uk; an online repository of government policy documents. Ultimately making policy analysis a method by which researchers can investigate policy and obtain vast amounts of data quickly, cheaply and easily without the need for ethical approval.

However, the method continues to be underutilised within qualitative research (Miler & Alvarado, 2005) and is something which has been attributed partly to qualitative researchers typically preferring to undertake research which represents participant's point of view through interviews and observations. This therefore conflicts with document analysis which relies upon 'at a distance' research where documents represent reality (Miller & Alvarado, 2005). The underutilisation of the method has also been credited to the lack of guidance available to researchers on how to conduct policy analysis (Walt et al., 2008). Given the uncertainty around how to undertake policy analysis and the variation in the methods and reporting of policy analyses, this chapter aims to provide a transparent account of how the present study was designed and undertaken. Additionally, previous health policy analyses (Bero, 2003; Daugbjerg et al., 2009; El-jardali et al., 2014) were used as a guide throughout the design, analysis and write up of the study.

2.4. Methodology

The study took place between November 2013 and August 2015 and adopted a qualitative research design, where documents were analysed thematically.

2.4.1. *Selection of documents:*

Inclusion and exclusion criteria:

Documents included in the study were:

- National NHS IT policy or:
- Evaluations of national NHS IT policy that were commissioned by the House of Commons, Cabinet Office or DoH.

Documents that were not eligible for the study were:

- NHS IT policy for specific IT projects such as the 'NHS electronic bookings project'.
- Evaluations of the NHS as a whole, which include sections dedicated to reviewing the progress of NHS IT e.g. 'The Wanless report' (DoH, 2004).
- Academic literature that has evaluated Health IT policy (Hendy et al., 2005; Greenhalgh et al., 2011).

Although it was proposed that EPRs should be implemented into the NHS in the 1992 IM&T policy, 1998 was the starting point for the main analysis as this thesis views the 1998 Information for Health (IfH) policy as an update of its predecessor in 1992 with the two strategies often discussed together. National NHS IT policy documents included in the policy analysis were those written by the DoH or NHS England and which provided an overall IT strategy for the entire health and care system. Due to beliefs among policymakers that EPRs will improve the efficiency of and enable the health and social care system to be integrated (chapter 1) the main focus of NHS IT policy has been dedicated to outlining the rationale and aims for implementing EPRs, making them a useful resource for exploring policy around EPRs. Policies for individual IT projects, such as e-prescribing were therefore not included as the study aimed to investigate the overall progress of policy in implementing EPRs and not individual aspects of NHS IT which may or may not be related to EPRs. Furthermore, evaluations of national NHS IT policy were only included if

they had been commissioned by the government, DoH or House of Commons to report on the progress of national IT policy. Evaluations of the NHS more generally, such as 'Securing our future health: taking a long-term view' (DoH, 2002), (more commonly known as 'The Wanless Report') were not included. Lastly, academic literature that evaluated NPfIT, but which was not commissioned by the government or DoH was not included, as the study aimed to determine the progress achieved in implementing EPRs from the macro level by exploring the perspectives of policymakers and those commissioned to independently review the progress of national policy. However, an independent academic evaluation of NPfIT was included, as the report (Cresswell et al., 2011) which was funded by the National Institute for Health Research, was commissioned by the DoH to specifically report on the implementation and adoption of electronic records during NPfIT. The report is also the source of the majority of UK literature (Robertson et al., 2010; Sheikh et al., 2011; Takian, Sheikh & Barber, 2012) that has been discussed separately within the overview of literature presented in chapter 1 (section 1.2).

2.4.2. *Identifying documents*

As the majority of policy documents were known to the author they were directly searched for via the Google search engine or the Gov.uk database. On the other hand evaluations of policy were not known and so were identified by searching for evaluations of the national NHS IT policies that met the study's inclusion criteria via the same online databases. Policies and evaluations of policy that were identified were then searched along with the academic literature used to inform the background section of this chapter (Wainwright & Waring, 2000; Richards, 2001) to ensure that all relevant policy and evaluations of policies had been identified (Wainwright & Waring, 2000 ; Richards, 2001).

2.5. Ethical considerations:

Ethical approval was not required as the study used secondary data which was publically and freely available online.

2.6. Analytic Plan:

A brief literature search was undertaken using Web of Science and Google Scholar to identify what qualitative methods have been applied to existing policy analyses. The search

determined that content analysis, thematic analysis, grounded theory, discourse analysis and framework analysis (Silverman, 2010; Walt et al., 2008) are all commonly used. As the study aimed to explore how EPRs had been addressed by identifying key aims, successes, failures and recommendations held within policy documents, techniques derived from thematic analysis was considered the most appropriate method.

2.6.1. *Thematic analysis*

Thematic analysis is perhaps the most commonly used approach for qualitative studies in HSR and is considered a flexible method for identifying, analysing and reporting patterns or themes, which provides a rich, detailed and complex account of the data. However, the flexibility of the method means there are a number of ways that researchers can conduct thematic analysis (Antaki et al., 2003), making it crucial that when using the approach researchers follow the guidance that is available without limiting flexibility. This is particularly important when considering that research is often criticised for not providing adequate descriptions of the analysis and reporting process; potentially due to the lack of clarity of the guidance available (Antaki et al., 2003; Braun & Clarke, 2006). This study and the qualitative semi-structured interviews reported on within chapters 5 and 7 followed established guidance for conducting thematic analysis as developed by Braun & Clarke (2006). After initially coding all transcripts into broad categories (such as how documents define EPRs) problems with the qualitative software Nvivo occurred and all data was lost. After consulting with colleagues who had similar experiences with the software, the analysis was conducted manually.

In this study, principles of thematic analysis have been applied to the analysis of documents and so the analysis comprised three stages; familiarisation, code and theme development and data reporting. Although the analysis is outlined according to these stages, it was an iterative and flexible process, where stages were revisited to allow themes that were grounded within the original data to be developed (Fereday & Muir-Cochrane, 2008).

Familiarisation:

After documents to be included in the main analysis had been identified familiarisation began. To aid familiarisation and the remainder of the analysis, a timeline illustrating all included documents was created (figure 2, chapter 3). Due to the number and volume of documents included, familiarisation continued with initially reading and re-reading executive

summaries of included documents. This allowed a broad understanding of each document to be obtained, which would have been harder to achieve by reading the full document due to their size and unfamiliarity.

Two tables similar to those used within systematic reviews for both policy and review documents were then created and are included in chapter 3 (section 3.1.1). These tables were used to extract descriptive information relating to; authors/publishers and the investment associated with each policy. When creating these tables the full document as opposed to just executive summaries were searched and so the tables provided a quick and easy way of extracting descriptive information, whilst also enabling an understanding of contextual information behind documents to be obtained. All documents were then read multiple times to aid familiarisation further. Following guidance by Braun & Clarke (2006) documents were read in an active way by searching for meanings and patterns whilst making preliminary notes and spider diagrams ahead of formal coding and theme development.

Coding and theme development:

Codes are a list of names that are applied to and which identify an aspect of the data that is of interest to the researcher (Tuckett, 2005; Green & Thorogood, 2013), with coding involving data being organised into meaningful groups (Tuckett, 2005). Initially, the thematic analysis was approached without a-priori codes, however, due to the volume of information held within the documents and difficulties in identifying what information within policies was directly relevant to the implementation of EPRs (e.g. key pieces of infrastructure) and so should be included within the analysis this proved both challenging and unsuccessful. The coding therefore used a priori themes according to the research questions and categorised data into four broad themes;

- How documents define EPRs?
- What have been the aims of NHS national IT policy documents and is there evidence that these aims have been recurring since 1998?
- What do evaluations of national NHS IT policy consider to be the reasons behind the limited progress in implementing EPRs between 1998 and 2015?
- Do National NHS IT policy documents show evidence of adopting the recommendations or conclusions provided in evaluations of national policy?

Coding and theme development continued with relevant information from policy and evaluations of policy, for each of the four broad themes being inserted into individual ‘thematic tables’ within separate Microsoft Word documents (table 2) (Green & Thorogood, 2009). This not only aided the management of information, but provided a clearer way of displaying data within each of the four themes; whilst also allowing me to compare, contrast and build up themes (Green & Thorogood, 2009).

Table 2 An example of a thematic table used to analyse evaluations of national policy

Successes	
The Protti report p.4	It is important to acknowledge that much has been achieved since Information for Heath was announced three years ago. Everyone involved, from those within the Department of Health and the NHS Information Authority to those operating at the coal face should be proud of what has been accomplished to-date. Even the harshest critics would have to be pleased with key pieces of infrastructure that are either in place or close to being delivered.

After all data had been entered into thematic tables, each table was printed and the analysis and data reporting continued a ‘theme at a time’, which ensured that the story of each theme and how it relates to the study’s research questions was captured (Braun & Clarke, 2006). For instance, the thematic table for ‘how policy documents define EPRs and whether these definitions change over time’ was analysed, sub-themes were created and data was reported, before the next theme was analysed. Firstly the thematic table for one of the four themes (e.g. how policy documents define EPRs) was read and notes were made regarding possible sub-themes. Highlighters were then used, with each sub-theme allocated a different colour. This allowed a visual representation of sub-themes to be quickly ascertained and also helped during data reporting as all quotes were easily visible and accessible. Once initial sub-themes were developed these were re-fined and reviewed with some themes combined or discarded. For each sub-theme, comparisons were made between and across policy or evaluations of policy documents to see how policy has progressed over time and to allow research questions such as ‘do policy documents show evidence of recurring aims to be answered. During the process of theme and sub-theme development mind maps were used displaying all themes and sub-themes and resulted in a couple of themes and sub-themes being revised. For instance, funding and evaluation of benefits were discussed together as these issues were considered inter-related.

During the thematic analysis a diverse number of factors were identified by evaluations of NHS IT policy as having affected the progress of implementing EPRs, with these documents also providing various recommendations for future NHS IT policies. These

factors and recommendations were mapped onto the three levels of sociotechnical thinking; macro, meso and micro. This is perceived to have facilitated the study's narrative, whilst also enabling a greater interpretation of its findings. Rather than just providing a descriptive list of the factors perceived to have affected the progress in implementing EPRs, the use of socio-technical thinking meant that whether policy and evaluations of policy consider social and technical issues could be considered; whilst also allowing for an exploration of what the levels of influence are according to evaluations of policy are hindering implementation the most.

For the purposes of this study macro, meso, micro level influences are issues identified by evaluations of national NHS IT policy to have directly affected the progress of implementing EPRs into NHS secondary care organisations. In this context, *macro* factors are those that operate at the national level such as how policy has approached interoperability and the overall management of policies. *Micro* factors on the other hand are those operating at organisational level, such as whether NHS hospitals have shown evidence of organisational learning or the sharing of best practice. Lastly, *micro* factors are those affected by the behaviors and characteristics of NHS staff e.g. are staff reluctant to change and adopt EPRs.

Data reporting:

Throughout data reporting, themes and sub-themes were often revised further. For instance, for the theme centered on whether policy has made progress towards implementing EPRs, data for successes and failures was initially presented separately. However, during the reporting process it became apparent that this led to repetition as a number of the sub-themes within 'successes' and 'failures' were inter-related. For instance, although evaluations of policy praised early management of contract and suppliers, this was also one of the key reasons attributed to the limited progress made by NPfIT.

Themes were supported by quotations from policy and evaluations of national policy to provide evidence of the point being made. Quotations are supported by an analytic narrative, with themes discussed within the discussion section of chapter 3. Tables and figures have also been used to facilitate the reporting of the study's findings where appropriate. The following chapter presents the results of the study and discusses them alongside existing literature and current NHS IT policy.

Chapter 3. An exploration of national NHS IT policy between 1998-2015: results and discussion

The results from the policy analysis described in chapter 2 are presented and discussed. After descriptive information for the study is provided the findings are presented using the 4 main a-priori themes informed by the study's research questions (2.1). Socio-technical thinking has also been used to aid the interpretation and presentation of the study's findings in section 3.1.4, with the use of the theory allowing greater interpretation and a clearer presentation of the reasons attributed to the limited progress in implementing EPRs by evaluations of policy. The results are then discussed in accordance with existing literature and current NHS IT policy, before the chapter is concluded by considering the study's strengths and weaknesses and recommendations for future NHS IT policy and research.

For clarity throughout the chapter, the names of national NHS IT policy and evaluations of national NHS IT policy are written in italics and have been shortened or abbreviated. For instance, the 1998 Information for health policy is referred to as "*IffH*". A full list of abbreviations used within this chapter for policy and evaluations of national policy are presented in tables 3 and 4 respectively.

3.1. Results

As described in chapter 2, this study has used national NHS IT policy documents and evaluations of national NHS IT policy to address the proposed research questions. The World Health Organisation (WHO) considers health policy to refer to:

....decisions, plans, and actions that are undertaken to achieve specific health care goals within a society. An explicit health policy can achieve several things: it defines a vision for the future which in turn helps to establish targets and points of reference for the short and medium term. It outlines priorities and the expected roles of different groups; and it builds consensus and informs people (WHO, 2015).

For the purposes of this study, national NHS IT policy refers to documents published by NHS England or the Department of Health (DoH), which outline decisions, plans and actions specifically for NHS IT. For example, '*Safer hospitals, Safer wards: achieving an integrated care record*' which was published by NHS England in 2013 outlines the NHS'

plans for achieving a paperless NHS. Due to this thesis being concerned with the implementation of EPRs into secondary care organisations, information within both policy and evaluations of policy that is directly related to the implementation of these systems are included. Therefore, any information within policy or evaluations of policy relating to infrastructure or systems that are not directly related to the implementation of EPRs (e.g. implementing NHSmail), or which concerned primary care was not included.

Evaluations of national NHS IT policy refer to documents and studies that were commissioned by the Department of Health, House of Commons, Committee of Public Accounts and Cabinet Office to review the progress of national NHS IT policy such as ‘IfH’ to inform how policies should proceed, or inform future policies depending on whether these evaluations were conducted to report on progress during or at the end of a policies lifetime.

3.1.1. Descriptive information:

To facilitate perspective, this section provides a summary of and descriptive information for the policy documents that met the study’s inclusion criteria.

As described in chapter 2 (section 2.4.1), the 1998 Information for Health (IfH) policy was the starting point for the main analysis as this thesis views this policy as an update of its predecessor ‘the 1992 Information Management and Technology’ (IM&T) policy (previously outlined in section 2.2.). ‘IfH’ was more ambitious than its predecessor, retaining many of its aims, however the old policy’s integration aim was revised with the 1998 ‘IfH’ policy pledging that ‘systems *will* be integrated’ (Wainwright & Waring, 2000). Additionally, ‘IfH’ was associated with increased political pressure, the tone of which was evident during Tony Blair’s speech at the NHS’ 500th conference:

“If I live in Bradford and fall ill in Birmingham then I want the doctor treating me to have access to the information he needs to treat me”.

(Tony Blair, Protti, 2002)

Ultimately ‘IfH’ strived to create a “modern and dependable” NHS in seven years. More specifically aiming to deliver; lifelong EHRs for all patients, 24 hour on-line access to patient records, best practice guidance for all NHS clinicians, a National Electronic Library

for Health, integrated care for patients through online information services and telemedicine, more effective use of NHS resources and increased information provision to NHS planners and managers (NHS England, 1998). An emphasis was also placed on the development of EHRs and EPRs, setting an ambitious target for all acute hospitals to have; level 3 EPRs, 24 hour emergency care access to patient records, electronic transfer of patient records between GPs and full implementation of first generation EHRs, by March 2005 (NHS Executive, 1998).

In 2001, a further update to 'IfH' was published, 'Building the Information Core: implementing the NHS plan'. The policy considered the implications of 'The NHS plan (DoH, 2000)¹, by outlining how IT could support the patient centered delivery of health and care services. In addition to updating the ambitions of 'IfH', 'Building the Information Core', aimed to deliver clearer priorities around three central themes: Information Services (e.g. a National Electronic Library for Health), Electronic Records (both within and between organisations) and National or Local applications (e.g. Human Resources); committing approximately £500million to these ambitions (DoH, 2001).

In 2002, the DoH published the world's most ambitious and expensive government programme for IT, 'The National Programme for Information Technology (NPfIT); which aimed for IT-enabled modernisation of the English NHS (Cresswell et al., 2011). Central to 'NPfIT' was The NHS Care Records Service, a programme that aimed to create 'a single cradle to grave EHR for every patient in England by 2010' (Cresswell et al., 2011). In contrast to previous NHS IT policies that had opted for a localised approach to electronic record implementation, 'NPfIT' originally planned to deliver these systems via a top-down centralised approach that would deliver a few centrally selected and procured electronic record systems, via a national IT infrastructure that would enable these systems to be integrated (Cresswell et al., 2011). However, as will be discussed later in this chapter (section 3.1.4), throughout its lifetime, 'NPfIT' underwent a series of changes in relation to the overall programme's management and delivery of electronic records (Cresswell et al., 2011). Most notably, in 2010, the policy's original top-down' centralised approach for delivering electronic records was replaced by a "connect all" approach which gave greater local autonomy to NHS trust in delivering the NHS Care Records Service and also reduced the number of electronic records to be delivered (Cresswell et al., 2011). Greater details

¹ The NHS Plan reported on the NHS' progress and set out a vision for a re-designed health service, centered on the patient (DoH, 2000)-

regarding changes to the delivery of electronic records during 'NPFIT' and the impact of these changes on the programme's overall success are provided in section 3.1.4.

The Health and Social Care Act in 2012, resulted in the publication of the DoH's policy, 'The Power of Information' (Gov.uk, 2012). This ten-year framework which aimed to transform information for the NHS, public health and social care (Gov.uk, 2012) acknowledged criticisms of previous initiatives. For example, a strong emphasis was placed upon allowing sufficient time for the project, recognising the overly ambitious timelines of previous policies such as 'NPFIT' and the rapid pace of technology development. Additionally, The Power of Information aimed to use national standards to aid: implementation, planning and flow, through localised approaches to funding, responsibility, market based solutions leadership decisions and priorities (DoH, 2012).

Following the decision to dismantle NPFIT, in a speech to the policy exchange in December 2013, The Secretary of State for Health challenged the NHS to go paperless by 2018 (Ilman, 2013). 'Safer Hospital Safer Wards: achieving an integrated digital care record' was published shortly afterwards and communicated NHS England's vision for 'an integrated digital care record' throughout the health and social care system. In addition to outlining ambitions for electronic prescribing in secondary care and advanced scheduling, 'Safer Hospitals Safer Wards' aimed to provide further details and support to trusts wishing to progress from paper to paper-light and eventually paperless record keeping. As a catalyst for supporting these aims, the policy provided details of the 'Safer Hospitals, Safer Wards Technology Fund' which made £500million of Public Dividend Capital available for NHS trusts wishing to move towards paperless working between 2013 and 2015 (NHS England, 2013).

Most recently, in 2014 'Personalised Health and Care 2020, a framework for action' was published. The policy, did not seek to outline a national plan in 'the conventional sense', but rather sought to provide 'a framework for action that would support frontline staff and patients to take better advantage of the digital opportunity' (DoH, 2014). More specifically, the policy proposed for health and social care professionals to have access to 'digital records', in real time by 2020. Reflecting, the recent change in the Secretary of State's call for a paperless NHS from 2018 to 2020 (DoH, 2014). A more detailed 'roadmap to a paperless NHS' and 'interoperable digital records is due for publication in 2016, which is

expected to provide more specific guidance for trusts aiming to implement electronic records (DOH, 2014).

Table 3 provides descriptive information for the 6 policy documents that met the study's inclusion criteria. Policy documents were between 32 and 124 pages long and were published by either NHS England or the DoH. With the exception of the '*National Programme for IT in the NHS*' (*NPfIT*) none of the policies continued for their allotted time frames. The reasons for this are unclear, however when considering the study's findings it is likely that the limited progress seen and ambitious nature of these policies (section 3.1.4) meant they were replaced or dismantled before their proposed end-date. During familiarisation when descriptive information within policy documents was extracted (chapter 2, section, 2.6.1) determining the amount of investment into NHS IT and EPR implementation was challenging, due to a lack of transparency regarding what funds would be made available both at the beginning and during policy lifetimes. This is illustrated by the fact that total expenditure during '*NPfIT*' is still unclear and by '*Personalised health and care 2020*' and '*the power of information*' failing to provide exact figures that would be allocated to meet their respective aims. Lastly, a large proportion of all policy documents were dedicated to rationalising the importance of NHS IT and 'digitising' the NHS. Whilst this is important contextual information, it outweighed the detail and amount of information allocated to timescales, funding allocations and implementation of electronic systems, which is crucial to ensuring EPRs are implemented successfully and benefits are realised.

Table 3 Descriptive information for national NHS IT policy documents meeting the study's inclusion criteria

Policy (abbreviation)	Year published	Published/author	Proposed time scale	Investment at time of publication	Additional investments
Information for Health (IfH)	1998	NHS England	1998-2005	£5billion modernisation fund to help implement the policy £2million research initiative.	Additional £214m made available to support modernisation of NHS (£79m 1999, £53m 2000).
Building the Information core	2001	DoH	2001-2005	-	Additional £113m for IM&T investment in 2001/2002 increased to £210m in 2002/2003, extra £210m in 2003/2004.
The National Programme for IT in the NHS (NPfIT)	2002	DoH	2002-2010	Program based on assumption that the SR2002 bid will provide increased funding.	Estimated expenditure of 12.4billion until 2013-14.
The power of information: putting all of us in control of the health and care information we need.	2012	DoH	2012-2022	No information provided.	
Safer Hospitals Safer Wards: achieving an integrated digital care record (Safer hospitals safer wards)	2013	NHS England	2013-2018	Safer hospitals, safer wards technology fund £260 million for NHS trusts to spend on IT projects. £90m available 2013/14 and £170m in 2014/2015.	£60m of tech fund not allocated as trusts failed to show return of investment. In 2014 additional £240 million available (£160million 2014 and 80million 2015).
Personalised Health and	2014	DoH	2014-2020	No information	

care 2020: a framework for action (Personalised health and care)				provided.	
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10 evaluations of national NHS IT policy were published within the 17 year period studied and were between 24 and 84 pages long (table 4). Evaluations of NHS IT policy were conducted to report on either the progress of, or to provide recommendations for, future policies. 9 of the 10 evaluations of NHS IT policy which met the study's inclusion criteria reported on progress during 'NPfIT', with none of the NHS IT policies published after 'NPfIT' having been evaluated at the time this study was undertaken. Evaluations of NHS IT policy were produced by a variety of sources including independent academic evaluations (*The Protti Report; Cresswell et al., 2011*), the National Audit Office, The Major Projects Authority and the Committee of Public Accounts (table 4). Although, each evaluation was commissioned by the DoH or government, to report on and evaluate the impact of NHS IT policy, the variation in the sources and individuals that formed these evaluations, may have impacted on their conclusions and perspectives. For instance an 'independent' academic evaluation of NPfIT conducted by academics and independently funded by the National Institute for Health Research, may differ to an evaluation conducted by the Committee of Public Accounts, which is comprised of a Select Committee of MPs. Whilst, this is not to say that any evaluation is 'better' than another, it highlights the importance of including a range of documents from a variety of sources to get an in-depth and contextualised picture of the progress that has been made in implementing electronic records within the NHS. The type and amount of evidence used to support the conclusions drawn by evaluations of national NHS IT policy also varied, with sources including: visits to NHS trusts; interviews with staff, trusts, suppliers, academics and policymakers; academic literature and policy documents and reviews relating to individual projects. Figure 2, displays, in chronological order, all policy and evaluations of NHS IT policy included in the study, along with key announcements affecting NHS IT policy such as the Secretary of State's call for a paperless NHS by 2018, in 2013.

Table 4 Descriptive information for policy evaluations meeting the study's inclusion criteria

Review (abbreviation)	Author	Commissioned By	Year Published	Policy under review
The Protti Report	D. Protti	Information Policy Unit, DoH, NHS Information Authority	2002	lfH
National Audit Office. Department of Health NPfIT. Report by the comptroller and auditor general session 2005-2006 (NAO: NPfIT session 2005-2006)	National Audit office, Comptroller and auditor general	House of Commons	June 2006	NPfIT
Department of Health: NPfIT report of session 2006-2007 (DoH: NPfIT session 2006-2007).	House of commons, committee of public accounts	House of Commons	April 2007	NPfIT
National Audit Office: The NPfIT: Project Progress Reports. Report by the Comptroller and Auditor General. Session 2007-2008 (NAO: NPfIT project progress report session 2007-2008)	National Audit Office, comptroller and auditor general	House of Commons	May 2008	NPfIT
NPfIT Progress since 2006. Second report of session 2008-2009. (NAO: NPfIT session 2007-2008)	House of Commons	Committee of public accounts	January 2009	NPfIT
The long and winding road...an independent evaluation of the implementation and adoption of the National Health Service Care Records Service (NHS CRS) in secondary care in England. Final Report for the NHS Connecting for Health Evaluation Programme (Cresswell et al., 2011).	Cresswell, K., Ali, M., Avery, A., Barber, N., Cornford, T., Crowe, S., Fernando, B., Jacklin, A., Yogini, J., Klecun, E., Lichtner, V., Marsden, K., Morrison, Z., Paton, J., Petrakaki, D., Prescott, R., Quinn, C., Robertson, A., Takian A., Voiutsina., K., Waring, J & Shekh, A.	An independent evaluation commissioned by the DoH.	March 2011	NPfIT
NPfIT an update on the delivery of care record	House of Commons	Committee of public accounts	August 2011	NPfIT

systems.				
Major Projects Authority programme assessment review of the national programme for IT (MPA review of NPfIT)	Major Projects Authority	Cabinet Office	June 2011	NPfIT
Review of the final benefits statement for programmes previously managed under the NPfIT. (Review of the final benefits statement)	National Audit Office	House of commons Committee of public accounts	June 2013	NPfIT
The dismantled NPfIT, Nineteenth report of session 2013-2014. (Dismantled NPfIT)	House of Commons	Committee of public accounts	September 2013	NPfIT

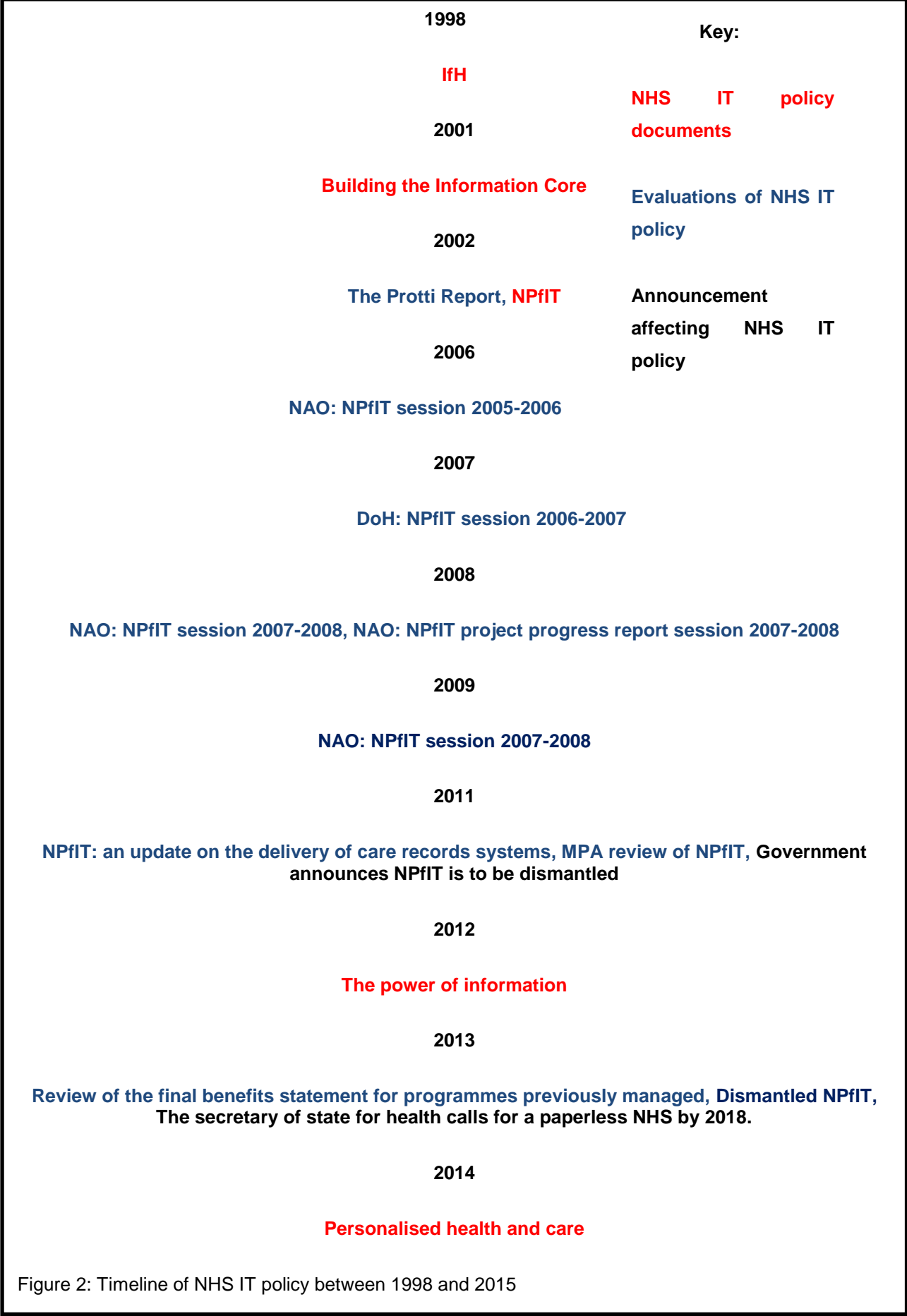


Figure 2: Timeline of NHS IT policy between 1998 and 2015

3.1.2. How do documents define electronic records and have these definitions changed over time?

In light of the lack of universally accepted definitions of EPRs and EHRs (chapter 1), how policy and evaluations of national NHS IT policy define these systems was explored. Despite 'IfH' calling for these systems to be defined in 1998, it is still uncertain what systems, content and functionality constitute an EPR, with the 'Safer Hospitals, Safer Wards' policy acknowledging this issue by describing the 'arena to be dominated by competing definitions and terms'. The implications of this for implementing EPRs were described by Protti:

There is no such thing as a solution to a problem when the problem itself has not been fully defined, still less agreed.

(The Protti report, 2002: p.30).

The confusion surrounding EPRs and EHRs, may be attributed to the fact that since 1998, every policy has introduced new terminology for electronic records (figure 3). Although this was recognised as an issue by 'Safer Hospitals, Safer Wards' in 2013, who as previously stated referred to the number of 'competing definitions and terms', the policy introduced the term Integrated Digital Care Record (IDCR). However, the strategy emphasised that the term was 'not introduced for its own sake' but would be used to convey an ambition for 'a single record for patients across health and social care'.

1992-2002

Electronic Health Record,
Electronic patient Record

2002-2011

EPR, EHR and care
records service;

2014-2015

Evolution of terminology

Digital records

2012

2013-2014

Integrated digital care record, summary care record

Electronic care records, health and care records

In addition to having proposed numerous terms for describing electronic records, definitions within NHS IT policy documents for this terminology are limited in terms of the detail they provide regarding the systems, functionality and approaches that these systems encompass. The various terminology and definitions that national NHS IT policy has proposed for electronic records is summarised in table 5. The most notable difference in how electronic records have been defined is between pre-2012 policies that consider electronic records to be EHR and EPRs and post-2012 policies that use the phrases; electronic care records, IDCR and digital records. Pre-2012 policy therefore considered electronic records to consist of two systems: 'locally based EPRs' which hold information about the care received by patients typically in one institution (e.g. acute hospitals) and EHRs which are longitudinal records of a patient's health and healthcare and which are comprised of locally based acute, mental health, social and community care EPRs. Contrastingly, 2013-2015 policies focus on a single system, 'or patchwork quilts of individual functionality rich modules' that are 'stitched together' or interoperable (best of breed) that create integrated records within and across health and care organisations.

Although NPfIT also introduced the terms 'summary care record' and 'detailed care record' as part of an NHS care record service aiming to implement electronic records, these terms were not introduced within the original 'NPfIT' policy document and so are not included within table 5.

Table 5 Definitions of EHR, EPRs and associated terms within NHS IT policy documents

National NHS IT Policy (Year)	Term	Definition/explanation within document
Information for Health (1998)	EHR	'The term EHR is used to describe the concept of a longitudinal record of patient's health and healthcare-from cradle to grave. It combines both the information about patients contacts with primary healthcare as well as subsets of information associated with the outcomes of periodic care held in the EPRs.'(p.25)
	EPR	'Electronic patient record describes the record of periodic care provided mainly by one institution. Typically this will relate to the healthcare providers, for example, specialist units or mental health NHS trusts.' (p.25)
Building the information core (2001)	EHR	'...and a subset of them will contribute to a lifelong record of a patient's health and healthcare-the Electronic health record'. (p.25).
	EPR	"Wherever a patient is treated, there is a record of that treatment. These are "organisational records" and at present they are, in the main, paper records. New technology gives us opportunities for making those records safer and available for other health professionals. These organisational records will become the Electronic Patient Records'. (p.25)
The National Programme for IT in the NHS (2002)	EHR	'a patient orientated EHR will be developed both for clinical conditions and for use in providing information for emergency care anywhere, anytime for use by authorised NHS staff. EHRs for clinical conditions e.g. cancer will be developed using national data standards and structures to provide local EHRs.' (p.11)
	EPR	'EPRs supporting care in different settings e.g. acute, primary and community will be provided locally by selection from the centrally-funded, nationally compliant EPR solutions. The basic components to be procured support a functional model that includes modules such as; patient administration, order communications and results reporting integrated care pathways, electronic prescribing, PACS and telemedicines and telecare' (p.11)
The power of information putting all of us in control of the health and care information we need (2012)	Electronic care records/health and care records	Our electronic care records progressively become the source for core information used to improve our care, improve services and to inform research, etc. – reducing bureaucratic data collections and enabling us to measure quality (p.28)
Safer hospitals safer wards: achieving an integrated digital care record (2013)	Integrated digital care record	'We want local health and care services to use digital technology to ensure that vital patient information and clinical decision and support tools can be viewed by an authorised user in a joined up manner in a single instance. We want information that is shared with or created by social care professionals to be available in the same application to enable true integration of care to be delivered effectively. '(pp. 10-11).
Personalised health and care 2020: a framework for action (2014)	Digital records/patient records	'We need patient records to be mobile, editable and accessible to all those in the care process, including patients themselves and carers. Digital records must support the delivery of care in the community as much as in the hospital-their mobility, extensibility and interoperability is fundamental. '(p.27)

3.1.3. What were national policies aiming to achieve by implementing electronic records and is there evidence that these aims are recurring?

This section explores what national NHS IT policy was aiming to achieve by implementing EPRs or digital records. Only aims which were explicitly referred to as such within policy documents and which directly relate to the implementation of EPRs or digital records are discussed here. Aims are discussed separately before the evidence for whether NHS IT policy has been repeating its aims are considered; as this is something which is believed by this thesis to be an indicator of whether progress has been made.

Integrated records and an integrated health and social care system

The vision of 'integrated records' for health and social care was first proposed in 1998 by 'IfH'. All subsequent policies have been unanimous in aiming for electronic records for all patients throughout England during their proposed timescales. However, this aim appears to have become more prominent since the 'Safer Hospitals Safer Wards' policy in 2013, which proposed that IDCRs will create an integrated health and social care system. The following statement preceded the documents key messages:

In this document NHS England reiterates the benefits case for safe digital record keeping as a precursor to achieving integrated digital care records across the health and care system.

(Safer hospitals, Safer Wards, 2013: p.7).

Additionally, the two latest policy documents (*Safer Hospitals, Safer Wards, Personalised Health and Care*) have shifted focus from electronic records being the main source of information, to these systems replacing paper entirely. The Health Secretary initially challenged the NHS to become paperless by 2018 in an address to the policy exchange (Ilman, 2013). Since then, the aim has been postponed to 2020 and has become the main target for all NHS hospitals. However, it is unclear where the idea of a paperless NHS originated from, with the two latest policies also providing little clarification as to what the phrase means in practical terms. This reflects the less prescriptive nature of the two latest policies, which have provided little detail and guidance for hospitals in relation to how to achieve a paperless hospital and/or implement IDCRs. Contrastingly, policies pre-2013 communicated specific aims for EPRs to be achieved within specific time frames. For instance, '*Building the Information Core*' called for 50% of primary and community trusts to have EPR systems by the end

of the policy's lifetime. However, it is unclear what is the best approach as generic aims create uncertainty and are open to interpretation whilst specific targets are difficult to provide for the NHS as a whole; due to the variation in the systems, functionality and stage of implementation of NHS hospitals in terms of EPRs. The difference in how policies pre and post-2013 have communicated their aims is illustrated in the quotation below and figure 4.

Over the period of the strategy all acute hospital sites will develop their information systems at least to the level necessary to support the new NHS target for clinical messaging with primary care, the wider strategic aims of this strategy, and internal EPR development. They should be able to support clinical activity such as placing clinical orders, results reporting, prescribing and multi-professional care pathways (i.e. to at least the level 3² functionality).

(IfH, 1998: p.38)

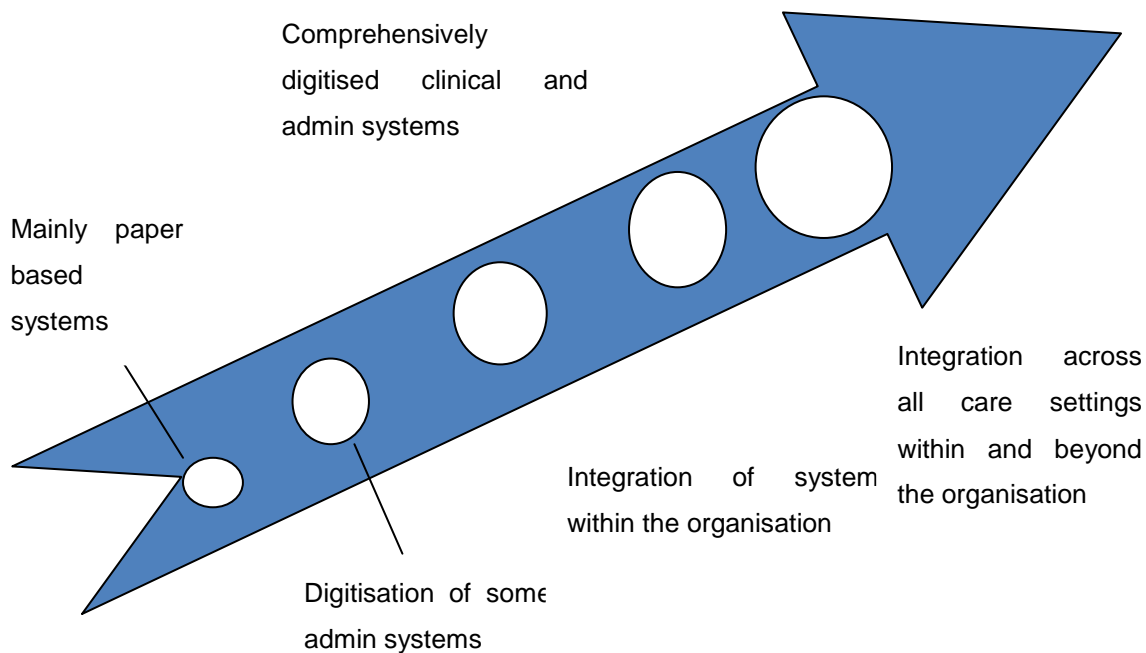


Figure 4: Path to IDCRs adapted from Safer Hospitals Safer Wards (NHS England 2013 p. 15).

Patient access to records

² 'This level of EPR will require each acute hospital to have an integrated patient master index, patient administration and departmental systems, plus electronic clinical orders, results reporting, prescribing and multi-professional care pathways' (Information for health, p.109).

Prior to 'Safer Hospitals, Safer Wards' in 2013, policies focused on the need to give patients access to their records, with 'the Power of Information' suggesting that a first step to achieving this should be through patients being able to access their GP records. Since, 2013, the aim has progressed to one which strives for patients to not only have access to but have the ability to enhance and add to their records:

It is essential that citizens have access to all their data in health and care, and the ability to write into it so that their own preferences and data from other relevant sources like wearable devices can be included.

(Personalised health and care, 2014: p.21).

Reliable, rapid access to records 24 hours a day

Up to and including 'NPFIT' policies stressed the importance of ensuring that only authorised NHS staff will have access to EPRs and that these individuals should be able to access patient information 24 hours a day to allow clinical information to be accessible in emergency situations and out of hours. However this has not been a feature of policy post-NPFIT, presumably because it is assumed that having electronic systems will mean that patient information is available 24 hours a day, whenever and wherever it is required by NHS staff:

The original IfH targets for full electronic patient records and an electronic health record for use in 24-hour emergency care by March 2005 remain unchanged.

(Building the information core, 2001: p.25).

'IfH' and 'the Power of Information' also aimed for electronic records to inform research, reduce bureaucratic data collection and provide information on quality of care and patient outcomes.

Is there evidence of recurring aims?

With the exception of providing staff with 24 hour access to patient records, the aims of national NHS IT policy in relation to EPRs have remained the same. Although policy has made slight adjustments to its aims in terms of introducing the concept of a 'paperless NHS' and shifting from simply providing patients with access to their records to wanting to give patients the ability to add to and enhance their records; the aims of providing patient access to their records and creating integrated care records have remained unchanged. It could therefore be argued that new policies have proposed the

same aims as their predecessors, using new terminology and different timescales. For example, 'NPfIT' proposed the idea of 'a unified health record, with all appropriate social care information by 2010', with 'Safer Hospitals, Safer Wards' proposing an integrated health and social care record by 2018. Based on these findings, it could be stated that limited progress has been made in relation to implementing electronic records since 1998, however the ambitious nature of these aims, particularly in terms of achieving an integrated digital care record for the entire health and care system is acknowledged. The reasons for the limited progress made by national NHS IT policy are outlined in section 3.1.4.

3.1.4. Progress in implementing EPRs between 1998 and 2015

This section aims to determine the reasons for the limited progress in implementing electronic records according to evaluations of national NHS IT policy. To provide a balanced account of progress, areas where progress has been made are also acknowledged. Judging progress was however challenging and was determined in two ways. Firstly through areas of progress being identified by evaluations of national NHS IT policy and secondly through my own assessment of whether the aims of national NHS IT policy were met. In terms of the author's assessment, this involved looking at the aims of policy e.g. 'a level 3 EPR' (*IfH*) and then seeing whether evaluations of NHS IT policy felt these aims had been achieved. Although, this is open to subjectivity and the aims proposed by national NHS IT policy are now considered unrealistic in hindsight, these were nevertheless what policy set out to achieve and also provided an additional way of determining and ensuring that all areas of progress are considered in this section. 'The Power of Information' and 'Personalised Health and Care' also presented specific case studies where innovations and technologies have been successfully implemented. For instance 'The Power of Information' reported that Kings College Hospital in London was planning to be paperless by 2013, had piloted a system for recording patients' vital signs and had successfully implemented e-prescribing. However as these are isolated, local examples of progress and not instances where progress has been made nationally, they are not discussed further.

'Building the Information Core', 'the Power of Information', 'Safer Hospitals, Safer Wards' and 'Personalised Health and Care' have not been evaluated and so the findings within this section and section 3.1.5 are based on evaluations of 'IfH' and 'NPfIT'. The majority of the evaluations of national NHS IT policy included in this analysis, with the exception of 'The Protti Report' reviewed and reported on progress made by 'NPfIT' between 2002 and 2011. Although all evaluations of 'NPfIT' were analysed and informed the study's findings, evaluations that took place before 2011' tended to identify

areas of progress, whereas evaluations of 'NPfIT' between 2011 when 'NPfIT' was dismantled and 2013 were used to report on the reasons for the limited progress in implementing EPRs in this section. This is presumably as evaluations of policy between 2011 and 2013 took place at a time when the projects limited progress was well known and so their purpose was to either inform the decision to dismantle or report on the dismantlement of 'NPfIT'.

Furthermore, as national NHS IT policy and evaluations of policy were concerned with NHS IT in general and not just electronic records, a number of other IT and infrastructure projects, were discussed and reported on by these documents. However as this study is concerned with the progress made in relation to electronic records, only the IT and infrastructure projects considered to directly influence the implementation of electronic records are discussed here. For example, Choose and Book, the Picture Archiving and Communications System (PACS) and e-prescribing (appendix 4) are commented on as these are considered key infrastructure projects affecting the implementation of EPRs by 'IfH' and 'NPfIT'. On the other hand, IT and infrastructure projects such as NHSnet, NHSmail, Electronic library for health, NHS Direct and broadband were considered to not directly influence the implementation of EPRs and so are not discussed. Furthermore, although there has been great progress made with the NHS considered one of the world's leading countries in relation to GP prescribing and primary care systems, this PhD is concerned with the implementation of electronic records into secondary care organisations and so primary care systems are not discussed.

The analysis of evaluations of NHS IT policy identified a number and range of reasons for the limited progress in implementing electronic records between 1998 and 2015. Socio-technical thinking (chapter 1, section 1.4.2) has been used as a framework for structuring the various reasons associated with this limited progress that were identified by evaluations of national NHS IT policy and allows the data to be presented not just as a descriptive list but as macro, meso and micro level influences to the implementation of electronic records (table 6). Due to a number of the reasons attributed to limited progress also being areas where progress was considered to have been made by evaluations of policy, to prevent repetition and allow comparisons these findings are discussed together and are highlighted in bold within table 6. For the purposes of this study, macro factors are those that influence the implementation of EPRs from the national level and include influences such as policy, investment into NHS IT and overall management of national policy. Meso factors are those that influence EPRs from the

organisational level e.g. whether NHS hospitals showed evidence of organisational learning and/or shared best practice, whilst micro level influences are those affected by the behaviours and characteristics of NHS staff, such as NHS staff's willingness to be involved in NHS IT policy and EPR projects.

Table 6 Macro, Meso and Micro factors that have affected EPR progress between 1998 and 2015

Macro	Meso	Micro
Delivering Electronic Records	Organisational learning and sharing of lessons learned.	Reluctance to change
Funding, costs and benefits		Level of staff and public commitment, buy in and involvement in NHS IT and EPR projects.
NHS IT Policy		
Interoperability		
Policy management		
Access to electronic records		
Infrastructure		

Macro factors affecting the implementation of electronic records

Delivering Electronic Records:

As previously mentioned, judgements of progress have in this study been based partly on whether national NHS IT policy has achieved its aims. On that basis, progress in implementing electronic records has been limited, as rather than having implemented these systems throughout the NHS as originally intended; when discussing the progress of 'IfH', 'The Protti Report' and 'Building the Information Core' acknowledged the development of the Electronic Records Development and Implementation Programme (ERDIP), the purpose of which was to facilitate the research and development of EHRs.

Despite aiming to implement a 'fully integrated care record system' progress during 'NPFIT' was limited. In light of the lack of progress, during 'NPFIT' contracts for delivering electronic records were revised so that the scope of the program was significantly reduced, without comparable reductions in costs. Instead of implementing a national electronic record 'NPFIT' contracted a range of suppliers to implement various different electronic record systems across three regions (London, South, North Midlands and East), where trusts were given autonomy regarding the functionality and cost limits of these systems as opposed to being provided with a national system. As a result, progress in implementing electronic records was extremely fragmented with variation

ensuing in terms of the number of systems and functionality delivered. Furthermore, as displayed in table 7, although progress in London exceeded elsewhere with electronic records delivered to the majority of community and mental health trusts, only a minority of acute hospitals received electronic record systems. This variation by trust type in London reflected that elsewhere as across the three regions a larger number of deployments were completed for mental health trusts in comparison to acute and community trusts.

When looking at the number of systems deployed in table 7 and throughout 'NPfIT' it is important to bear in mind that electronic records were delivered in stages, with each 'release' of the systems containing added functionality. Furthermore, trusts that received systems during 'NPfIT' had received releases one or two, which were considered not to have the level of functionality needed to meet the policy's aims. Therefore, the figures presented in table 7, may present a more positive picture of implementation than what was experienced by trusts, as although it could be argued that a number of systems were successfully implemented particularly into mental health trusts, the functionality and maturity of these systems was relatively poor.

Table 7 the number of systems delivered in each of the three regions within England and the value of contracts during NPfIT according to review between 2011 and 2013

Region	Supplier	Systems delivered	Contract value
North, Midlands and East	CSC	56/90 community care trusts 10/97 acute trusts 0/35 mental health trusts 80 interim systems delivered.	105 million for interim systems Original contract 3.1 billion for delivery of care record systems to 220 trusts. Expected to cost 2.2 billion despite issues.
South	Fujitsu, replaced by BT after Fujitsu contract terminated	23/25 community and mental health trusts 7 acute trusts. BT to deliver 35 of original systems.	Fujitsu terminated, BT London contract extended 454 million. 214million BT 151 million to Fujitsu.
London	BT	All 37 community and mental health trusts received system. Half acute trusts (number not specified).	444 million Original cost increase from 65 to 85 million Extended at cost of 546 million

The most frequently cited issue associated with the limited progress in implementing electronic records by evaluations of 'NPfIT' was its poor management of contracts and

suppliers, the reasons for which are multifaceted. Firstly, evaluations of 'NPfIT' described 'NPfIT and electronic record contracts as too ambitious and risky. This was attributed to the fact that when contracts were originally signed, the electronic record systems that were to be delivered had not been developed. Additionally, evaluations of 'NPfIT' explained how even after contracts had been re-negotiated to account for delays to the delivery of electronic records, for the aims of 'NPfIT' to be met by the revised target of 2016, electronic records would have had to have been procured and delivered at an unrealistic rate. No clarification within evaluations of 'NPfIT' was provided as to why these revised targets were not set more realistically:

In the South, care records systems need to be procured and delivered to 28 acute trusts, 13 community health services and four ambulance trusts by October 2015
(NPfIT an update on the delivery of care record systems, 2011: p. 15).

Evaluations of 'NPfIT' also reported that the policies decision to contract three main suppliers to deliver electronic records hindered the supplier market, with the resulting lack of demand believed to have constrained the development of next generation systems whilst increasing the costs of procurement and services. Additionally, the lack of viable competition among suppliers made a fully open and regulated market challenging, exemplified by the fact that only a couple of suppliers have Patient administration system (PAS) solutions available for use in the NHS. It could be argued that the implications of this are still impacting the NHS as the supplier market is dominated by American EPR providers, whose systems do not necessarily meet with the NHS data model or requirements:

LSP contracts have potentially constricted the health care systems market in England and there has been little development of new generation systems due to the lack of free demand.

(MPA review of NPfIT, 2011: p.5).

As previously discussed, significant delays to the development and implementation of electronic records were encountered during 'NPfIT' due to: local tailoring of electronic record systems to individual NHS trust requirements, the technically ambitious nature of systems and defects with delivered systems which breached contractual limits. As a result, in each of the three regions (North, East and midlands, London and the South) renegotiations with suppliers were entered over contracts for delivering electronic records. However, poor negotiating from the DoH and contract management meant that these renegotiations led to increased costs or in London small reductions in costs, despite the number of systems to be delivered throughout the NHS being significantly

reduced. These issues were exemplified in the South, where delays to the delivery of electronic records and poor contract management led to the supplier for that region 'Fujitsu' terminating their contract. Following termination, Fujitsu were no longer contractually bound and the costs of maintaining 'live sites', where systems had been delivered doubled. However, contract management and negotiation issues continued with the new supplier, BT who were also responsible for delivering electronic record systems in London. Despite BT receiving £9million for each electronic record system delivered in comparison to trusts outside 'NPfIT' who were paying BT £1-2million for the same system, the contract stipulated for only 35 of the 90 systems required in the South to be delivered:

The Department reports to the Committee that the original timescales had not been achieved because the suppliers were having to do more customisation to meet the needs of individual NHS organisations than was envisaged and because of the technically ambitious nature of the systems. The Department also reports to the Committee that it terminated Fujitsu's contract after negotiations to reset it had failed. One particular area of difficulty was the cost of what Fujitsu termed 'new requirements.' The Department's position was that the majority of these requirements were remedial and were necessary to make the system being provided by Fujitsu fit for purpose. Furthermore, that the delay to the programme was as a result of Fujitsu's failure to meet its contractual obligations. Fujitsu's position was that all the requirements were new and incremental to the existing contract and therefore needed additional funding. Fujitsu's view was that the Department had caused delay to the Programme as a result of substantial changes to the system. The Committee questions the remaining suppliers' capacity to deliver and raises concerns about the strength of the Department's negotiating position.

(NPfIT an update on the delivery of care record systems, 2011: p.5)

Further contract issues that were unique to the North, Midlands and East region related to 'interim' electronic record systems that were introduced when Lorenzo, the supplier for that region missed its delivery targets. Although these systems were implemented as a temporary 'stop-gap' and were considered not to have the required level of functionality required to meet 'NPfITs' aims, a number of these systems were not replaced. It could be argued that this not only hindered the progress within that region in terms of meeting the aims of 'NPfIT' for electronic records, but provided trusts with systems that had reduced functionality and which may have also contributed to the

variety of systems that are available and which are not integrated within the NHS currently:

The delays in developing and delivering Lorenzo have meant that around 80 interim systems have been delivered in its place. The Department reported that by March 2011 it had paid CSC £105 million for these systems. It confirmed that many of these interim systems will not now be replaced with Lorenzo, even though these systems were previously considered by the Department not to meet the aims of the Programme. The Department made no assessment of how much these interim systems would have cost had they contracted for them from the outset of the Programme. CSC confirmed that, if finalised, the revisions to its contract with the Department would result in reductions to the number of systems to be delivered and the functionality to be provided.

(NPfIT an update on the delivery of care record systems, 2011: p. 7-8)

Despite the aforementioned criticisms, an evaluation of 'NPfIT' conducted in 2006 which reported on early progress of the policy described a number of mechanisms that were put in place at the start of 'NPfIT' to ensure value for money from electronic record contracts. Firstly, to prevent the tax payer funding services that had not been delivered, it was proposed that suppliers were only to receive payment after working electronic record systems had been delivered; thereby placing delivery risk onto suppliers. A suppliers' capacity to deliver on contract requirements was also tested as 'winning bidders' were required to undertake proof of solution and due diligence tests, with all suppliers also obligated to pay the government between £50 and £500 million if they defaulted. Additionally, suppliers incurred performance deductions if monthly performance targets were not met, however they were given the opportunity to earn these deductions back in the event that performance was rectified within three months; otherwise the DoH kept the money. Lastly, the DoH ensured change control mechanisms were in place so that any changes to contracts or systems required during 'NPfIT' could be met without the DoH incurring excessive charges from suppliers. Despite these intentions, in practice, contracts and clauses which aimed to incentivise suppliers were poorly implemented and managed. For example, deductions incurred by suppliers for poor performance were paid into an escrow account, however if suppliers improved their performance within three months they received their deductions back with interest. Moreover, if delays were not the fault of suppliers, the DoH was required to compensate suppliers. It could therefore be argued that mechanisms aimed at incentivising suppliers to meet their targets, in some cases rewarded them for poor performance. Particularly when considering that during 'NPfIT' performance deductions of £142 million were incurred, of which the DoH kept £5.7 million. Lastly, although evaluations of 'NPfIT' stated that mechanisms such as penalising suppliers for delays

and 'proof of solution' tests are not always in place in other large scale projects, It could be argued that these are things that most individuals would expect from projects of this scale and that involve such large financial investment:

Suppliers who fail to meet key levels of service accrue performance deductions, and have to pay into an escrow account amounts depending on the severity of the performance failure and its repetition. If a supplier rectifies its failure for the following three months, the performance deductions are refunded with interest. Otherwise, NHS Connecting for Health is entitled to keep the money.

(NAO: NPfIT session 2005-2006, 2006: p.36).

Additionally, the NAO evaluation of NPfIT in 2006 praised 'NPfITs' processes for the procurement and selection of suppliers for electronic records. More specifically, the National Audit Offices' (NAO) evaluation praised the policies rapid procurement which was reported to have helped to contain costs and increase the potential for benefits to be realised. Additionally, 'NPfITs' centralised approach for selecting suppliers was commended as this was reported by the NAO to have guaranteed competition among suppliers whilst also enabling significant price reductions on contracts to be secured. 'NPfIT' ensured competition for suppliers in a number of ways which in addition to those highlighted in the extract below included: adhering to 'NPfITs' procurement strategy, bundling services to ensure contracts were of sufficient value, maintaining clarity with bidders and keeping contract selection to a short timetable to allow the private sector to compete:

NHS Connecting for Health secured vigorous competitions for the IT contracts, maintaining competitive tension by negotiating contracts with at least two final bidders before selecting a winner and dispensing with the preferred bidder stage. Through the use of standard financial model templates NHS Connecting for Health made like for like comparisons of bids, which together with the vigorous competition, enabled it to achieve significant price reductions from the eight prime contractors, the difference between their initial and final bids totaling £6.8 billion.

(NAO: NPfIT session 2005-2006, 2006: p.2).

However, *The Protti Report*, and evaluations of 'NPfIT' that informed or were conducted after the decision to 'dismantle NPfIT' had occurred (2011-2013) criticised their respective policies decisions to use local ('IfH') and centralised ('NPfIT') approaches to the procurement and implementation of electronic records. It is easy, with the benefit of

hindsight to condemn the way that electronic records were procured and implemented, particularly considering the limited progress made and various factors that suggest these processes were carried out poorly (table 6). However, the rationale for using local and then centralised approaches to implement and procure these systems do not seem to warrant criticism. The reasons for this are threefold, firstly following the limited success of *IfH*, many within the NHS including *Protti* in '*The Protti report*'; called for a centralised approach to procurement and implementation as the local approach adopted by *IfH* resulted in individual NHS trusts procuring and maintaining their own systems, leaving various electronic systems operating in silo; without the ability to share information. Secondly, centralisation was suggested following the successful use of the approach in other IT projects within the NHS and other industries (e.g. the NHS' procurement of Microsoft). Thirdly, as described by '*The Protti Report*' in 1998 when '*IfH*' was published there was and remains today uncertainty regarding the best routes to procure and implement electronic records. The decision to adopt a centralised or one size fits all approach to the procurement and implementation of electronic records during '*NPfIT*' was therefore based on previous experience during '*IfH*' and other industries. It is therefore difficult to criticise either '*IfH*' or '*NPfIT*' for their approaches to implementation and procurement as no clear best method had been established. The difficulties in knowing how to implement EPRs is described by *Protti* in the extract below:

The EHR journey is taking the NHS through terrain more complex than expected. The EHR landscape is more like the mountains of Afghanistan than it is the deserts of Kuwait. One cannot readily see the best routes to follow-even from up high.

(The Protti Report 2002: p.11).

Although the approaches used to implement electronic records during '*IfH*' and '*NPfIT*' are difficult to criticise, '*NPfIT*' can be criticised for the way that these approaches were carried out in practice. During '*NPfIT*' it became apparent that a one size fits all, or centralised approach to implementation and procurement did not account for the significant variation between NHS trusts in terms of their requirements of electronic records both clinically and technologically. As a result, significant delays to the delivery of electronic records ensued and the centralised approach to implementation was revised. This ultimately placed the responsibility of implementing these systems from being that of the policymakers to individual trusts. Consequently and as previously mentioned, rather than implementing a universal system throughout the NHS, different regions tailored electronic record systems to local needs, which created systems of varying functionality that operated in silo (table 7). *Evaluations of NPfIT* articulated that the lack of information given to trusts following these changes in terms of how they

should be implementing these systems and the costs associated with local tailoring of systems, significantly hindered progress in their delivery. This suggests that it was not necessarily the approach to implementation that was the issue here but the way that it was managed and carried out that contributed to the delays and limited progress in implementing electronic records:

The approach taken by the programme originally was to provide a single solution in a Trust care setting that was all encompassing, a 'one size fits all' standard configuration. This nature of full integration of all tasks required in a trust does not line up with the needs of clinicians on the ground, where they want only those parts of the system that support their particular tasks. As a consequence this approach was changed several years ago to a 'connect all' solution in which different systems would be interconnected and interoperate across the NHS national infrastructure which has been established.
(MPA review of NPfIT, 2013: p.11).

Funding, costs and benefits:

The NHS is one of the few healthcare organisations worldwide to have provided significant and regular investment into IT (tables 3 and 7). However, the allocation of this investment is something that continues to jeopardise the ability of policies to fulfill their ambitions. For example, evaluations of policy described how a large proportion of funds intended for 'IfH' were directed to other areas outside of NHS IT with 'NPfIT' based on the assumption that an unconfirmed (SR2002) would provide funding. Additionally, with the exception of 'Safer Hospitals Safer Wards', where a 'technology fund' which committed £500million to the implementation of electronic records between 2013 and 2015 was outlined, the remaining policies lack transparency in relation to the amount of funding available to support their aims. This is exemplified by the failure of either 'The Power of Information' and 'Personalised Health and Care 2020' to provide any detail regarding funding available to support their proposals (table 3):

70% of the hypothecated funds intended for investment in IM&T in the 2001/2 national allocations were diverted to other purpose If this problem persists in 2002/3 the NHS will fail to deliver key IfH objectives particularly the development of electronic records.
(The Protti report, 2002; p.28).

In addition to policy documents failing to provide adequate descriptions of the funding available to support them, evaluations of NHS IT policy also either failed to comment on

(*The Protti Report, IfH*) or reported inconsistent (*evaluations of NPfIT*) figures regarding their respective policies total costs. For example, evaluations of *NPfIT* reported the policy to have cost either £11.4billion or £9.8billion, depending on whether 'potential future costs' were omitted. The reasons for this was attributed to uncertainty surrounding future costs of the policy due to ongoing disputes with suppliers and future procurement costs following suppliers exiting their contracts being unknown. Additionally, evaluations of *NPfIT* stated that even after omitting future costs the estimate of £9.8bn was also unreliable. This was attributed to the DoH's failure to provide evaluations of *NPfIT* with the information they needed to adequately 'scrutinise' the policy and determine accurate cost estimates. For example, the DoH claimed they were unable to provide a breakdown of how much they paid for each of the electronic record systems they procured and were reportedly unable to provide 'basic management information' on the number of systems delivered, amount spent on each system and the costs of contract changes; despite spending £820million on program management. Given the uncertainty around future costs and the reliability of figures provided by the DoH being brought into question the total costs of *NPfIT* can be considered unreliable, and are something which is still unknown (Mance, 2013, Syal, 2013, Mathieson, 2011). Furthermore, omitting potential future costs and reporting the figure of £9.8billion potentially provides a false and conservative estimate of the extent of the financial wastage that occurred during the policy:

It is unacceptable that the Department has neglected its duty to provide timely and reliable information to make possible Parliament's scrutiny of this project. Basic information provided by the Department to the NAO was late, inconsistent and contradictory. We are surprised that in its memorandum to us of 7 June 2011, two weeks after our hearing, the Department did not mention that it made an advance payment to CSC of £200million in April 2011.

(NPfIT: an update on the delivery of care records systems, 2011: p.6).

Evaluations of *NPfIT* reported that the policy had not achieved value for money and considered its costs to outweigh the benefits, with *the review of the final benefits statement'* reporting that 65% (£7billion) of the overall benefits of *NPfIT* were yet to be realised; due to the limited number and functionality of electronic record systems delivered by the program. The rigor and certainty of reported benefits figures were however questioned by evaluations of *NPfIT*, who criticised the poor monitoring of benefits both prior to and during the policy. A number of examples of how benefits evaluation was inadequate during *NPfIT* were provided and included the lack of baseline for establishing benefits and monitoring progress at the start of the policy. Additionally, although a methodology for trusts to monitor and track benefits during the

program was established, there was no systematic accumulation of benefits from trusts or Strategic Health Authorities. Lastly, trusts submitted benefits information to the DoH on a voluntary basis, increasing the risk that this information was incomplete or not representative of the whole NHS. Despite this, evaluations of 'NPfIT' remained confident that the benefits of electronic record systems would exceed costs over the systems lifetimes. However, the vast uncertainty as to whether electronic records could bring future benefits due to 'end of life dates' for a number of these systems being too far into the future (2024) and later releases of electronic record systems which contained the level of functionality needed to realise benefits having not been developed was acknowledged by evaluations of NPfIT:

It is clear there is very considerable uncertainty around the benefits figures reported in the benefits statement. This arises largely because most of the benefits relate to future periods and have not yet been realised. Overall £7 billion (65 per cent) of the total estimated benefits are forecast to arise after March 2012, and the proportion varies considerably across the individual programmes depending on their maturity. For three programmes, nearly all (98 per cent) of the total estimated benefits were still to be realised at March 2012, and for a fourth programme 86 per cent of benefits remained to be realised. There are considerable potential risks to the realisation of future benefits, for example systems may not be deployed as planned, meaning that benefits may be realised later than expected or may not be realised at all.

(Review of the final benefits statement, 2013 p.17).

The 'structured and logical approach to measuring and reporting benefits' adopted at the start of NPfIT was however praised by *the review of the final benefits statement*, which also described various mechanisms that were in place (outlined below) to ensure a consistent approach to benefits monitoring and evaluation was adopted. However as previously described the evaluation and management of benefits during NPfIT was poorly followed through and was acknowledged as something which is challenging to achieve in practice due to the various different projects within NPfIT which all used different approaches to estimate benefits:

- Benefits informatics zone; a repository for benefits information and an outline forum developed by the department.
- Benefits eligibility framework; appraising and evaluating policies, programmes and projects, including guidance on how benefits could be categorised,

quantified and valued, advice from economists and specialists and road shows to educate SROs and project teams.

- Change and benefits leads from SHAs to ensure consistent approach to benefits realisation across the NHS.

NHS IT policy:

It could be argued that 'IfH' and 'NPfIT' were destined to fail as both policies received criticism for being ambitious and unwieldy from the outset. This was attributed to the number of initiatives and targets within the two policies, which were not always aligned with other NHS targets. For example, 'The Protti Report' identified that 'IfH' contained over '40 EHR initiatives at national level as well as various other non-health initiatives relevant to EHRs'. In addition, the various initiatives proposed by 'IfH' and 'NPfIT' were subjected to 'shifting priorities, re-scoping and re-prioritisation' as illustrated below:

One of the many observations I made this year was the apparent shift from the primary intent of 'IfH' in supporting day-to-day clinical practice to one of collecting data for retrospective analysis such as clinical governance.

(The Protti report, 2002: P.7).

The ambitious nature of NHS IT policy is also illustrated by the fact that since 1998, NHS IT policy has had to revise its timescales which suggests that policies have tried to achieve too much within their allocated timeframes. For instance, 'Building the Information Core' was published in 2001 as an update to 'IfH' as it was acknowledged that 'IfH' would not achieve its ambitions within its original time scales. Evaluations of 'NPfIT' also criticised the fact that due to delays in the implementation of electronic records the timescales of 'NPfIT' were revised. Despite this, the trend of overly ambitious NHS IT policy is continuing, and is reflected by the Secretary of State's target for a 'paperless NHS by 2018', an aim which has already been delayed to 2020. However, one evaluation of 'NPfIT' (*The Dismantled NPfIT*) has also criticised the feasibility of a paperless NHS, with this early skepticism based on the fact that the aim relies on standards being implemented across the NHS, a more realistic timetable, GPs to be paperless by 2015 and a budgeted and costed plan for achieving the ambition. It could therefore be argued that not only are policies too ambitious in terms of the number of initiatives and time frames in which these aims are to be achieved, but that the feasibility of their aims should also be questioned:

After the sorry history of the National programme, we are skeptical that the department can deliver its vision of a paperless NHS by 2018

(The dismantled NPfIT, 2013: p.6).

A policy issue unique to 'NPfIT', which affected the implementation of electronic records was the re-organisation of the NHS proposed in 2010. Evaluations of 'NPfIT' considered the re-organisation to not only threatened the future of 'NPfIT', but believed it created a number of issues for benefits and particularly EPR contract management that would not have occurred otherwise. The re-organisation was considered to have particularly affected contract management as contracts became the responsibility of NHS trusts and were due to expire at the same time that the health reforms were scheduled. Hospitals were therefore left in-the-dark as to how to manage contracts and whether 'NPfIT' would continue. Technical issues also emerged when individual trusts were given responsibility for implementing electronic record systems, as suppliers had to do a large amount of customisation to meet individual trust needs, which ultimately caused further delays to the implementation of electronic records:

The re-organisation of the NHS announced in July 2010, which involves major changes to the role of the Department and many parts of the NHS, has a number of implications for the future of the programme. Currently, the programme is managed nationally by Connecting for Health, part of the Department, with ten strategic health authorities responsible for implementation and benefits realisation locally. By 2012, as part of the re-organisation of the NHS, strategic health authorities will be abolished and the existing governance structure will disappear.

(NPfIT: an update on the delivery of care records systems, 2011: p.41-42).

Additionally, after 'NPfIT' was dismantled, the future of electronic records was put into question and although the DoH claimed that 'NPfIT' had been abolished, contracts were still honoured and projects were still running. Although the reasons for this were not explicitly stated within evaluations of policy it can be inferred that contracts and projects for delivering electronic records continued as they were due to finish in 2014 and 2015. Therefore if the NHS were to exit these contracts early, they would have incurred large exit costs which would have increased the overall cost of 'NPfIT' further without having delivered the systems:

Although the department told us that the National Programme had been dismantled, the component programme's are all continuing, the existing contracts are being honored and significant costs are still being incurred. The only change from the National

Programme that the Department could tell us about was that new governance arrangements were now in place.

(The dismantled NPfIT, 2013: p.8).

Interoperability:

Integrated care has been a feature of NHS IT policy since 'IffH' (1998). However difficulties in achieving interoperability or the extent that systems and devices can exchange and interpret data (HiMMS, 2015) is often described anecdotally as one of the key challenges associated with implementing electronic records. This has been attributed to the local approach used for implementing electronic records during 'IffH' and revisions to the centralised approach during 'NPfIT' leading to a lack of commonality in the systems used by hospitals throughout the NHS. Furthermore, despite proposing that electronic records will be interoperable throughout the NHS since 1998, no mechanism for achieving this exists; with the only guidance for trusts on the subject relating to the importance of universally used standards to facilitate data sharing and an 'interoperability toolkit'³. What is more, despite this uncertainty and delays to delivering electronic records the DoH remained optimistic throughout 'NPfIT' that its vision of integrated records could be achieved and estimated that achieving interoperability would cost approximately £220 million. However, where this estimation originated from, given that the way to achieve interoperability remains unknown is unclear:

The department believes that its compromise of a 'networked' approach of locally tailored systems will still enable the programme's aims to be achieved, but it has no means by which to ensure interoperability between locally procured systems and those delivered through the programme.

(Dismantled NPfIT, 2013: p.11).

Policy Management and leadership:

The Protti report and evaluations of NPfIT perceived the lack of responsibility and accountability from policy management as contributory factors to the limited progress achieved. *Protti's* criticisms of 'IffH's' management were attributed to uncertainty surrounding who was responsible for the various different electronic record initiatives and how they interact and contribute to the overall aim of integrated electronic records. Conversely, despite praising the commitment and support from senior ministers and

³ A common set of specifications, frameworks and implementation guides to support interoperability across health and social care (HSCIC, 2015)

leaders of 'NPfIT', evaluations of the policy considered its poor management and weak leadership to have directly contributed to the limited progress realised and held Sir David Nicholson solely responsible for the policies weak program management.

One factor which contributed to these failings is the department's weak programme management. We are concerned that, given his significant other responsibilities, David Nicholson has not fully discharged his responsibilities as the Senior Responsible Owner for this project. This has resulted in poor accountability for project performance.

(NPfIT an update on the delivery of detailed care record systems, 2011: p.3).

Access to electronic records:

Although providing patients with access to their records and concerns over the security and confidentiality of these systems continue to be debated topics within current NHS IT policy ('Safer hospitals safer wards', 'Personalised Health and Care 2020'), *The Protti report* was the only evaluation of national policy to consider these issues as challenges to implementing electronic records. The report particularly highlighted the need for the public to trust the way the NHS handles and uses their information. *Protti* argued that the issue of patient access was exacerbated by the lack of legislative guidance and professionals' reluctance for patients to be informed of what data they have access to. Whilst the financial consequences of litigation were discussed within *The Protti Report*, the potential damage to the NHS' reputation and risks to staff were not. This is despite the fact that if trusts are not provided with sufficient legislative guidance and therefore are not aware of their legal obligations surrounding patient access, record security and confidentiality it is unlikely that staff are either:

Legal opinion was given that a number of bodies are currently exposed to a degree of legal risk in relation to patient records. Many of these organisations may be unaware of their duties and obligations under the law in respect of patient records. They may also not fully appreciate the implications of breaching them. It should not go unnoticed that negligence against NHS hospitals have risen by £700million in one year, to an estimated £3.9billion-almost 10% of the annual NHS budget 1999-2000 for England of £40.1billion- according to May 2001.

(The Protti Report, 2002: p.7-8).

Infrastructure:

The NHS is renowned for its ‘internationally acclaimed infrastructure’ (*The power of information*). Although these achievements have been described as ‘window dressing’, ‘Protti’ responded to this criticism by stating that without it ‘all the applications in the world would do little to facilitate electronic communications within the NHS’ (*The Protti Report*). Figure 5 displays the key pieces of infrastructure where progress has been made by the NHS between 1998 (*IfH*) and 2012 (*NPfIT*). Key pieces of infrastructure are applications and services which NHS IT policy (*IfH*, ‘*Building the Information Core*’ *NPfIT*) considers to be pivotal to the implementation of electronic records. Definitions for the infrastructure described in this section are provided in appendix 4.

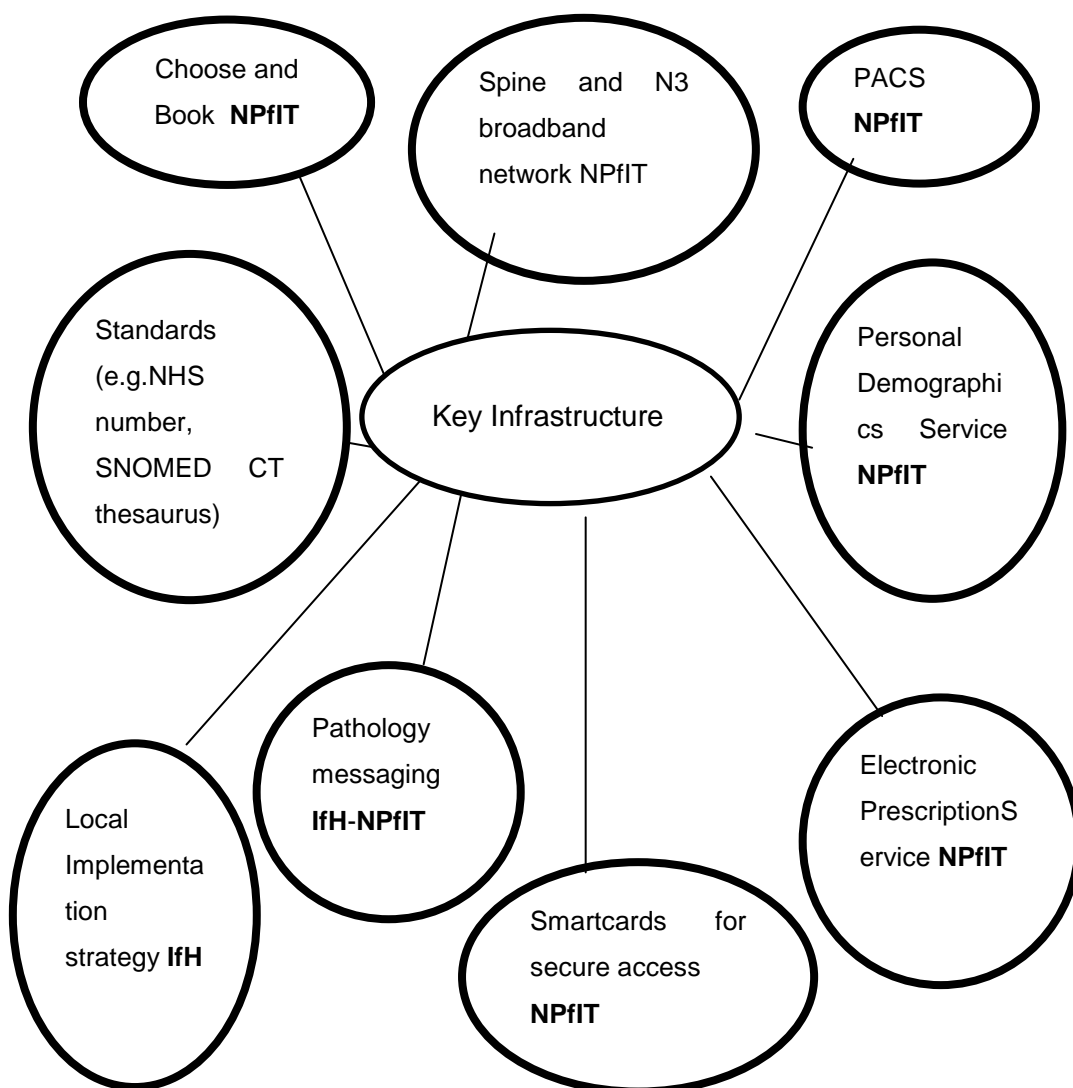


Figure 5: Key pieces of infrastructure which have seen success and that are crucial to implementing electronic records

used to provide universal codes for communication and the development of electronic records; however the use of this as the primary identifier for patient data is yet to be achieved. *NPfIT* also saw the successful implementation of 'Choose and Book' a service allowing outpatients to book appointments and the Picture Archiving and Communications Service (PACS) system, which enables 'the whole health system to share images securely'.

However, although Choose and Book and PACS were implemented into all acute NHS trusts and in the case of Choose and Book also primary care, the reporting of this progress by evaluations of *NPfIT* could be considered misleading. Firstly, these 'successes' were reported on numerous occasions, with one evaluation of *NPfIT* describing how PACS had been successfully implemented into all NHS acute trusts on four separate occasions. Secondly progress or successful implementation equated to infrastructure being implemented and available, however usage rates which were often poor were scarcely mentioned. For example, an evaluation of *NPfIT* reported that Choose and Book had been implemented into all acute and primary care trusts, but usage was 'lower than expected' due to some trust systems being incompatible with the Choose and Book system. In reality, patients were either unable to book appointments or were required to use an 'indirectly bookable service' which required patients to telephone hospitals to make appointments. Additionally, when usage was described this was on some occasions reported as the number of times a system had been used, which without any context or understanding of what would be expected or would reflect NHS wide access these figures are meaningless. Lastly, PACS and Choose and Book were not within the original scope of *NPfIT* and so it could be argued that these were successes that should be attributed to previous policy. In light of this and the way that progress was reported it could be argued that evaluations of *NPfIT* have overemphasised the progress made by *NPfIT*, particularly considering that prior to *NPfIT* PACS had already been implemented into a third of NHS acute trusts in England:

Since then uptake has been slower than expected and at October 2005 was about a year behind schedule, by 3rd April 2006 245218 bookings had been made with 4109 patients making at least one booking.

(NAO: NPfIT session 2005-2006, 2006: p.17).

Meso factors affecting the implementation of electronic records:

Organisational learning and sharing of lessons learned:

National NHS IT policy considers organisational learning and sharing best practice as critical to the development and implementation of electronic records since 1998. Despite this, *The Protti Report* and evaluations of *NPfIT* implied that the only sharing of best practice and lessons learned between NHS trusts occurred through informal networks or personal contacts; which suggests and supports anecdotal evidence that the NHS has been historically poor on both accounts. *The Protti report* was particularly critical of the lack of organisational learning that took place during *IfH* and highlighted the failure of the English NHS to learn from Scotland despite their significantly greater progress in implementing electronic records. Furthermore despite the Electronic Record Development and Implementation Program (ERDIP) which aimed to be a facilitator for organisational learning using a number of trusts in England as demonstrators to explore the implementation and development of EHRs during '*IfH*', the only organisational learning that occurred was through creating and disseminating reports:

Another observation that caused me some anxiety was the apparent lack of organisational learning that is so critical to long-term success. I found little evidence of anyone bringing together the many lessons being learnt.

(The Protti report, 2002: p.7).

Micro factors affecting the implementation of electronic records:

Reluctance to change

It is well acknowledged that the NHS is a complex environment within which to introduce change. However, both *the Protti Report* and evaluations of '*NPfIT* perceived national policy to have underestimated the complexity and amount of change associated with introducing electronic records. Reluctance of NHS staff to accept this change was considered a particular issue by evaluations of national NHS IT policy. However, whilst *The Protti report* attributed this to staff feeling over-worked, under-supported and in 'response mode' to the various different initiatives within NHS IT policy and the wider NHS, evaluations of *NPfIT* attributed it to the historical use of paper and delays in the development and deployment of electronic records during the policy:

The origins of the programme come from an era when a hospital consultant would use a pen to write notes on the GP's patient referral letter as part of the paper-based patient care record. The NHS environment being a large and loose confederation of organisations and services represents a formidable environment in which to bring about changes to business process. There continues to be an under-estimation, by stakeholders and observers of the magnitude and complexity of the change involved.

(MPA review of NPfIT, 2011: p.11).

Lack of engagement and commitment from NHS staff

The Protti Report attributed a lack of commitment and buy-in from NHS staff as a reason for the limited progress made in implementing electronic records; however the issue was not expanded on further. Evaluations of *NPfIT*, also attributed the limited progress made during '*NPfIT*' to issues with clinician involvement and stated that if clinicians were to have been involved from the beginning some of the issues encountered during the policy could have been prevented. The limited involvement of clinicians during '*NPfIT*' is illustrated by an independently conducted survey cited within evaluations of the policy which reported that only 30% of staff had the opportunity to shape decisions about IT systems. Furthermore evaluations of *NPfIT* stated that clinician involvement was restricted to staff representatives on boards with front-line staff only being consulted after systems had been procured; allegedly due to resource constraints and perceptions that involving staff earlier would raise expectations that could not be met. Therefore, despite national NHS IT policy consistently identifying NHS staff engagement and involvement as a key enabler to the successful implementation of electronic records, this has not been achieved and was reported by one evaluation of *NPfIT* to have been underestimated. This suggests that more could be done to ensure staff are effectively engaged and involved at all stages of implementation. It could also be argued that evaluations of national policy have underestimated this issue as in comparison to other, macro factors that have been previously discussed the attention and detail given to this issue and other meso and micro factors discussed in this chapter was limited:

The department also recognised that care records systems would have been easier to deliver if there had been more clinical engagement at the outset of the Programme to help define specifications for the required IT systems.

(NPfIT: an update on the delivery of detailed care record systems, 2011: p.7).

Section summary:

The NHS has implemented 'internationally acclaimed infrastructure', which has provided essential foundations for electronic records, however, progress in implementing electronic records has been limited. Evaluations of national NHS IT policy identified a number of reasons for this, which have been structured and discussed using the three levels of sociotechnical thinking; macro, meso and micro. Given that the macro level in

this context represented influences on electronic record implementation that operate at the national level (policy, social norms, technological developments and finance), it is unsurprising that the majority of reasons attributed to the limited progress made by evaluations of national NHS IT policy were macro level influences. Despite being well acknowledged issues within evaluations of NHS IT policy, all of the macro level influences continue to hinder the implementation of electronic records today. For example, it is still unknown how to achieve interoperability and trusts continue to be faced with ambiguous and overly ambitious targets which are to be achieved within small timescales, without descriptions of what these aims mean in practical terms and without practical knowledge of how to achieve them (e.g. a paperless NHS by 2018).

Conversely, only three meso and micro factors were attributed by evaluations of NHS IT policy to the limited progress that has been made. Despite each of these factors (organisational learning, change management, clinician involvement) featuring within NHS IT policy and being identified as critical to successful implementation of electronic records little attention was given to these issues by evaluations of policy in comparison to macro level influences. Furthermore, the meso and micro factors identified were also social or human issues whilst the macro level influences tended to be more technically orientated. This may therefore illustrate a potential underestimation of social level influences by NHS IT policy. However, given the evidence that cites the importance of giving equal weight to both social and technical issues when implementing technology into healthcare organisations, the over-emphasis on technical issues by NHS IT policy, could in itself be considered a reason for the limited progress made in implementing electronic records.

3.1.5. Recommendations

Evaluations of national NHS IT policy provided a number of recommendations for future policy. Of these recommendations a number were made by evaluations that took place during 'NPFIT' and so are not discussed here as they are specific to that policy. For instance, recommendations that related to the management of specific electronic record contracts are not included in this section. As in section 3.1.4, due to the range of recommendations that were identified by evaluations of NHS IT policy, these have been structured and are discussed as macro, meso and micro level recommendations. Whether these suggestions have been adopted by current NHS IT policy (*Safer Hospitals, Safer Wards, Personalised Health and Care*) is also considered and was determined by exploring existing policy to see whether their aims and strategies show evidence of considering the recommendations proposed by previous NHS IT policies.

Macro level recommendations:

Delivering electronic records:

In light of the uncertainty surrounding the best routes to implementing electronic records *Protti*, stated that he felt unable to provide explicit guidance for trusts to follow and so offered some generic recommendations that included: collaborative planning, clinical commitment and the need for local health economies to co-operate so that patient data could be shared. However, as previously discussed, the local approach for implementing electronic records during 'IfH' created vast heterogeneity in the types and functionality of electronic record systems that were introduced and so *The Protti Report* suggested that future policy should take a more centralised approach to implementation. However, this also proved unsuccessful during *NPfIT* as despite aiming for a standardised electronic record to be implemented, after the policy was dismantled the NHS was once again left with a fragmented and limited number of electronic record systems. This may account for evaluations of *NPfIT* failing to provide recommendations for future policy and the limited guidance featured within current NHS IT policy, which although outlines two potential routes to electronic records, acknowledges that no best method has been established:

The technology stack of a hospital IDCR system ranges from 'a fully functional, single, end-to-end, integrated system that covers every clinical function' to 'a patchwork quilt of individual, functionally rich modules, stitched together to allow data to transfer between systems' with lots of varying combinations in between. These can be referred to as 'single solution' and 'best of breed.' There is no definitive right answer when deciding which architectural approach to take.

(Safer hospitals safer wards, 2013: p.16).

However, to help trusts move towards integrated electronic records, evaluations of 'IfH' and 'NPfIT' suggested that future attempts to implement electronic records should focus on introducing core areas of functionality. For instance, after the original vision of a single integrated record was disregarded, evaluations of *NPfIT* proposed that five clinical areas of functionality and specific departmental systems should be implemented. This recommendation has subsequently been used to formulate the basis of levels 1-3 of NHS England's Clinical Digital Maturity Index (CDMI) (appendix 5); a framework proposed in 2013 to enable hospitals to assess the functionality of their current electronic systems and which was also designed to help them move towards an IDCR (NHS England, 2014a).

This review identified five clinical areas of functionality and certain departmental systems, such as maternity or A&E, as being the minimum specification that would be acceptable to clinicians. The original vision will not be delivered and the Department is now focused on delivering these five areas of functionality from a 'menu of modules' which enables each NHS acute trust to select those aspects of the system they need most.

(NPfIT an update on the delivery of detailed care records, 2011: p.11).

Lastly, when considering recommendations made by evaluations of 'NPfIT' in relation to the delivery of electronic records it is surprising considering the comparably greater success in implementing these systems into London hospitals (table 7) that the reasons for this were not explored and that this success was not built on or used to inform future policy and implementations of electronic records.

Funding, costs and benefits

As discussed in section 3.1.4, there has been a general lack of transparency in the reporting of the amount invested into electronic records with funds originally intended for electronic record projects also in some cases being re-allocated to other projects outside of NHS IT. *The Protti Report*, therefore stated the need for a longer-term investment strategy that guaranteed funding over a number of years, with evaluations of NPfIT also recommending that to achieve a paperless NHS a specific budget for achieving the aim was required. NHS IT policy responded to these recommendations and developed the 'Safer Hospitals, Safer Wards Technology Fund' which committed £500 million to be invested into hospitals wanting to implement IDCRs between 2013 and 2015. However, the most recent policy *Personalised Health and Care* has failed to provide any indication as to how electronic records and the policies aims will be implemented despite the *Safer Hospitals, Safer Wards Technology Fund* not being available for hospitals from 2016; therefore making the future funding of electronic record projects uncertain:

The key enabler will be the £260 million Safer Hospitals, Safer Wards Technology Fund announced by the Secretary of State for Health in May this year. NHS England will administer and deliver the Fund, which is open to NHS Trusts, including Foundation Trusts, ensuring that it facilitates the rapid progression to digital records.

(Safer hospitals safer wards, 2013: p.6).

Following the failure of 'NPfIT' to adequately report on the policies costs and benefits, evaluations of the policy highlighted the importance of providing future evaluations of

NHS IT policy with 'timely and reliable information' so that where necessary parliament can be held accountable and accurate reports of costs and benefits can be produced. This was considered to be of particular importance given the uncertainty that ensued and which still surrounds the final costs of 'NPfIT', despite evaluations of the policy having called for the then forthcoming Whitehall-wide review to re-report on the final costs of NPfIT:

The Department must provide timely and reliable information in future to support effective accountability to Parliament.

(An update on the delivery of detailed care record systems, 2011: p.6).

NHS IT policy:

The Protti Report and evaluations of NPfIT suggested new directions for national NHS IT policy. Although '*Building the Information Core*' which was an update of '*IfH*' had been published earlier in 2002, *The Protti Report* recommended that EPR and NHS IT targets should be revised as they were no longer considered achievable or in line with the policy or business needs of the wider NHS. More specifically, *Protti*, suggested that a reduced number of less ambiguous EPR targets, that prioritised the delivery of the aforementioned core modules and functionality (results reporting, order entry, medication prescribing, scheduling and integrated pathways) should be proposed. Perhaps the most notorious recommendation that emerged from evaluations of NHS IT policy was for 'NPfIT' to be dismantled as the '*MPA review of NPfIT*' felt that the remaining £4.3billion that was available to the policy would be better spent elsewhere and that dismantling the policy would allow new management and governance of NHS IT to be established without compromising the ambition for 'improved patient care through technology enablement'. Although, it could be argued that since '*IfH*' the number of electronic record related initiatives have been reduced, the number of policies published since then (figure 2), which have proposed ambiguous or challenging targets to be implemented, within short timescales (an IDCR, a paperless NHS by 2018) suggests that this advice has not been fully headed. Furthermore, despite evaluations of NPfIT shedding doubt over the feasibility of a paperless NHS and the target already having been postponed to 2020, these targets remain at the heart of NHS IT policy:

There is a pressing need to reduce the number of developments and initiatives. It would be wise to focus down on a number of key initiatives in the next two years to bolster

confidence in what is being done by making demonstrable improvements for NHS staff and patients.

(The Protti Report, 2002: p.6).

Defining terms:

Despite aiming for EHRs and EPRs to be implemented throughout the NHS, at the end of 'IfH' the concept of an EHR and EPR and the specific standards, content and functionality of these systems was not established. In recognition of the difficulty in implementing systems which are not adequately defined, *The Protti Report* called for the terms to be clearly established. Whilst it is now generally accepted that electronic records represent systems for enabling integrated care throughout the NHS, their specific content and functionality is something which is still not universally known (chapter 1, section 1.1.) and has been complicated for the variety of terms used to describe electronic records (table 5). Protti's recommendations are therefore still valid today, the importance of defining these terms and ensuring that definitions that are unambiguous and which are accepted throughout the NHS are highlighted in the extract below:

From the limited material available up to now, it is clear that there is still uncertainty about the EHR, not only from a standards perspective but also in terms of its content, functionality, protection, and usage. Whether the EHR should be a primary and/or a secondary record, and whether it should be an active (directive) or passive (retrospective) record also needs further investigation. If active, then the full array of decision support tools (alerts, reminders, etc.) would have to be included.

(The Protti report, 2002: p.30)

Interoperability and data sharing:

The Protti Report suggested that to overcome data sharing restrictions, more detailed descriptions of interoperability and sharing expectations were required; with the need for the NHS number to become the key identifier for patient data so that information can be located and retrieved from patient records throughout the health and care system also emphasised. Since then, policy and evaluations of NHS IT policy have provided a greater emphasis on interoperability and evaluations of *NPfIT* have proposed a number

of recommendations for achieving the ambition including: using the spine and NHS network as the 'glue' for connecting care settings and applying exchange standards, ensuring products used by GPs and trusts comply with rules and technical standards. However, aside from an 'interoperability toolkit' being developed as a guide for trusts, little progress has been made and interoperability is now considered one of the key barriers to the implementation of electronic records by NHS IT:

*Where local ICT services are obtained by Trusts and GPs they will choose from the market. In order to ensure connectivity and interoperability the products they choose must comply with rules and technical standards. This already applies to private sector healthcare providers. The Interoperability Toolkit (ITK) developed by **[Connecting for Health]** CfH provides a basis for some form of accreditation of products' connectivity to the Spine and network, which is an essential prerequisite for the market to operate effectively for the NHS. There will need to be a form of a regulation around connectivity standards and compliance rules which enables choice of product and service provider by Trusts.*

(MPA review of NPfIT, 2011: p.24).

Policy management and leadership:

The Protti Report made a number of recommendations for future NHS IT policy management which included the need for clinician's to lead future NHS IT projects and for future policy to have clearer leadership with an individual committed to change management and electronic records at the forefront. Additionally, it was proposed that Chief Information Officers (CIOs) should be introduced and should be responsible for not only managing technology but improving NHS staff performance, change management and the human aspects of program management. It could be argued that 'NPfIT' acted on these recommendations by appointing Sir David Nicholson as SRO for the policy. However, Protti's warning that one person cannot lead a major program was ignored and ultimately, Sir David Nicholson was held accountable for the policy's weak management. The uncertainty surrounding the outcome of the NHS reforms meant that recommendations for the future management of NPfIT made by evaluations of the policy were not definitive; as if the programme and NHS was to be re-structured then significant changes to management and those responsible for the implementation would and indeed did ensue. However, evaluations of NPfIT did propose that Connecting for Health (the organisation responsible for maintaining and developing NHS' infrastructure,) should be disregarded. This was acted on and NHS England is now

responsible for NHS IT policy, with different teams for different projects and in some cases different care settings existing:

The proposed elements of how future work will be managed and organised are as follows: Dedicated informatics teams in each national and local body in health and social care. An Information Centre for Health and Social Care authorised to conduct national data collection. An encouraged range of informatics" shared services", where local organisations choose to share. A national shared informatics pool of skills on IT architecture, standards, programme management, change management, contract management etc., available to support local dedicated informatics teams.

(MPA review of NPfIT, 2011: p.15).

Access to electronic records:

Security issues associated with electronic records have been described as the key standards issue hindering their delivery by evaluations of NHS IT policy, however only *The Protti Report* provided recommendations for overcoming these issues. Central to this was informed consent with *Protti* outlining the importance of ensuring the public trusts the way the NHS handles and accesses their information. More detailed suggestions for overcoming this issue and ensuring that only authorised individuals have access to patient records included: revised legislation, automation of the consent process (or consent through GPs), auditing who accesses patient data and establishing who is involved in consenting to data being transferred into electronic records. Further recommendations for how the NHS and DoH could overcome the issues surrounding patient consent and informed consent are outlined below. *The Protti Report* also provided a number of recommendations for providing patients with access to their records including; the need for secure systems created by health professionals, a national directory of web sites and health care professionals, back up security including audit trails and the use of the NHS number in all NHS systems. However, with the exception of GP records, patients are still unable to access their records and issues surrounding security, confidentiality and public trust are still debated within current national IT policy, suggesting that the issues discussed and recommendations made by *Protti* have not yet been resolved:

The commitment to informed consent as the norm for handling patient information requires action to be taken to address the current shortcomings in the ways in which the NHS captures, stores and processes personally identifiable information is required that patients are properly informed of what data is being held, the uses to which it will be put, and those who might have access to that data. Except in the case of statutory

requirements, patients would also have the right to refuse consent. In all other circumstances, steps will need to be taken to anonymise the data.

(The Protti report, 2002: p.33).

Meso level recommendations:

Organisational learning and sharing lessons learned:

Evaluations of *NPfIT* criticised the lack of organisational learning and sharing of best practice during the policy and subsequently suggested that trusts should be incentivised to collaborate through ‘levers in governance arrangements’ and ‘capitalising on informal networks that currently exist for inter-organisational learning’. More detailed recommendations were however provided within *The Protti Report* where it was proposed that academic institutions and the NHS Electronic Library for health should act as facilitators for organisational learning and sharing best practice. In addition to the recommendations outlined below *Protti* also called for: sharing of positive practice, a ‘clearing house of information related activities’ comprising an indexing system identifying who is doing what and what is their experience in relation to electronic records and an ‘organised experimentation’ approach to be taken with electronic records; due to no best route having been established. However, these recommendations provide little guidance for hospitals to follow which in conjunction with the poor history of organisational learning within the NHS and the fact that NHS organisations are often in competition with one another for funding (e.g. the Safer Hospitals Safer Wards technology fund required trusts to apply for funding) sharing lessons and best practice is in reality a complex and challenging issue:

Develop an active and vibrant knowledge management (learning) program. Knowledge management is about creating a learning environment where knowledge sharing is part of the culture. Learning is fundamental to enhancing local creativity and national cohesiveness. In an information-intensive service such as healthcare it is a ‘must have’ not a ‘nice to have’. It is critical to information sharing and a common direction.

(The Protti report, 2002)

Micro level recommendations:

Change management and engaging NHS staff:

The Protti Report was the only evaluation of NHS IT policy to provide recommendations for change management, however the importance of the issue is highlighted by the fact that NHS IT policy has and continues to acknowledge the amount of organisational change required to implement electronic records and the challenge of overcoming staff's reluctance to accept and adopt new technology. *The Protti Report* stated the importance of ensuring that clinicians perceive the benefits associated with implementing electronic records to outweigh the costs. *Protti* also suggested that to ensure successful implementation senior NHS staff buy-in and end-user engagement is crucial, as if staff are not engaged with the technology it is unlikely they will be willing to use it. To facilitate this, *Protti* recommended the use of local champions to help promote systems, build support and overcome resistance to change. However, it was acknowledged that achieving successful change management is challenging particularly considering the time it takes to produce clinical benefits and the potential detrimental effects that delays to projects and lengthy implementations can have:

IfH is very much about change. It is about changing behaviours. Changing information behaviours requires change management approaches and thinking. The ultimate goal of managing information behaviour is to create a positive information culture-one where it's simply the norm to "do the right information thing".

(The Protti report, 2002: p.45).

Training NHS staff:

Training NHS staff is regularly featured within NHS IT policy as a key enabler to successful EPR implementations however only a small number of recommendations within *The Protti Report* were proposed. The report suggested that when it comes to training staff although it is easy for organisations to cheat and not provide adequate training 'enough is never enough' as the benefits, if training is delivered properly outweigh the costs. Additionally *Protti* described the need for hospitals to ensure that staff have protected time for IT training and are held responsible for ensuring that all staff are IT literate. Although training was not identified as a reason for the limited progress in implementing electronic records by evaluations of national NHS IT policy, the fact that NHS IT policy continues to outline the importance of ensuring all NHS staff are computer literate suggests that this is not the case for all NHS organisations:

It is very easy to cheat on training yet when done well, it reaps rewards will beyond the investment costs.

(The Protti report, 2002: p.45).

Section summary:

Evaluations of national NHS IT policy proposed a range of recommendations for future policy. Although there appears to have been some instances where policy has utilised these recommendations (e.g. *NPfIT* adopted a central approach to implementing electronic records, as suggested within *The Protti Report*) the lack of reference to previous evaluations within policy documents makes it difficult to say with any certainty the extent that their aims are based on these recommendations. However, given that the reasons for limited progress in implementing electronic records are being repeated (3.1.4) and recommendations for future policy have remained relatively unchanged since 1998, this suggests that lessons are not being learned and recommendations are not being acted upon. The reasons for this are discussed in more detail within section 3.2.1.

3.2. Discussion:

3.2.1. Findings:

This is the first study to explore progress made by the NHS in relation to implementing electronic records over time. This section will answer the study's research questions by discussing the key findings in relation to current NHS IT policy and existing literature.

Definitions and terminology relating to electronic records is inconsistent and has changed over time:

This study confirmed concerns that there is confusion and a lack of universally accepted definition for electronic records (Garets & Davis, 2006; chapter 1 section 1.1). Despite being identified as an issue within *The Protti Report* in 2002, there is still no accepted definition or terminology for electronic records (NHS England, 2013). This study has provided some insight into this issue as it was determined that since '*lfH*' in 1998, each NHS IT policy has introduced new terminology for electronic records; without always clarifying the systems and functionalities that these terms encompass (figure 3). Adding to the confusion, since '*NPfIT*' was dismantled in 2012, national policy has moved away from the terms EPR and EHR and instead refers to IDCR and digital

records when referring to electronic records. However, other than stating that IDCRs refer to an ambition for integrated digital records no explanation of what systems or functionality this term encompasses or how an EPR fits within this definition was provided. Therefore, whilst it may be anecdotally assumed that EPRs are one way of achieving IDCRs this has not been established and the current ambition and terminology is open to interpretation. Furthermore, those responsible for implementing electronic records and academics continue to use the terms EPR and EHR, however without a universally accepted definition reporting and disseminating academic literature and indeed best practice regarding electronic records and/or EPRs is difficult.

Aims of national policy in relation to implementing electronic records are recurring:

The aims of national policy in relation to electronic records have remained unchanged since *'IfH'* in 1998; with all policies striving to implement integrated electronic records for all patients throughout England whilst also seeking to provide patients with access to their records. This suggests that limited progress has been made in implementing electronic records, the various reasons for which have been identified in section 3.1.4 and are discussed below. A further reason which may be associated with the limited progress made may be attributed to the fact that the aims proposed by NHS IT policy are too ambitious and are suggested without the technological capabilities for achieving them being in place. For instance, in 1998 *'IfH'* proposed that integrated electronic records should be achieved by 2005 despite the concept of an EPR being poorly defined and the systems and functionality necessary to achieve this aim not having been developed. Furthermore, the practicalities and knowledge of how to achieve interoperability which relates to how systems being implemented into NHS organisations connect was not known and remains one of the biggest challenges facing the NHS and IDCRs today.

A range of social and technical factors can be used to explain the limited progress in implementing electronic records between 1998 and 2015:

This thesis is underpinned by social technical thinking (chapter 1, section 1.3), a theory that challenges the idea that IT implementations in healthcare fail purely for technical reasons (Coiera, 2004). In support of this, the findings of this study suggest that a range of social and technical factors can be attributed to the limited progress in implementing electronic records into NHS health and care organisations. For example, the level of

staff commitment to IT projects and difficulties in ensuring EPR systems were interoperable within and between NHS organisations were acknowledged issues by evaluations of NHS IT policy. As in section 3.1.4, the various factors that were seen to contribute to the limited progress in implementing electronic records, are discussed as macro, meso and micro level influences on progress between 1998 and 2015.

Macro level influences on progress in implementing electronic records:

As expected from a study whose conclusions were drawn from policy documents and evaluations of policy, the majority of influences on the NHS' progress in implementing electronic records were macro factors that operate at the national level. Of these factors, despite praising the way in which electronic record contracts were selected and suppliers were procured the majority of criticisms of 'NPfIT' related to the weak negotiating capacity of the DoH and the poor management of electronic record contracts and suppliers. This is perhaps most clearly exemplified by the fact that after revisions to contracts for electronic records the number of systems to be implemented was significantly reduced without comparable reductions in costs.

The local (hospitals have autonomy) and centralised (the DoH has autonomy) approaches to implementing electronic records adopted by 'IffH' and 'NPfIT' were also criticised by evaluations of national policy. However, the lack of established 'best method' for implementing electronic records has been a recurring issue since the 1980s (Wainwright & Waring, 2000. Chapter 2, Section 2.3) and makes it difficult to criticise the rationale for using these approaches as no evidence was available other than lessons from other NHS IT projects (e.g. Microsoft) or previous policy; which in the case of 'NPfIT' were used to formulate the policies decision to adopt a more centralised approach. Given that both local and centralised approaches adopted by 'IffH' and 'NPfIT' led to vast heterogeneity and a limited number of systems being implemented, it is also difficult to ascertain which method was more successful; particularly when considering that evaluations of NHS policy suggest these approaches were poorly implemented and were changed. For instance, 'NPfIT' altered its approach from a standardised one size fits all to a connect all approach where systems were to be implemented and later integrated or connected. The idiosyncratic nature of the health and care organisations into which these systems are to be implemented (trust type, size, clinical needs) does however make it reasonable to assume that no single system is likely to meet all NHS hospital's needs. Reflecting this assumption, 'Safer Hospitals Safer Wards' proposed two approaches to implementing electronic records: 'Best of Breed', where a range of departmental systems are implemented gradually and 'Single Solution' which typically

relates to one supplier providing a single all-encompassing system. However, no practical guidance as to how to use these approaches or evidence exploring the pros and cons of each approach or indeed circumstances under which they would be best suited was provided.

Although evaluations of NHS IT policy praised the level of funding that has been consistently invested into IT, information pertaining to the amount of money available was not always reported within NHS IT policy or in the case of 'NPfIT' was dependent on an unconfirmed bid being available. *The Safer Hospitals Safer Wards, technology fund* has however recently committed £500million to support trusts in their move towards IDCRs, with £260million and £240million being allocated to trusts in 2014 and 2015 respectively. The fund is however not available for 2016 with the latest policy document '*Personalised Health and Care*' failing to provide any funding information which when combined with the unprecedented financial pressures currently facing the NHS not only leaves a funding gap but also potentially places the government target for a paperless NHS by 2020 into jeopardy as no financial reassurance for trusts is available.

Additionally, despite estimating that 'NPfIT' cost approximately £11.4billion or £9.8billion (omitting future costs) a limited number of benefits aside from infrastructure were realised, with the program ultimately considered not to have provided value for money. The reported and continuing uncertainty of the costs reported, which evaluations of 'NPfIT' attributed to a variety of reasons including inaccuracies and inconsistencies in the figures provided by the DoH, suggests that final cost estimates may be conservative. In light of the limited progress and benefits that have been realised from 'NPfIT' it is critical that future policy considers evaluations and learns from the mistakes and its poor monitoring of costs and benefits so that the same level of financial wastage is not repeated.

Since the 1980's NHS IT policy has been criticised for being overly ambitious and trying to achieve too much within a short space of time (section 2.2, chapter 2), reflected by the number of policies that have been published in the 17 year period under study (figure 2). As a result, aims have often been subject to change or have been postponed, a trend which is continuing with the ambition for a paperless NHS having been altered from 2018 to 2020 since it was proposed in 2013. An additional observation from the analysis was that the aims of policy have become more visionary over time. For example, 'IfH' proposed a timeline for achieving its aims with specific projects and functionalities to be delivered by certain time-points, which although were in hindsight unrealistic did provide an explicit account of everything to be achieved. In contrast,

current policy (*Safer hospitals safer wards, Personalised health and care 2020*) communicates NHS-wide visions for IDCR and a paperless NHS. Therefore, whilst previous policies could be criticised for being too prescriptive, details as to what ambitions such as 'a paperless NHS' mean in practical terms are essential to promote a common goal and prevent these ambitions from being interpreted differently throughout the NHS.

'Most hospital information systems remain impenetrable to care professionals outside the hospital gate' (*Personalised health and care, 2020*). Nevertheless policymakers have persisted with their vision for IDCRs and a paperless NHS and have estimated the costs of achieving interoperability to be approximately £220million; despite the solution being unknown. A range of guidance for tackling interoperability and procuring and implementing interoperable solutions are available to NHS trusts: 'the interoperability toolkit' national standards e.g. using the NHS number as the primary identifier on all data, the interoperability handbook) (NHS England, 2013; HSCIC, 2015a). However, NHS health and care organisations have a number and range of departmental or electronic systems, which would be costly to replace but are not currently interoperable. Therefore if the NHS is to continue with their aim for IDCRs and a paperless NHS it is crucial that this issue remains a debated topic as it is fundamental to achieving these ambitions.

Evaluations of NHS IT policy also attributed the poor management of policy to the limited progress made in implementing electronic records. In particular, evaluations of policy criticised the uncertainty as to who is accountable for the various projects and initiatives responsible for EPRs. It could be argued that this remains an issue as various government bodies and organisations (DoH, NHS England, Health and Social Care Information Centre) are responsible for NHS IT and are comprised of numerous teams working on separate components and issues relating to electronic records (e.g. Interoperability, benefits realisation, patient access to records); with it unclear from policy how these individuals and organisations come together and work towards the overarching aims of policy.

In primary care patients have been able to access their GP records for some time and despite being a recurring ambition of policy since 1998 '*IfH*', *The Protti Report* was the only evaluation of NHS IT policy to acknowledge this as a challenge. Although providing patients with access to their records continues to be a key aim of current policy, the limited number of secondary care organisations with hospital wide electronic systems,

makes this aim appear somewhat premature at this stage. Furthermore, despite the success of Renal Patient View (Royal College of General Practitioners, 2010) and 'my diabetes my way' (NHS Scotland, 2016), which are systems that enable renal patients and diabetics to access their secondary care records respectively, the utility of providing all patients with access to their secondary care records is in my opinion debatable and raises the question of why patients without long term conditions would need to do so. Particularly when considering that patients have been able to access their paper records since the 1990s, which although had some associated procedural and physical difficulties was rarely utilised.

It is important to acknowledge that the NHS has successfully implemented a number of pieces of essential infrastructure that are considered crucial for being able to implement electronic records (figure 5), however the extent to which these applications are used was reported ambiguously. Furthermore, although significant progress has been achieved in some areas progress throughout the NHS is varied. For instance, there is a lack of universal Wi-Fi access across the NHS (*Personalised health and care 2020*). It is important not to forget this variation when considering the aims of NHS IT policy as whilst issues such as interoperability are significant barriers, if the NHS is to become paperless then the more 'basic' pieces of infrastructure such as Wi-Fi need to be universally implemented.

Meso and micro level influences on the progress of implementing electronic records:

Meso and micro factors that were perceived by evaluations of NHS IT policy to have influenced progress in implementing electronic records were restricted to organisational learning, change management and commitment and buy-in from NHS staff. Although considered critical success factors by policymakers and being well cited barriers within the literature (Thakkar et al., 2006; Overtveit et al., 2007b; Robertson et al., 2010; Waterson, Glenn, Eason, 2011; Takian, Sheikh & Barber, 2012; Evans & Stemple, 2008; Williams & Boren, 2008; Yu et al., 2013; Silow-Carrol, Edwards & Rodin, 2012) the time spent reflecting on these issues by both policy and evaluations of policy was limited; particularly in comparison to macro and technical factors. One potential explanation for this could be as unlike technical or macro factors the extent that these issues affect different healthcare organisations varies and so reporting and providing solutions for them is challenging. However an alternative explanation could be because failing to engage staff, share lessons or ensure change management does not have direct consequences to the implementation of electronic records or financial and political consequences.

Is there evidence of policy adopting recommendations made by evaluations of national policy?:

Evaluations of national NHS IT policy proposed a number of recommendations for each of the macro, meso and micro level factors that have been previously discussed. However there has been little evidence of these suggestions being adopted by previous or current policy, demonstrated by the reasons for limited progress and recommendations made by evaluations of policy remaining relatively unchanged since 1998 *'IfH'*. One explanation for this could be as although a number of suggestions have been made, they rarely include practical guidance or solutions for trusts; potentially as solutions for some issues such as interoperability are unknown. Additionally, new policies have often been published prior to, or a few months after evaluations of previous policies were conducted, giving little time for recommendations and lessons to be drawn upon. For example, *'Building the Information Core'* was published before *'The Protti Report'* and more recently *'Safer hospitals safer wards'* was published, months after final evaluations of *'NPFIT'* (figure 2). What is more, the way that evaluations of NHS IT policy are structured and worded does not always allow for key recommendations or issues to be easily identified, which may contribute to these recommendations not being taken on board by future policies. The apparent lack of lessons learnt from previous policy does however reflect a wider issue in terms of the purpose of these evaluations as if they are not used to inform future policy and lessons are not learned then their utility is questionable.

3.3. Strengths and weaknesses:

This is the first study that has aimed to explore the progress of NHS IT policy over a significant period of time and so adds to an evidence base that is currently limited to qualitative evaluations of *'NPFIT'* (Hendy et al., 2005, Hendy et al., 2007, Greenhalgh, 2011, Kreps & Richardson, 2007). The study also adds to a limited number of studies that have used policy analysis within health services research. Chapter 2 may therefore prove useful to others wishing to use the method as a detailed account of how documents were selected, identified and analysed is provided.

Using documents to explore the progress made by NHS IT policy is open to a degree of subjectivity and could be considered the study's main limitation. Particularly as progress was determined by thematically analysing whether aims of national policy were achieved and by identifying areas that evaluations of national policy felt limited progress had been made. However, due to the lack of guidance available for undertaking policy

analysis and the study aiming to explore progress over a 17 year period the methods chosen were considered preferable to other methods. For instance, interviewing stakeholders would not have been feasible, would have been subject to recall bias and would have been influenced by the negative portrayal of policies such as 'NPFIT' by the media.

The fact that NHS IT policy before 1998 'IfH' and evaluations of policy after 'NPFIT' (2012) were either not available or had not been conducted is a further limitation of the study as it could be argued that the conclusions drawn may not reflect or be generalisable to all NHS IT policy within the period. However, given that the issues identified by evaluations of policy are unresolved and the aims of policy have remained unchanged, the study is believed to represent the key issues that have affected and which continue to impact on the limited progress that has been made in implementing electronic records.

Lastly, the analysis was conducted by a single researcher and so could be considered open to researcher bias. To combat this, throughout the analysis regular meetings with members of my Thesis Advisory Panel (TAP) were held to ensure that the themes identified reflect the data.

3.4. Recommendations:

On the basis of the study's findings and recommendations made by evaluations of national NHS IT policy the following suggestions are proposed for future electronic record research and policy:

If NHS organisations are expected to implement electronic records, then the plethora of terms that currently exist for these systems need to be consistently used and defined. Policy could facilitate this by creating definitions with the help of clinicians, IT managers and academics and should pay particular attention to defining the systems, content, usage and functionality that these terms encompass. Additionally, policy should refrain from introducing more terms and should instead concentrate on ensuring that these terms are used consistently by all those responsible for implementing electronic records. It is also important that when reporting research, clear definitions of the systems studied are used and that the terms EHR and EPR are used appropriately and not interchangeably.

In light of the study finding that the aims of national policy have been repeated since 1998, it is essential that aims proposed are feasible and are supported by realistic

timelines. Perhaps more importantly, is the need of ensuring that before aims are proposed that the NHS has the technological capability and infrastructure in place to achieve them. To facilitate this, proposing a number of shorter, practical targets which are easier to achieve would not only help to reduce the heterogeneity between NHS organisations in terms of their infrastructure and current digital maturity but would also ensure that the foundations for achieving electronic records are in place. For instance, the NHS should aim to ensure that all health and care organisations have universal access to Wi-Fi.

The approaches to implementing electronic records need to be explored by policymakers and researchers, with the aim of producing guidance which includes practical advice and previous experiences of implementation within the NHS. It is acknowledged that achieving this is difficult, particularly as a one-size fits all approach or system will not be appropriate as it would not consider the variation between NHS organisations in terms of the care they provide, their resources and current levels of digital maturity. However, more formal evaluations of the costs and benefits of different approaches and their impact on factors such as the quality and safety of care provided would be useful. Additionally, NHS England should aim to proactively foster organisational learning and sharing of best practice between NHS organisations, even if at a regional level as this would allow organisations at different stages of implementation to share their experiences and prevent the same issues from occurring.

In regard to providing patient access to records, it is suggested that before significant time and resources are spent on achieving this for all patients, that research exploring the demand and need for this is conducted. If demand for this is established, a potential approach may be to use the model adopted by '*Renal Patient View*' (Royal College of General Practitioners, 2010) to create access to records for patients with long term conditions that are in regular contact with health and care services (e.g. diabetes) to ensure that this is something which is technologically viable and used before being rolled out for all NHS patients.

It is also suggested in light of the previous ambiguity in terms of the funding that has been invested into previous NHS IT policy and the current uncertainty regarding what funding is available to support the aims of '*Personalised health and care*' that policy clarifies what funding will be available. However, given the previous financial wastage and unprecedented financial pressures that the NHS are currently under, it is important that future investments are rigorously monitored and are allocated to areas where costs

are known and where investments will make a marked difference. For instance, at this stage investing significant amounts of capital into interoperability where solutions are unknown may be unwise given that the same amount of investment could significantly improve the infrastructure available to some trusts.

Finally, policy should aim to provide a greater focus on the meso and micro level factors that were considered to have contributed to the limited progress made by evaluations of NHS IT policy. Rather than identifying these issues as critical to success policy should seek to include more practical advice for trusts as to how to overcome these issues. This could be achieved by dedicating sections of NHS IT policy to providing practical examples of how NHS trusts have avoided or overcome these potential barriers to implementing electronic records.

3.5. Conclusions:

This is the first historical policy analysis of progress made by NHS IT policy in relation to implementing electronic records into secondary care organisations. The study which was underpinned by socio-technical thinking has identified that there is inconsistency and uncertainty surrounding the terms and definitions for electronic records. The findings of the study also suggest that little progress has been made by the NHS in implementing electronic records, highlighted by the recurring aims of national NHS IT policy and the various reasons evaluations of NHS IT policy attributed to the limited progress that has been made. The study also adds to a limited number of studies that have used policy analysis within health services research and so the methods section (chapter 2) may prove a useful guide for others wishing to utilise the method. The study's findings are discussed alongside those from the remaining empirical chapters of this thesis in more detail within chapter 8.

Chapter 4. Investigating the implementation of Electronic Patient Record (EPR) systems into NHS trusts: methods and analytic plan

This chapter presents the rationale, aims and objectives for a mixed methods study investigating the implementation of EPRs into NHS acute, mental health and community care trusts in England. An overview of mixed methods research and a justification for

using this approach is then given. The study's methods are then presented and are followed by ethical considerations. Lastly, the analytic strategy for the study is outlined and includes a description of the statistical and qualitative methods used for the analysis of survey and interview data respectively.

4.1. Rationale, Aims and Objectives

Political pressure for hospitals in the NHS to implement EPRs has been mounting over recent years, notably through DoH initiatives such as, '*Personalised Health and Care, 2020*' (DoH, 2014) and the Secretary of State Jeremy Hunt's call for a paperless NHS by 2018 (Illman, 2013). Previous failures of national NHS IT policy such as '*NPfIT*' also provide additional pressure on NHS hospitals to implement these systems effectively (chapter 3). National NHS IT policies have also been costly with a lack of demonstrable benefits. For example, '*Safer hospitals, Safer wards: achieving an integrated digital care record*' policy has cost the NHS £500million since its publication in 2013, with £60million of the first instalment being unallocated due to trusts failure to demonstrate a return of investment (Whitfield, 2014).

Despite the political and financial implications of implementing EPRs, there is a lack of empirical evidence in the UK (chapter 1 section 1.2). A recent systematic review (Boonstra, Versluis & Vos, 2014) examined EHR implementation, which included EPR literature showing U.S hospitals to be at different stages of implementation with varying levels of EPR functionality (Pagliari, Detmer & Singleton., 2007). The EPR literature also found a number of challenges and disadvantages to implementation including; reduced doctor productivity, technological issues such as software design (Pagliari, Detmer & Singleton, 2007; Williams & Boren, 2008) and information sharing and confidentiality (Scott et al, 2005). Whilst the literature included in the systematic review (Boonstra, Versluis & Vos, 2014) was primarily from the US there were some studies from the UK, however these focused on EHR implementation (Scott et al., 2005; Cresswell, Worth & Sheikh, 2012). There is also a lack of consistent definitions in distinguishing between EHRs and EPRs (chapter 1, section 1.1.), which makes the dissemination and use of literature in this area problematic as it can be unclear what type of system is being investigated. This lack of guidance from research makes achieving government targets such as 'a paperless NHS by 2018' arguably more challenging. Therefore, this study explores the status of EPR systems and the different approaches to and benefits and challenges of implementing EPRs into English acute, mental health and community care NHS trusts. A mixed methods approach that

consisted of a national survey and qualitative interviews was adopted to address the following aims:

- To describe the current status of EPR systems implemented in English NHS trusts.
- To quantitatively and qualitatively explore the different approaches used by trusts to implement EPR systems.
- To qualitatively explore participants perceptions of the term 'paperless NHS'
- To qualitatively explore participant's perceptions and experiences of the benefits and challenges associated with implementing EPRs.

4.2. Methodology

4.2.1. Mixed methods research:

"Mixed methods research is the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" .

(Johnson & Onwuegbuzie, 2004).

A mixed methods approach provides breadth and depth to understanding (Johnson Onwuegbuzie & Turner, 2007) and also accrues knowledge that informs theory and practice (Johnson & Onwuegbuzie, 2004). By combining quantitative and qualitative methods, researchers may enrich a study in ways which may be missed when using a single method (Brewer & Hunter, 1989, Tashakkori and Teddlie, 1998). For example, qualitative research offers the explanatory power to support and add depth to quantitative findings in a given research area (Collins, Onwuegbuzie & Sutton, 2006; Johnson Onwuegbuzie & Turner, 2007). Mixed methods research has been of particular interest to health researchers (Wittink, Barg & Gallo, 2006, Katz et al., 2007, Killaspy et al., 2009, Greenhalgh et al., 2010), due to the complexity of health care and the variety of methods available to approach health research. Therefore considering the importance of understanding the various factors affecting health, it is easy to appreciate the benefit of using different methods (Morgan, 1998).

Mixed methods research provides a logical and practical alternative to the traditional quantitative and qualitative paradigms and is considered the third research paradigm (Johnson and Onwuegbuzie, 2004). Mixed methods research attempts to combine qualitative and quantitative perspectives and is therefore assumed to be positioned between the two paradigms; considering multiple perspectives in its approach to

knowledge (Johnson Onwuegbuzie & Turner, 2007). Sale and Brazil (2004) argue that the paradigm debate within mixed methods research reaches beyond methodological and philosophical differences with the two paradigms resulting in the emergence of different journals, sources of funding, expertise and methods. Despite this, mixed methods research is seen to fit with the philosophical paradigms that have multiple perspectives (Tashakkori & Teddlie, 2003), such as dialectical and pragmatism (Hanson et al., 2005). Pragmatism, which philosophically underpins this thesis, is commonly associated with mixed methods research (Miller & Fredericks, 2006; Johnson Onwuegbuzie & Turner, 2007; Bergman, 2008, Teddlie & Tashakkori, 2009) providing justification for mixed methods through arguing that 'paradigm incompatibility' is unacceptable and that quantitative and qualitative research methods may be combined without violating philosophical principles (Morgan, 2007). More formal attempts to link pragmatism and mixed methods have been made with Tashakkori and Teddlie (2003) arguing that the research question is more important than the method, theoretical lens or paradigm.

4.2.2. Quality and reporting standards in mixed methods research

The quality of mixed methods research has been discussed within health research, (Caracelli & Riggan, 1994, Creswell, Fetters & Ivankova, 2004, Sale & Brazil, 2004). Despite, various quality assessment tools existing for studies employing single quantitative (QUOROM, CONSORT, STROBE) and qualitative (Quality in Qualitative Evaluation Framework and the UK Critical Skills Appraisal Program Approach) methodologies (Sirriyeh et al., 2012), little guidance for mixed methods research exists. This lack of available guidance has led to uncertainty regarding reporting mixed methods research (Johnson & Onwuegbuzie, 2004). Although some standards exist for quality (Patton, 2005) and reporting (O'Cathain, Murphy & Nicholl, 2008) the credibility and trustworthiness of mixed methods research remains a contested issue (Johnson & Onwuegbuzie, 2004). Future work is needed to clarify quality and reporting standards, which are affecting the structure, publication and analysis of mixed methods research (Bryman, 2006). In light of the variation amongst mixed methods reporting, it is imperative that mixed methods researchers state the frameworks used for their reporting to allow transparency of the reporting processes (Creswell & Clark, 2007). This project will use the 'Good Reporting of a Mixed Methods Study' (GRAMMS) framework devised by (O'Cathain, Murphy & Nicholl, 2008) specifically for health services research. The framework necessitates the following stages:

1. Justify the use of a mixed methods approach to the research question
2. Describe the design for each method.
3. Describe where integration has occurred, how it has occurred and who participated in it
4. Describe any limitation of one method associated with the presence of another
5. Describe any insights gained from mixed methods

4.2.3. Why mixed methods?

The literature provides guidance which aims to help researchers decide and justify the use of mixed methods. The typologies proposed by Greene, Caracelli & Graham, (1989), which has since been expanded by Bryman (2006) provides 16 reasons for mixing methods. It is suggested that to justify the use of a mixed methods approach, a minimum of one of the reasons proposed by Bryman's (2006) should apply. The typologies proposed by Bryman (2006) are displayed in table 8, with those used to justify the mixed methods approach adopted in this study highlighted in bold. As previously stated this study used a national survey and qualitative interviews to address the proposed research questions. Interviews provided a more detailed exploration of the approaches to implementation (hardware and solution strategies) to complement survey data and allowed an understanding of the benefits and challenges of implementing an EPR to be obtained. Further justifications for each of the methods used are outlined below:

Surveys are used for collecting data from a sample of the population of interest and are a quick, efficient data collection method. Surveys are also preferable when direct observations are not possible (Bowling, 2009). For example in this study, direct observations of NHS trusts throughout England were not feasible within the study's constraints. Surveys can be structured, semi-structured or un-structured. As opposed to unstructured surveys which are typically qualitative, in-depth and exploratory, this study used a structured questionnaire which comprised fixed questions with the majority of response choices being pre-coded (Bowling, 2009); although some open ended questions were incorporated where necessary. The two main approaches to delivering surveys are postal and online, however an online survey was considered the most economical and convenient method for surveying NHS trusts throughout England (Evans & Mathur, 2005).

A qualitative interview aims to contribute to a body of knowledge that is both conceptual and theoretical and that is based on the meanings that life experiences hold for participant's (DiCicco-Bloom & Crabtree, 2006) There are various types of qualitative

interview, most commonly however the literature refers to unstructured, semi-structured and structured interviews (Crabtree, 1999). Semi structured interviews are widely used within health research and are organised around a set of pre-determined, open-ended questions with other questions often also emerging (DiCicco-Bloom & Crabtree, 2006). The two main modes of qualitative interviews are face-to-face and telephone. Despite the limited amount of comparative literature, a review by Sturges & Hanrahan, (2004) deemed telephone interviews a useful method for qualitative research, particularly as is the case in this study, when participants have access to a telephone and the interview does not involve sensitive questions. Telephone interviews are also economic in terms of time and resources (Bowling, 2009), an important factor considering that interviewees in this study represented a range of trusts throughout England.

Table 8 Justification for combining qualitative and quantitative methods (adapted from Bryman, 2006)

	Typologies for mixing methods
Triangulation	Qualitative and Quantitative methods may be combined in order to mutually corroborate findings
Offset	Quantitative and Qualitative methods have their own strengths and weaknesses, combining them allow researchers to offset their weaknesses and combine their strengths.
Completeness	A more comprehensive account of the area of enquiry may be gained by employing quantitative and qualitative methods.
Process	Quantitative research provides an account of structures and qualitative research provides a sense of process.
Different research questions	Quantitative and qualitative research can answer different research questions.
Explanation	One method can explain findings generated by the other.
Unexpected results	Quantitative and Qualitative research can be combined when one generates unexpected results which can be understood by using the other.
Instrument development	Qualitative research is employed to generate questionnaire and scale items.
Sampling	One approach is used to facilitate the sampling of respondents.
Credibility	Employing both approaches enhances the integrity of findings.
Context	Qualitative research provides contextual understanding, partnered with broad relationships, or externally valid findings among variables uncovered in a survey.
Illustration	Qualitative research illustrates quantitative findings.

Utility	Combining the two approaches will be more useful to practitioners and others.
Confirm and discover	Qualitative data generates a hypothesis and quantitative research tests them within one project.
Diversity of views	Includes two slightly different Rationales; combining researchers' and Participants' perspectives through uncovering relationships between variables through quantitative research while revealing meanings among research participants through qualitative research.

4.2.4. Study Design

A mixed methods study was adopted and consisted of a national survey and qualitative interviews with Chief Information Officers (CIOs). The online survey was distributed between October and November 2013 via email and was a census of all 235 acute, mental health and community care trusts in England. 17 CIOs who expressed an interest in participating in a follow-up qualitative interview were contacted to take part in the study. The survey and interviews were informed by and piloted with CIOs at two trusts in the North of England.

4.2.5. Inclusion Criteria

To be included in the study participants had to be either:

- A CIO, Director of IM&T, Head of IT or equivalent individual
- Employed at an acute, Mental Health or Community Care Trust in England

4.2.6. Quantitative Method: Survey

Identification of the sample

As there is no centralised record held by the DoH of contact details for CIOs (or heads of EPR) and following DoH guidance a list of all NHS acute, community care and mental health trusts switchboard telephone numbers were obtained via the NHS choices website. All 235 trusts within England were then contacted via telephone to obtain email addresses for their CIO. However, a lack of consistency in job title and in some cases inability or unwillingness to provide this information meant that email addresses for communications, human resources or IT departments were often obtained rather than for a specific individual. In this instance, where generic email addresses were obtained, an email including a link to the survey was sent indicating that the survey should be sent to the CIO or equivalent person at that trust.

Survey design and content

Survey Monkey (Survey Monkey, 2015) was the platform used to develop and design the online survey. As previously mentioned, CIOs from two trusts in the North of England with experience in implementing EPR systems into NHS trusts informed the survey's content and development and were also used to pilot the survey to support face and content validity. After the survey had been piloted adjustments were made to the content and phrasing of survey questions. For example key informants felt that some questions, which required more detailed responses were better suited to the interview.

After ethical approval was obtained (section 4.3) the survey was emailed to 235 acute, community care and mental health trusts in England. Initial emails included a brief introduction to the study, the participant information sheet (appendix 6) and the link to the survey. The participant information sheet included contact details for myself, and further information about the study, data confidentiality and storage. Potential participants were told that they should contact me should they have any questions prior to completing the online survey. Implicit consent was taken, as should individuals wish to take part they would be required to fill in the survey online. Participants were asked should they not wish to take part to express this via email so as not to receive reminder emails. All participants were asked if they would like to be informed of the results of the study. The questionnaire was sent to trusts CIO's or where not available to the generic department email addresses (e.g. communications). The survey was distributed on the 14th October 2013 and was available for one month. Reminder emails, which included the link to the survey, were sent to all participants (unless they expressed disinterest) two weeks after the initial email (28th October, 2013) and in the final week of the one month period (11th November 2013) with the aim of increasing the response rate.

Participants were able to skip questions if they did not wish to respond, to avoid participants from not taking part because they were unable or did not wish to answer certain questions; perhaps due to anonymity concerns. It was anticipated that the survey took approximately 10 minutes to complete. The survey (appendix 7) included 8 fixed and 2 open questions relating to:

- Trust demographics; type of trust and geographical location.

- Trusts EPR status; do trusts have any form of EPR, will their EPR system enable them to reach the paperless ambition and when will the EPR be the definitive paper record so as to eradicate the paper record.
- Approaches to implementing the EPR system; strategy, functionality, hardware, solutions.

At the end of the survey, participants were asked to state whether they would be happy to take part in a telephone interview, if yes they were asked to provide their contact details.

4.2.7. Qualitative Method: Interviews

Sampling Strategy

It was initially aimed for 12 individuals to be purposively sampled (Guest, Bunce & Johnson, 2006) based on trust type and EPR status. Instead, participants were recruited using convenience sampling of those who indicated they would be happy to participate in a telephone interview at the end of the survey.

Interview design and content

Participants were contacted via email and were reminded that as they had expressed an interest in a telephone interview they were being invited to take part. Emails also included the participant information sheet (appendix 8) and consent forms (appendix 9). The participant information sheet provided details relating to the interview process, anonymity and confidentiality.

Interviews were conducted by telephone using a topic guide (appendix 10) that was developed and piloted with the same key informants that had informed the survey. Pilot interviews also enabled questions to be refined and practiced, to improve interview flow. Interviews began by ensuring that participants had read and understood the participant information sheet. Participants were then given the opportunity to ask questions and were reminded that the interview was being audio recorded and that direct quotations could be published but that no identifiable personal information would be used. Participants were informed that all data would be stored securely and reported anonymously before the study's aims and topics to be discussed were reiterated.

Interviews provided a more in-depth explanation of the approaches to implementation (hardware and solution strategies) to complement survey data and also explored participant's perceptions of the benefits and challenges to implementing EPRs.

Interviews began with more factual simplistic questions to help build rapport with participants and gain the confidence of interviewees. For example, "Please could you tell me about your involvement in setting up your trusts EPR system?" More sensitive questions were placed at the end of the interview. For instance, "Have you realised any of the benefits you predicted in your business case?" Where necessary interviewees were probed for further details or asked to provide clarification. At the end of each interview participants were thanked for their time and asked if they had any additional comments or questions. Participants were reminded should they have any questions after the interview to contact myself via the telephone or email provided.

4.3. Ethical Considerations

Ethical approval for the study was granted from The Health Sciences Research Governance Committee at The University of York in October 2013. All survey and interview data were anonymised and stored on a password-protected computer within a locked room at The Bradford Institute for Health Research (BIHR) where I was primarily based.

For the analysis of survey data, trusts were allocated a unique ID and for the interviews individuals were allocated pseudonyms, both of which were used in the conduction, analysis and write-up of the study. All survey data and audio-recordings of interviews were stored on a password-protected computer within a locked room at BIHR. No trust identifiable information was obtained during the study other than information as to the region and type of trust of participating trusts. Consent forms and contact details were the only identifiable personal information obtained during the survey and interviews. Participant's contact details were necessary for interview recruitment. Contact details were stored separately to other data on a password-protected computer held within a locked room at the BIHR. Participants were aware through the participant information sheet and verbally prior to interviews that direct quotations might be published, but that all data would be anonymised. Data will be retained for 5 years to allow the completion of my PhD thesis.

4.4. Analytic Strategy

4.4.1. Statistical Analysis of Survey data

Data Cleaning

All closed question responses were analysed using SPSS for windows version 21 (IBM Corp, 2012). Survey data was manually entered into SPSS due to limitations with survey monkey. Prior to data entry, codes were assigned and recorded in a data dictionary using Microsoft Excel (appendix 11). After the raw data had been entered and data codes were assigned data cleaning was undertaken to minimise the risk of errors impacting on the study's results (Van den Broeck et al., 2005). The following errors commonly associated with questionnaires were checked for as recommended by Van den Broeck et al. (2005)

- Data entry errors, such as entering 11 instead of 1
- Missing values were replaced with 999.
- Transfer error was checked for, by ensuring that responses were coded correctly and replicated the participant's responses in SurveyMonkey.

Descriptive statistics

Initially, data collected from the survey were used to produce descriptive statistics to explore the sample's demographic characteristics. Trusts demographics related to geographical location, (North England, East England and the Midlands, London and South England) EPR Status (whether trusts had an EPR) and trust type (Foundation Trust, Non Foundation Trust, Mental Health/Community Care Trusts and Combined). As the number of respondent's in each category for trust type and location was relatively small, these categories were collapsed to those previously mentioned. For trust type, trusts assigned to the combined category were those, which had indicated that they were Mental Health, Community Care and Foundation Trust. Assumptions that the data were independent and normally distributed were checked. Descriptive statistics were also used to explore the survey data in relation to trusts functionality of EPR's, hardware strategy's, solution strategy's and whether trusts feel they will be paperless by 2018.

Univariate analysis

Pearson's chi squared test was used to explore whether there was an association between trusts' EPR status and whether trusts thought they would be paperless by 2018. Assumptions of the Pearson's chi squared were checked to ensure that no expected frequencies were less than 5. Fishers exact test explored associations between categorical variables, which do not meet the assumptions of Pearson's chi squared (e.g. some cells had expected frequencies less than 5). Fishers exact test explored associations between EPR status and trust type, trust location and the solution strategy adopted.

Analysis of open survey questions

Questions that were open-ended such as, when will your trusts EPR be authorised as a definitive record, so the paper record will no longer be used or required? were analysed by counting the number of times themes or responses emerged. This allowed for questions where fixed responses were inappropriate to be asked and also for a more in-depth understanding to be obtained.

4.5. Interview data

Interviews with CIOs were conducted after the survey had been closed. All interviews were analysed manually due to the relatively small number of interviews conducted. Throughout the analysis of the interview data and particularly during coding and theme development, I had regular meetings with a senior qualitative researcher to aid the inter-coder reliability of any themes and codes established during the analysis (Westbrook, 1994).

4.5.1. Thematic analysis:

As in chapter 3, interviews were analysed using the five stages of thematic analysis as outlined by Braun & Clarke (2006); transcription, familiarisation, coding, theme development and data reporting. As an overview of thematic analysis and the stages proposed by Braun & Clarke (2006) has already been described and used for analysis of documents in chapters 2 and 3, only the aspects of the analysis that differ from those described elsewhere are described in this section:

Step 1, Transcription

Interviews were transcribed by myself at the earliest opportunity after each interview to ensure transcription was undertaken whilst the interview was still clear in my mind. During transcription I also reflected on the flow of the interview and the answers provided by the interviewee, recording and amending the topic guide ahead of future interviews where necessary. Transcription enabled an early and thorough understanding of the data to be obtained and facilitated my familiarisation with the data (Lapadat & Lindsay, 1999).

Step 2, Familiarisation

As previously mentioned, transcription aided familiarisation as it allowed me to obtain prior knowledge of the data ahead of the analysis. Further immersion within the data was then undertaken to gain a greater awareness of the breadth and depth of the data (Braun & Clarke, 2006). This involved reading and re-reading the interview transcripts whilst making preliminary notes ahead of formal coding and theme development (Braun & Clarke, 2006).

Steps 3 and 4, Coding and Theme Development

Coding and theme development was undertaken manually due to the study's small sample size. Initially, transcripts and audio recordings were revisited, with transcripts coded many times to establish an understanding of the data and the patterns and relationships between them. Coding and theme development was deductive using a-priori codes driven by the topic guide. Themes such as 'challenges of implementing an EPR' were therefore largely pre-determined by the research questions and questions within the topic guide. However some themes such as, 'clinician involvement and managing clinicians expectations' were data driven.

After initial themes had been established, data associated with each theme was entered into separate thematic tables, within individual word documents (table 9). This allowed me to compare contrast and build-up themes and discuss the meaning of the data (Green & Thorogood, 2009). Once all data had been entered into the relevant thematic tables, these tables were printed and different colour highlighters were used to identify sub-themes. Themes were analysed individually to capture the story of each theme and how it relates more broadly to the research question (Braun & Clarke, 2006). Throughout this process codes and themes were discussed with a senior qualitative researcher to ensure that the themes accurately reflected the data.

Table 9 Example of tables used within the thematic analysis

Name of theme: Clinician involvement		
Pseudonym	Line Number	Description of quote
010301	17-22	Clinician involvement part of job description. Acts as link between clinicians and IT team. Acts as voice so IT and clinical teams understand one another's priorities. Q

After initial themes and sub-themes had been developed these were refined and reviewed further. For instance themes without sufficient data to support them were broken down or combined with other themes where appropriate. It was ensured that data within themes cohered in a meaningful way and any themes, which no longer appeared meaningful, were discarded. During this process a map was created displaying all the themes and sub-themes and at this point a couple of sub-themes and themes were merged. For instance, the benefits trusts were expecting and had already experienced from implementing EPRs were merged to create one broader 'benefits' theme.

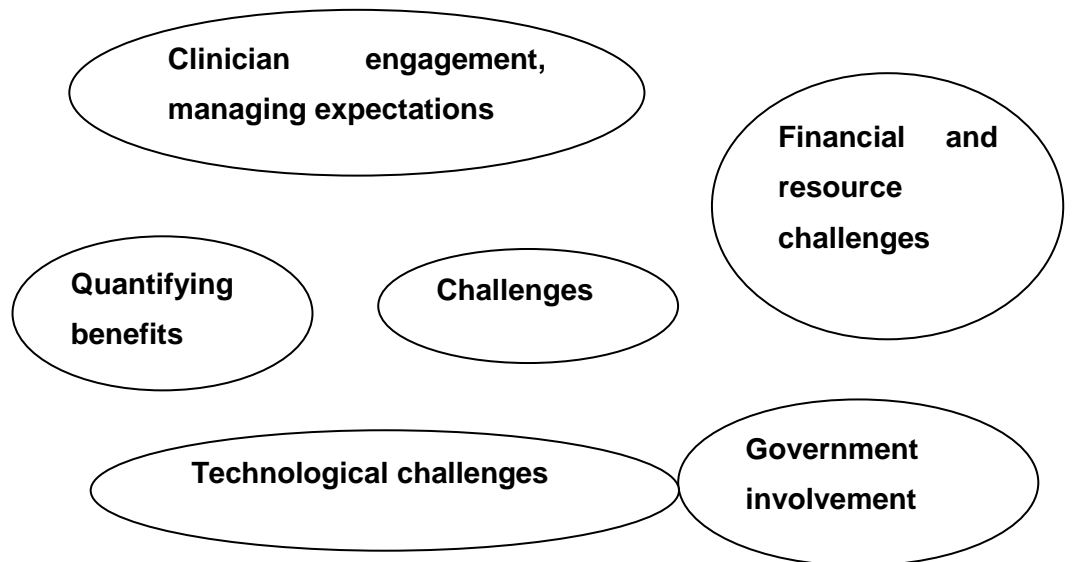


Figure 6: Example of thematic map used within the thematic analysis

After themes were decided, the final stages of the analysis and write-up occurred. Direct quotations from interviewees are reported within the results section (chapter 5) and were selected on the basis of which quotations were perceived to provide the best evidence and support for the point being demonstrated; whilst ensuring that enough examples were provided to demonstrate a themes prevalence. Quotations are accompanied by an analytic narrative and are later discussed to ensure that the study goes beyond a description of the data and provides an argument that coincides and answers the study's research questions (Braun & Clarke, 2006).

4.5.2. *Integration and presentation of survey and interview data*

Integration, refers to the interaction between the qualitative and quantitative components of a mixed methods study (O'Cathain, Nicholl & Murphy, 2009). Although failing to integrate data limits the knowledge generated (O'Cathain, Nicholl & Murphy, 2009) and provides results equivalent to those in independent qualitative and quantitative studies, mixed methods research is often criticised for not integrating data (Barbour, 1999). This is particularly problematic at publication where different components are often published separately, making it difficult to appreciate the interaction between qualitative and quantitative data (Morse 2003 in O'Cathain, Nicholl & Murphy, 2009). The task of integrating data is made more challenging by the various approaches for integrating data suggested within the literature (triangulation, mixed methods matrix, following a thread and the priority sequence model) (Morgan, 1998; Johnson & Onwuegbuzie, 2004; O'Cathain, Nicholl & Murphy, 2009). The approach to integration is often thought to depend upon the researchers epistemological position, which dictates which area quantitative or qualitative receives more weighting (Johnson & Onwuegbuzie, 2004). However as was the case in this study, qualitative and quantitative methods are often used to examine different aspects of the research question (O'Cathain, Nicholl & Murphy, 2009). For example, survey and semi-structured interviews identified and explored the solution strategies adopted by trusts implementing EPRs.

After the initial analysis had been completed for both the quantitative and qualitative material, data were integrated, with triangulation considered the best approach for this study as data were combined at the interpretation stage after both data sets had been separately collected and analysed (O'Cathain, Nicholl & Murphy, 2009). Triangulation began by generating a list of themes from the qualitative and quantitative preliminary analysis, where both types of data were available for the same theme, this was presented together. However, some themes only had qualitative or quantitative data available (e.g. challenges and benefits of implementing EPRs) and so these themes

were presented separately. When integrating data, some themes were re-named and re-structured to allow qualitative and quantitative data to be combined. For instance, the themes hardware and solution strategies were combined to create qualitative and quantitative data illustrating the approaches and systems used by trusts to implement EPRs. During triangulation, where findings agreed (convergence) offered complementary information to the same issue (complementarity) or contradict each other (dissonance) was also considered (O'Cathain, Nicholl & Murphy, 2009).

4.5.3. Reflexivity

Qualitative researchers often try to approach their research reflexively to deal with biases and assumptions ensuing from their own life experiences or indeed their interactions with research participants. Reflexivity refers to the assessment of the influence of the researchers background and their perceptions and interests on the qualitative research process (Ruby 1980 in Krefling, 1991). Despite researchers previously claiming neutrality it is important to consider how the researcher may influence the study especially when considering that the qualitative approach is reflexive in that the researcher is part of the research and not separate from it (Aamodt 1982 in Krefling 1991). Qualitative researchers should therefore analyse themselves in the context of the research, reflect on their own characteristics and examine how they influence data gathering and analysis to enhance the credibility of a study (Krefling, 1991).

The use of a field journal is one method, which enables researchers to describe and interpret their own behaviour and experiences within the research context. In accordance with the recommendation by Lincoln, (1985) a notebook was kept throughout the research process and was used to record personal reflections such as feelings and frustrations regarding interviews as well as any problems or initial hypothesis. Methodological changes such as changes to the topic guide were also noted. These reflections are considered during the study's main discussion (chapter 5). The following chapter will present the results for this study and will discuss them in the context of existing literature and socio-technical thinking, which is the theory underpinning this thesis.

Chapter 5. Investigating the implementation of EPRs into NHS trusts: results and discussion

This chapter presents the results from survey and interviews, which explored English NHS trusts approaches and experiences of implementing EPRs. Before the study's findings are presented, key terminology analogous to the survey and interviews is provided. The chapter concludes with a discussion section, which comprises a summary of the study's key findings, strengths and weaknesses, reflexivity and recommendations.

5.1. Terminology used within the survey and interviews

To ensure clarity for the reader, prior to presenting the study's findings it is important to define the key terminology used within this chapter. Initially, academic literature and the internet, were searched for definitions that were universally used and accepted by those researching and implementing EPRs. However, after this search and upon consultation with the key informants for this thesis (chapter 1, section 1.4.2) it was apparent that there are inconsistencies in how a number of terms used to describe and implement EPRs are defined and interpreted. For instance, whilst individuals who assisted with the definitions below were in agreement that the definition for the term 'Best of Breed' provided by NHS England (2013) is too broad, their own descriptions of the approach had subtle, but important differences. To overcome this issue and to ensure consistency and clarity for this chapter the definitions provided below have been developed in conjunction with the key informants and aim to encompass their different views and perspectives. Key informants encompassed the same CIOs that informed this study's survey and interview content (chapter 4), however the solutions provider and NHS England employee were contacts obtained through my work with the trust which this thesis aims to provide feedback to and so provided invaluable support in forming this definitions. The solutions providers contacted provide data integration solutions for trusts such as those defined in section 5.2.5. To protect individuals' anonymity where key informants have provided definitions for key terminology these are referenced as personal communications.

5.1.1. EPR functionality

An EPR is made up of various functionalities such as, clinical decision support and results functions; however, there is disagreement as to how these terms are defined. Furthermore what is considered the 'core functionality' for a system to be called an EPR also varies (Jha et al., 2009, Seckman, 2013). The survey question 'What functionality does your EPR currently include' was therefore devised alongside key informants. The

functionality included in this question is defined below and represent 'core EPR functionality' for the purpose of this study's survey (table 10). It is acknowledged that not all the possible permutations of what trusts EPR systems could include are represented.

Table 10 Core functionality of an EPR

Functionality	Definition
Clinical Decision Support	Broadly speaking this enables the support or enhancement of clinical decisions (Hughes et al., 2008). These systems allow storage and management of clinical data and include decision making or alerting tools to assist clinicians (Marcos et al., 2013).
Results function	Often involves the management of results enabling viewing laboratory results, imaging results and the return of electronic images (DesRoches et al., 2008).
Ordering drugs function	Includes ordering prescriptions and laboratory tests (Jha et al., 2009).
Words function	Clinical documentation such as medication lists, nursing assessments, physician's notes and problem lists (Jha et al., 2009)
Numeric Function	Processing of numeric data such as physiological measurement data (temperature, respiratory rate) and returning of results as part of a wider decision-support capability (Personal Communication, CIO, NHS trust).

5.1.2. Hardware strategies

This chapter refers to the types of devices provided by trusts through which an EPR may be accessed. The survey classified the hardware options for trusts with advice from key informants into the following categories to accommodate the wide variety of devices that can be included when implementing EPRs; Computers on wheels (COWs)⁴, handheld PCs, fixed desktops, Personal Digital Assistant (PDA), IOS devices, android devices, tablets and smartphones⁵.

⁴ In recent years the term 'COW' (computers on wheels) has been replaced by 'WOW' (workstations on wheels). However as the survey and interviewees referred to COWs the original terminology has remained unchanged.

⁵ Key Informants requested that a distinction be made between IOS, android devices and other tablets and smartphones (e.g. Microsoft tablets) as at the time IOS and android devices were the predominant, but not the only available tablets and smartphone devices available.

5.1.3. **Solution Strategies**

Solution strategies relate to the approaches trusts are using to implement their EPR systems and are outlined below:

A best of breed approach: is where you implement and digitise gradually in an incremental fashion. Individual modules (e.g. clinical decision support) are chosen based on the needs of the clinical speciality with replacing one module not affecting or disrupting other specialities (NHS England, 2013). The strategy involves multiple and different systems that are often chosen by the end-user (e.g. clinicians) according to their preferences. Interoperability is therefore a large strategic factor and refers to making the different systems work together. Ideally to work effectively a best of breed approach requires an integration engine (Personal communication, CIO, NHS trust).

An *Integration Engine* is often used within best of breed approaches to make different departmental systems work together. NHS England (2013), define an integration engine as 'a patchwork quilt of individual functionality rich modules stitched together to allow data to transfer between systems'. An integration engine is a software product or suite that acts principally to enable the automated transfer of data between systems. They are often deployed to enable the synchronisation of patient data (demographics), movements (admissions, discharges, transfers) or clinical information (test results) between systems. Integration engines are often regarded as being of more benefit to best of breed strategies where synchronisation of data between systems is a key requirement to ensure a consistent accurate record of patient information within individual systems (Personal communication, solutions provider).

Write it yourself: relates to providers or trusts that choose to build their own EPR solution rather than procuring one from a commercial supplier. The provider may source the development capacity in-house or contract it out to an external development resource. For example, trusts who have a team of programmers supporting in-house EPR (Personal communication, CIO, NHS trust).

Megasuite: Used to describe the EPR systems provided by suppliers such as Cerner (Millennium) or Meditech (EPIC). These systems normally contain the full range of clinical and non-clinical EPR functionality that a hospital requires, (such as in section 6.1.1) in the form of a single integrated solution rather than via a suite of separate systems interfaced to each other via an integration engine (Personal communication, solutions provider and CIO, NHS trust).

Clinical EPR, separate interfaced Patient Administration System solution; Megasuite systems usually contain a patient administration system (PAS) module as part of their functionality. A PAS is a system encompassing all aspects of patient administration across a hospital including inpatient and outpatient activity and patient demographics (Systmone, 2014a). There are however, some EPR providers who supply EPR solutions that contain clinical functionality but do not have PAS functionality. If a hospital chooses such a system they will need to have a separate PAS system and interface this to the EPR solution using an integration engine (Personal communication, CIO, NHS trust).

Clinical Portal/viewer; a single view of the same patient in multiple systems that involves a single sign on to multiple systems. This solution requires integration tools to allow multiple systems to work together effectively (Personal communication, solutions provider).

5.2. Results:

As described in chapter 4, after initial analysis had been conducted, where quantitative and qualitative data were available for the same theme these findings were integrated and so are presented together within this chapter. However, for some themes only qualitative data were available (clinician involvement and the benefits and challenges of implementing EPRs) and so this data is presented separately.

5.2.1. Participants

59 of the 235 trusts invited to participate in the 'English Electronic Patient Record Survey' completed the questionnaire (25%). Assuming that the response rate was differential with 63 email addresses being incorrect or generic departmental emails (e.g. IT departments) an adjusted response rate of 59 participants from 174 correct email addresses (34%) would ensue. A flow diagram illustrating the number of trusts recruited and included in the survey and interviews are shown in figure 7. Qualitative interviewees comprised 8 CIOs (or those with equivalent titles) from a variety of NHS acute, mental health and community care trusts in England. 17 individuals had originally stated a willingness to be interviewed. However time constraints or failure for participants to respond prevented these individuals from taking part. Additionally this study occurred at the same time as an NHS England and e-health insider survey which explored the routes to EPRs and so this may have impacted the response rate obtained

here as trusts were required to complete the survey for NHS England under the freedom of information act (Personal communication, CIO, NHS Trust).

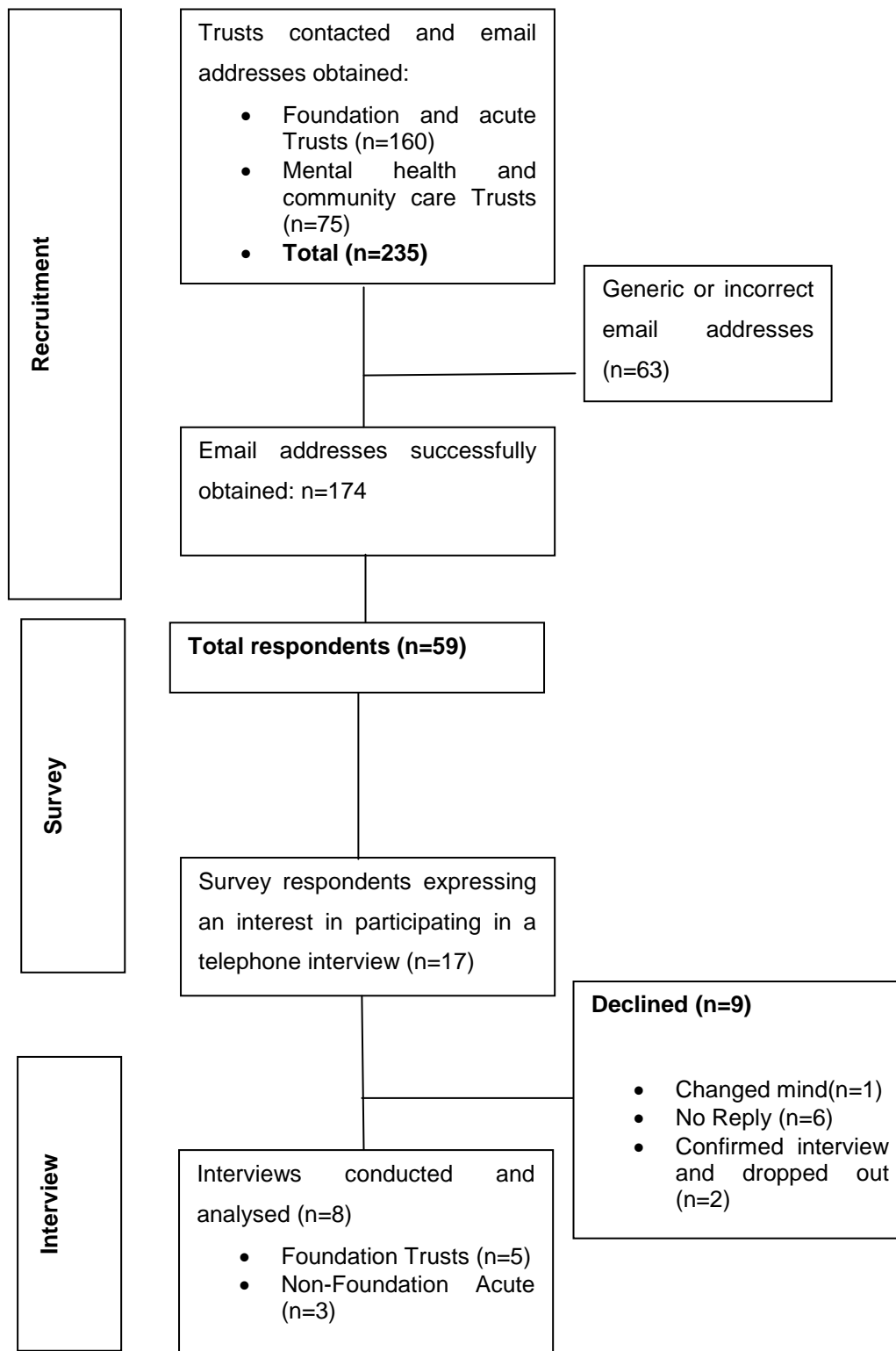


Figure 7: Participant flow

Demographic information for survey and interview participants is presented in table 11. The majority of survey and interview respondents were implementing an EPR, n=47 and n=6 respectively. Due to the problems with defining an EPR (section 5.2.2) this question was phrased as “do you currently have any form of EPR within your organisation”. Furthermore this figure should be taken with caution as there is uncertainty regarding what systems, approaches (e.g. best of breed) and functionality considered an EPR, with this figure also not considering the different stages of implementation. Survey respondents represented a range of locations: North England (n=16), East England and the Midlands (n=3) and London and the South of England (n=15) with 25 respondents not specifying their location. Survey and interview respondents also represented a range of NHS trust types including: Foundation trust (n=26, n=3); Non-Foundation Acute trusts (n=13, n=5), Mental Health and Community Care trusts (n=11) and Combined (n=9). Trusts within the combined category were those that indicated that they were Mental Health, Community Care and Foundation Trusts. Fishers exact determined no statistical association between trust location and EPR status (2.467 p=0.48) or trust type and EPR status (4.571 p=0.19). Additionally, amongst interviewees there was no uniform job title representing those responsible for trusts’ EPR projects and so interviewees had a range of job titles as shown in table 11. Despite the variation in job title, there was unanimity in their roles, which were described as being strategic and involving: overseeing implementation, decision-making and strategy around EPR or other systems. Participants were also asked to describe their teams which included implementation teams, developers, analysts, project managers, IM&T transformation offices, the business unit and in some cases clinicians.

Table 11 Demographics for survey and interview participants

	Frequency	
	Survey Respondents	Interviewees
	N (%)	N
EPR Status		
Yes	47 (79.7)	6
No	12 (20.3)	2
Trust Type		
Foundation Trust	26 (44.1)	3
Non Foundation Acute Trust	13 (22)	5
Mental Health/Community Care Trust	11 (18.6)	0
Combined	9 (15.2)	0

Trust Location		
North England	16 (27.1)	4
East England and the Midlands	3 (5.1)	1
London and South England	15 (25.4)	3
Unspecified Location	25 (42.3)	-
Job Title		
Clinical Information Officer and clinical safety officer	-	1
Director/associate director of IT	-	2
Director of IM&T and deputy director of IM&T	-	2
Director of PAS system	-	1
Director of Informatics	-	1
Program Director	-	1

5.2.2. Defining an Electronic Patient Record

The majority of interviewees described an EPR as a system that enables clinical decision support and clinicians to have the information they need when they need it whilst removing the need for the management of paper during the patient pathway.

041202: *I always said our initial view was that...the EPR was providing the information that people needed to know as where and when they wanted it so that was a simple...phrase we used when we first launched the idea of having an EPR system...so for each individual patient the information that's available that you need for that patient should be available to you it should also be able to support some of your decisions it should also be able to guide people... on what the best treatments are so for example we have things like order sets so if a patient has asthma or comes into our A&E department with a particular condition they can look up that condition and request the diagnostic tests that the trust recommends so it's advising and helping people but it's also providing that that set of information that people need to know to treat that patient (76-86).*

However, debate persisted among interviewees as to what is considered an EPR. This was a particular problem in relation to best of breed approaches where participants had contrasting opinions as to whether this approach and range of systems could be referred to as an EPR:

051601: *so first of all we don't have an EPR...like many trusts we don't have a EPR... certainly from our...from my perspective can mean different things to different people ...American IT health care providers are very good at selling this notion of one big system of an EPR...our view is to take that best of breed approach so departmental systems that are really good for their job and then have some glue that brings that*

together...so we have a single view of the patient as they go through the organisation (27-34).

From the qualitative data it appears that the term EPR may be insufficient in describing the various systems and approaches currently being implemented. Readers should be aware that when referring to an 'EPR' throughout this study that there are various different systems, functionality and approaches that are encompassed by this term. Moreover, interviewees and survey respondents' classifications of what is and is not considered an EPR may differ and conflict.

5.2.3. A Paperless NHS?

Given the government target for the NHS to be paperless by 2018, survey participants were asked whether they felt their trusts would realise this ambition. Of the 59 trusts surveyed, 26 (44.1%) believed they would be paperless by 2018 in comparison to 33 (55.9%) who felt they would not reach this target. As being paperless by 2018 seemed closely tied with whether trusts had, or were planning to implement an EPR, we hypothesised that those trusts who felt they would be paperless by 2018 would be more likely to have an EPR. This was confirmed in the survey data ($\chi^2=4.589$, $p=0.032$).

Table 12 whether trusts believe they will be paperless by 2018 and whether they have an EPR in place

		Trusts who believe they will be paperless by 2018		
		Yes n (%)	No n (%)	Total
Have EPR in place	Yes n(%)	24 (51%)	23 (49%)	47
	No n(%)	2 (16.7%)	10 (83.3%)	12
Total		26	33	59

Those who stated that they would not be paperless by 2018 were asked to indicate during the survey whether they will still strive to become paperless at some point and if so how. The majority of respondents (53%) felt that their trust could be paperless if they were to replace their current system; with a further 25% specifying that a procurement of an EPR is required. Interestingly, a number of participants (19%) commented that they had no plan to become paperless, as they perceive it to be an unrealistic and poorly defined target (table 13).

Table 13 open responses to the survey question, “if you will not be paperless by 2018, what is your plan for achieving this aim?”

Survey question	Themes from open responses	Number of responses (%)
If you will not be paperless by 2018 what is your plan for achieving this aim?	No plan/unrealistic and poorly defined target	6 (18.8)
	Replacing current system/getting new system	17 (53.1)
	Procure EPR	8 (25)
	Need to evaluate the market	1 (3.1)
Total		32

In contrast to the quantitative data where some trusts felt that a paperless NHS was a realistic target, there was an overall consensus among interviewees that a paperless NHS was not feasible, with some participants considering ‘paper-lite’ a more realistic target. Interviewees questioned the feasibility of a paperless NHS mainly due to the current need for paper to allow hospitals to communicate with other health and care organisations and the reliance and comfort felt by staff when using paper. Additionally, interviews commented on the sheer amount of paper within the NHS and the investment that would be needed to remove it. The differences in opinion as to whether a paperless NHS is an achievable aim may also be explained by how the term ‘paperless NHS’ is defined and interpreted. Interviewees understanding of the term ‘paperless’ was centred on the removal of paper through the patient pathway and clinical process. However, participants stressed how ‘paperless’ does not mean the complete removal of paper from an organisation. This may be due to the term paperless being portrayed more literally and ambiguously within government targets “a paperless NHS by 2018”. Consequently a divide has emerged between those interpreting the term to mean literal ‘paperlessness’ and those who see it as removal of paper from the patient pathway but not the organisation as a whole:

051601: in its simplest terms it means no paper (laughs) in the...patients or pathway through various parts clinically of the organisation which is a hospital...in its simplest terms in real terms it means...a non-reliance on paper to process manage patients through the hospital journey...so in some areas the default position is paper practice referrals clinics documentation pre-assessment so its where there is bits of paper flying around and in some from our perspective it is the altruism of getting rid of paper

completely will be very difficult to achieve even in those organisations we've visited which are paperless still seem to have lots of paper kicking around (13-19).

020401: paperless hospital I equate to HIMMSS level seven which means everything is either automated or it's somehow digitally available I think the NHS in some of its press releases may or may not have that same definition and they're very generic when they say paperless hospital so I'm not sure I'm able to exactly say what the NHS think of paperless hospital 7 (30-34).

5.2.4. The current status of EPR systems:

Table 14 shows the different functionality within trusts' EPR systems, with results (71.2%) and words (66.1%) functions being the most frequently implemented. Despite table 11 reporting 12 participants answering 'no' to the question are you implementing any form of EPR, only 9 participants did not respond to the question in table 14, which could be a reflection of the confusion around what systems and approaches constitute an EPR. Additionally some trusts may have responded to this question that are introducing individual systems or modules, which provide some of the functionality below (e.g. ordering drugs function) without being an EPR. For instance, an e-prescribing module such as Ascribes electronic prescribing and medicines administration (ePMA) may be being implemented in isolation rather than as part of an EPR.

Table 14 Number and proportions of trusts EPR functionality

	Yes (%)	No (%)
Clinical Decision Support Function	22 (37.3)	28 (47.5)
Results Function	42 (71.2)	8 (13.6)
Ordering Drugs Function	23 (39)	27 (45.8)
Words Function	39 (66.1)	11 (18.6)
Numeric Function	32 (54.2)	18 (30.5)

A number of interviewees commented on how their trusts were relatively digitally advanced with trusts being "paper-lite", "40% digitised" or having their EPR system as the primary record. However, others felt their trusts were behind others in the UK.

010301: there is more on the reliable data on our EPR than there is in the notes. Our EPR is already the primary patient record (34-36).

Survey respondents were asked to comment on when they felt their EPR system would be used as their trust's primary medical record to the extent that the paper record is no longer used or required. This question was asked as it was hypothesised that not all trusts would believe in, or would be aiming for a paperless NHS. It therefore seemed prudent to ask when trusts felt that they would become dependent on electronic records to the degree that the paper record would no longer be used; yet not necessarily remove paper from the organisation completely. This question allows for the stages of implementation of trusts EPRs to be inferred. However, for those that responded to this question (n=54) there was considerable uncertainty, as respondents varied in relation to whether they thought having their EPR as their trust's primary record was something that was feasible or not. For instance, whilst 15% and 41% of respondents already considered their trust's EPR as the primary record or felt this would be achieved within the next four years, 5% felt this was not possible (Table 15).

Table 15 Responses to the open survey question 'when will your trust's EPR be authorised as a definitive record, so the paper will no longer be used or required?'

Survey question	Themes from open responses	Number of responses (%)
When will your trust's EPR be authorised as a definitive record, so the paper record will no longer be required or used?	To be confirmed	8 (15)
	In next four years	22 (41)
	Already in place	8 (n= 4 not in all areas) (15)
	Not applicable	4 (7)
	Not possible	3 (5)
	Do not know	7 (12)
	Participant did not understand the question	1 (1)
	Possible but not at the moment	2 (need change system, could be achieved but not using EPR) (4)
Total		54

5.2.5. The approaches and systems used by trusts when implementing an EPR:

Hardware strategies mainly included fixed desktops (93.2%), with trusts also incorporating computers on wheels (COW's) (66%), Handheld PCs (79.7%), Tablets (69.5%) and Smartphones (64.4%). 58% of trusts were using five or more devices to deliver their EPRs, with 22% and 20% of trusts using two or less or 3-5 devices

respectively. Survey respondents that indicated 'not applicable' or did not indicate a response to this question were categorised as not utilising that device.

Respondents also rated the usefulness of the devices that formed their hardware strategy, however, some survey participants commented that they had rated these devices despite not currently using them. Appendix 12 therefore represents devices' perceived and experienced usefulness. The majority of trusts rated fixed desktops' usefulness as average or above. For COW, IOS, android, PDA, smartphones and tablets a large number of respondents stated that rating the devices was 'not applicable', with no consensus regarding these devices usefulness reached.

Participant's described their experiences of using these devices, and reported positive experiences of laptops and mobile devices. The benefits of laptops and mobile devices included: mobility, battery life and flexible data entry. However tablets and mobile devices were often being trialled and were not used extensively due to concerns relating to: confidentiality, security, maturity; battery life; compatibility with existing software and problems resulting from the devices being designed for domestic use. A few participants also mentioned the use of fixed desktops or PCS, as these devices provided staff with another hardware option for accessing EPRs. COW were implemented predominately for mobility and the use of computers at the bedside, however contrasting experiences of these devices were reported:

020401: so people love the COWs... that tends to be the most...popular item here {laughs} mostly because they round with them...and they round with... medical students and residents and they pull up on the screen everything that they need to see on a patient chart and then do what they need to do...I love COWs I think everywhere I have worked people have liked them (143-147).

010301: our experience with both sets of COWs has been very negative in that there is a huge problem with the battery life and the speed of access and everything on the computers and so the COWs and there also big...difficult to move around and so they tend to even though there mobile they tend to be moved to one bit of a ward and or just left there (110-114).

The activities for which the devices (appendix 12) are being used for mainly included; nursing observations, data entry and noting, order communications, correspondence, results, ward rounds and access to patient information at ward level. Less frequently

mentioned activities that involved trusts to be at a higher level of digital maturity were; discharge summaries, whole hospital patient access and in one instance the use of white boards to create status boards using TPR charts and early warning scores.

082404: *so what we tried to do is to make sure that depending on what the task is that you're doing you have the appropriate access device so...it might be that you use a laptop it might be that you need an iPad it might be that you're a consultant just walking in to the hospital you just need to see if there are any tests that you need to look at or you want to see a quick look at your in-basket or something like that you should be able to do that from your smartphone (136-141).*

Survey participants cited a variety of approaches that they are using to implement EPRs, with the most popular approach being 'best of breed' (32% n=19). The majority of respondents had a solution strategy in place with only 1 trust still developing their strategy (Figure 8).

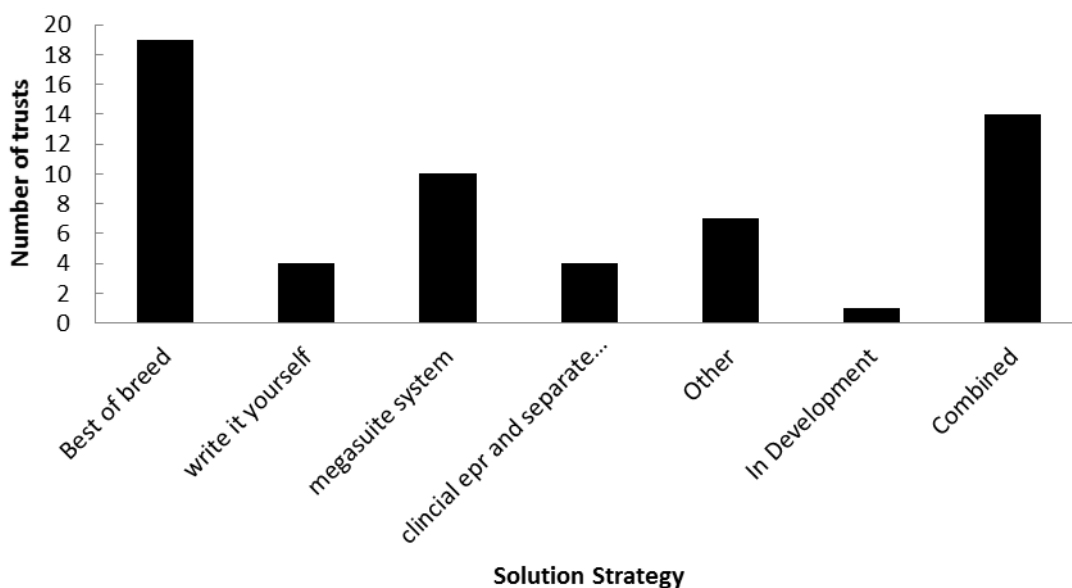


Figure 8: Trusts responses to the devices used and their perceived or experienced usefulness

A variety of reasons for adopting a best of breed approach were provided by interviewees and included: different systems plays to the multifaceted issues encountered by patients, the idiosyncratic data model of the NHS, an inability to afford or lack of availability of large American systems (or all in one approaches) and having no software development teams. Despite the approaches popularity, a few individuals raised concerns and cited evidence regarding the complexity and inconsistency of the approach. Those who had adopted a best of breed approach also described how their system had developed over time, with EPR functionality added as it was required. The

use of an integration engine to link all departmental systems together, providing a single view of the patient was also commented on for those utilising this approach:

051601: our view is to take that best of breed approach so departmental systems that are really good for their job and then have some glue that brings that together...so we have a single view of the patient as they go through the organisation (30-34).

Comparisons were drawn between best of breed and megasuite (big bang) approaches to implementation, where EPR systems are installed quickly, requiring staff to use the system immediately (Ludwick and Doucette); with benefits and challenges attributed to both approaches. Pros and cons of megasuite approaches were cited by interviewees, with trusts using this method typically being well resourced, digitally mature and involving clinicians heavily within their EPR projects:

082404: there's quite a lot of published evidence to say that best of breed is not necessarily the best solution and the interfaces can become quite complex...and we have experienced some really bad interfacing problems and actually as it turns out even with what you call a megasuite there are still interfaces (98-102).

There was no consensus among survey participants as to the system or range of systems used to deliver EPRs. Of the 52 trusts who responded to this question, 37 different systems were cited by respondents. However, it is not known to what extent these systems are used by trusts and at what stage of implementation they are at. Table 16 displays the most frequently used electronic systems or solutions adopted by participants with systems included in the table if they were used by 2 or more trusts. Furthermore, in some instance trusts were using a combination of systems in their efforts to meet the paperless ambition. Taken together this could reflect the lack of knowledge around the 'best' systems to use and potentially the lack of any one system that can meet all clinical requirements. Additionally, although 12 participants stated they did not have an EPR, table 16 indicates that there were 7 non-responders to the question 'what systems are you using to implement your EPR'; further reflecting the confusion as to whether trusts consider themselves to be implementing an EPR.

Table 16 The systems being used by trusts to deliver their EPR

Type of system	Frequency	Functions
Best of Breed	9	This category is for trusts who indicated they were using a best of breed approach or range of departmental systems (see section 5.13).
In House Developments	9	See section 5.1,3
RiO (RiO mental health)	6	An EPR software solution for recording and documenting health care services. Predominately used in mental health and community health settings (Servelec Group, 2014).
Sunquest ICE	5	An integrated clinical environment providing a range of products mainly associated with results and reporting. Other features include; discharge, wristband and label printing (Sunquest, 2014).
System One (System One community)	4	Comprises a range of modules (hospital, GP, child health) used together or in isolation. The 'hospital module' includes; PAS, bed management, e-prescribing, e-discharge, A&E and clinical record viewer. (systemone, 2014)
KAINOS Evolve	4	An EPR enabling the creation, capture and handling of medical records. Extra features include; e-discharge, patient manager (planning and monitoring clinical activity), timeline (an at a glance patient history) and living forms (to monitor patient progress) (KAINOS, 2014).
Civica Paris	4 (2 Civica Windip)	EPR and care management system for monitoring and managing community and social care. WinDip is an electronic workflow and document management system complementary to the EPR(Civica health and social care, 2014).
Ascribe	3	A range of solutions which include PAS, order communications, e-prescribing, scheduling, e-handover (Ascribe, 2014).
System C (Medway, Careplus, Liquidlogic)	3	A range of solutions to health and social care such as: Medway EPR, Medway Maternity (see chapter 7), Careplus(child health records solution) Liquidlogic (child or adult social care system) (SystemC Connected Care, 2014).
IPM	3	Integrated patient management solution which allows the whole patient journey to be tracked within a single system (CSC ipatient manager, 2014).
Millenium	2	An EPR allowing real time access to patient results and clinical information. Features include; handover, real time dashboards, real time bed management, prescribing, clinical decision support (Cerner, 2014).
Graphnet	2	Can be used as either a shared record viewer across organisations or a single EPR in an acute trust. Provides immediate access to up-to-date patient information, assessments, data collection, workflow and notifications across organisations (Graphnet, 2014).
PACS	2	A system enabling images such as X-rays to be stored

		electronically and viewed on screens so information can be accessed and compared to previous images (NHS Institute for Improvement and Innovation, 2006-2013).
Meditech	2	An EHR comprising a suite of integrated applications including EPR and PAS which include components such as; order communications, A&E management, theatre management, document management and results reporting (Meditech, 2014).
No response	7	

5.2.6. Clinician involvement in trusts EPR projects

Whilst the majority of interviewees mentioned that there was clinician involvement in their EPR projects, the type of clinicians involved varied. For instance, for a number of participants clinician involvement equated to senior staff (e.g. chief nurses) attending steering groups or boards, whilst others felt that in addition to senior staff, front line staff were also involved in their EPR projects. For those involving front line staff clinicians were involved at all project levels (e.g. from design to system development and implementation):

082404 so the clinicians are clearly involved in the choice of systems...but now we're actually into the implementation side of things and [supplier] implementation they said that we had to take about a 100 whole time equivalent staff out of the organisation for 18 months to actually...deliver this system...it was a huge investment I don't think I've ever come across an NHS trust that's made this kind of investment and making front line staff in so the systems is being built not by our IT people but by frontline staff...25 out of those 100 are consultants...there's actually quite a lot that are consultant grade there's also a lot of junior doctors involved we've got nursing staff we've got pharmacists radiographers midwives nurses I mean we've got over 50% of the people who are building the system are from a clinical background (74-84).

Contrastingly, a couple of trusts were either not involving clinicians in their EPR projects or were only involving them at the end of projects when showing staff the system. These trusts attributed the lack of involvement to clinicians not being interested in being involved or a belief that clinicians should not lead EPR projects. However, these participants stated that were something to go wrong or if projects were more clinically focussed they would involve clinicians more:

061803: *we have not yet engaged our clinicians at a detailed level and in respect to our patient administration system they are engaged more strategically in terms of our theory we have three of them involved in that but they've yet to come to detail with our patient administration system and my past experience of that is that they will not be terribly interested...we will have their key issues they will want to have resolved but in terms of how our patients are processed and how you report through all the treatment pathways... the reaction is likely to be when there's a problem with roll out rather than to anticipate in the workshop or identify benefits beforehand of the system and the nature of things...when we move to more clinically based systems their involvement and interest is much greater...and a particular example is I don't expect to be mobbed (82-91).*

Interviewees also described how they have or would use the following to involve clinical staff in their EPR projects; training clinicians in IT, having clinical leads or clinical champions with allocated time for the project and investing in engagement. A couple of participants also acknowledged the importance of using trainers who were clinically and IT trained to ensure staff engagement:

041202: *one of the early mistakes we made was we employed a chap who was a very good trainer he could train people and knew how to use word and excel and all those sorts of things and we used him to try and do some of the training and some of the consultants and they ran rings round him...and they were all awkward they weren't doing some things and actually what we found was that actually by employing people who had that nursing background the nurses were able to say to some of the senior consultants well you don't actually do that do you...I know the way it works on the wards whereas you know someone like the person we employed didn't have that background knowledge (192-200).*

5.2.7. The benefits of implementing EPRs:

Interviewees cited benefits they are expecting to see as a result of implementing EPRs and benefits they have already realised. Whether participants mentioned realised benefits depended on the level of digital maturity at that trust. When relating expected benefits only two participants referred to benefits realisations plans or business cases. The realised and expected benefits that emerged during the interviews were centred around; patient safety, efficiency and the quality, availability and access to information.

Patient Safety:

A number of interviewees felt that patient safety could be improved as a result of EPRs and more specifically e-prescribing through: fewer adverse events, more consistent prescribing, reduced errors from reduced repeat prescribing and lower levels of contraindicated prescribing. Interviews also expected advanced decision support to accrue patient safety benefits through; routine allergy and prescription alerting, prompting for best practice, monitoring and identifying at risk or deteriorating patients and reductions in medication errors, transcription errors and medication related events.

020401: it's the more advanced decision support. I pull up some common ones ...serious reduction in transcription errors...less or almost no mis-doses speedier time from ordering to delivery of medications ...some of the harder ones are the alerting that happens so when you order one OPO and then somebody orders another one what does the system tell you to do and how does that assist you so there's some huge advantages to just those routine alerts that you've programmed in that fire and fire and fire because essentially you could potentially have saved someone's life in one of those (164-172).

As previously mentioned, whether participants had realised patient safety benefits was dependent on the digital maturity of their trust. Participants from mature trusts in terms of EPR development and implementation provided detailed, practical examples of how EPR systems have brought patient safety benefits through; early warning scores, monitoring deteriorating patients and nag features prompting the acknowledgement of results. However participants from trusts with lower EPR maturity explained that they have failed to realise the patient safety benefits to the extent that they expected.

010301: the electronic observation was a big jump forward for us in making explicit what patient early warning scores were across the whole hospital so we can now see where the sick patients are very quickly across the whole hospital all the designs and work that we are doing within the EPR is helping support the safer care of our patients (211-215).

Efficiency:

The majority of participants reported that they expect EPRs to lead to efficiency benefits through speedier flow of information, data entry and completion of tasks such as discharges. Efficiency benefits that had been realised related to EPRs saving staff time

by streamlining processes and having all clinical information accessible and available. Additionally, participants articulated how they expected their trusts to become more efficient in terms of their finance and resource savings as a result of; not having paper, reduced prescribing costs from e-prescribing and a reduction in the number of diagnostic tests. A number of participants also described how their trust had become more efficient through reductions in admin staff and paper note storage:

051601: *we're...able to turn around things like pathology and radiology reports much faster (138-139).*

Quality, availability and accessibility of information:

Participants suggested that there will be, and in some instances have been, benefits from EPRs improving the quality, availability and accessibility of information. These benefits are expected to result from having all patient information in one place enabling the use and sharing of information within and across health and care organisations:

030608: *you can actually do better audits better review of care...better comparisons how come patient consultant team takes patient length of stay is normally five days whereas patient consultant team 2 length of stay takes ten days what's the difference...and you can't do that sort of comparison very easy with paper records...but the ability to share that sort of information and turn that information into working knowledge that we use again for new patients (202-208).*

5.2.8. Challenges of implementing EPRs:

As previously mentioned interviewees represented a range of trusts that are not only at various stages of implementation, but in some instances have no current plans to implement an EPR. This section therefore explores the various challenges associated with implementing EPR systems and moving towards a digital NHS.

Clinician engagement and managing clinician's expectations:

The challenge most frequently mentioned by interviewees was the difficulty of engaging clinicians with a trusts EPR project. A number of participants commented on clinician's level of IT knowledge, with variation in their knowledge perceived to make engagement difficult. A practical example of this was where animosity between junior and senior clinicians occurred, due to senior clinicians feeling threatened by their junior's computer literacy and which resulted in a senior clinician not using the new ward computer. Increased societal use of technology was also perceived to influence clinician

expectations. This has ultimately raised clinicians' expectations of what technology should be available at work due to the sophistication of the technology they are used to at home to complete a range of daily tasks.

041202: we've got lots of people who are experts at computers or at least they think they are ...because they use them at home in every walk of life they're using a computer nowadays and of course you know the fact is that the NHS is behind a lot of industries there's no doubt about it you know if you book a holiday it's a lot easier I would argue that it's actually a lot easier to book a holiday than to provide a whole series of diagnostic tests to request from but people have got to the stage where you know they can do their shopping they can book their holidays and whatever else easily and with all the latest modern technology...and I think what's becoming more and more of a challenge to me now is that people want to be able to use their phone to do things and see things and as I say we we're using technology which is nearly 20 years old so that's quite a challenge.

I: so it's like their expectation is that the technology is going to be to the standard that they are used to at home and it's possibly not up to that standard.

041202: indeed there's a very good quote I heard at one conference recently... when I started work if I wanted the latest technology I went to work....now I stay at home (laughs) because I've got better technology at home...and its true... and my phone is much better than my computer at work (421-437).

Managing clinician's expectations in terms of what can be achieved from EPR projects and within what time scale was an additional challenge as interviewees described how clinicians expect EPR projects to finish. However in reality 'the shifting landscape of technology' means new technology becomes available and creates new possibilities, meaning EPR projects are rarely finished. Variation in clinician's desire or willingness to be involved in EPR projects was also perceived to affect clinician engagement. This variation in 'keenness' was attributed to a lack of time for clinicians to be involved and willingness to adopt change:

010301: you have a huge variation in those who are keen to use IT and those that are not keen to use IT and so engagement with the staff and getting them to understand the importance of utilising the technology that we have has been a big challenge (306-309).

Finance and resources:

Although considered a side issue by one of the more soundly resourced trusts within the study, a number of interviewees described how financial instability and constraints are preventing projects and trusts from achieving their EPR ambitions. One interviewee emphasised this point by stating that it was not technological constraints preventing their EPR development but their financial situation:

061803: if we'd had greater continuity of management and more resources available to us in the first place instead of having to fight for each and every project, whilst we had two or three reasonable years the last two years have been fairly dire in terms of resource because of the situation we are in financially...thinking about results has created more issues in terms of financial stability and nobody's really prepared to own up to that (198-203).

Participants also raised concerns over the 'unequal playing field' that has been created by NHS trusts different financial and resourcing situations. This was perceived by participants to have been enhanced by national policy, which sets the same aims and targets irrespective of NHS trusts financial situations and levels of digital maturity. Ultimately this was viewed to have created a 'catch up' situation for some trusts with interviewees explaining how they felt the need to develop their EPR systems at the same rate as other trusts who are in a better position in terms of their digital maturity, finances and resources:

061803: the problem basically nationally is the policy as soon as we all started equal we did anything but...it's extremely difficult to deal with a catch up situation in the regime that we're in.

I: ok so you think ...potentially it's the sort of resources coming down nationally?

061803: yeah unfortunately even though you end up with the same objective of improving patient safety and improving the patient experience because our pay back is after the event there's nothing as attractive as employing more wards more nurses in the emergency care wards...that doesn't get you headlines...it doesn't get you a CQC...ticks in the box either ...there's a lack of national appreciation of how you approach this and how difficult this is if you approach this piece mail (206-215).

National policy and government influence upon NHS IT:

Around half of the interviewees within the study named the government and national IT strategies as a challenge. Participants stated how they feel they are 'battling' with different policies that are enforced upon them and rendered the situation a 'political football'. There was also clear tension surrounding The National Program for IT (NPfIT) (DoH, 2002) with participants still considering the program to be impacting on the implementation of EPRs. Whilst the program was considered by participants initially to be a good idea, it is now viewed as a lost opportunity that is still hindering the innovation and development of EPRs to the extent that the UK and NHS are behind other countries. The animosity among participants towards government and national IT policy was also evident when interviewees spoke of 'political milestones' that are enforced upon trusts, which do not meet trust or clinical needs:

071212: lack of foresight because actually when a lot of these things come out of number 10 or wherever they come out of there's people on the ground that are going oh no and yet somebody still thinks this is a good idea...I mean who thinks the friends and family test is a good idea [laughs] collecting that and reporting it by ward it's a terrible idea but we have to waste our time doing it....so the reality is that we waste a lot of our time doing things that are completely useless and add no value to the clinical service whatsoever so there's something that I would change (244-251).

Software, technology and the supplier market:

A number of interviewees commented on how software and technology is behind, to the extent that for some ambitions such as 'clinicians being able to access records through one device', software is currently not mature enough to allow this. Therefore despite trusts wanting clinicians to have access to a variety of devices according to their needs, doctors are in reality carrying and or accessing multiple devices, which is impractical:

051601: one of the real challenges we've got is people and we want clinicians to be mobile so as to have access to information they need from wherever they are but what we find is software vendors or solution providers are a little bit behind on that curve (114-117).

The technology and systems that are currently available within the UK was an additional challenge. For instance one participant explained how trusts often have to compromise between a foreign megasuite system, which does not fit the NHS data

model, or an imperfect UK system which does not have all the necessary functionality for an EPR. Additionally, the lack of competition within the UK supplier market which is currently dominated by two major suppliers along with the suppliers themselves who do not deliver what they initially promise were additional challenges:

051601: *suppliers is difficult...some marketing departments are fantastic promise you the earth and...struggle to deliver you anything...there is a lot of talk in the NHS about...widening out that supplier community our view is it's pretty wide already but one or two EPR vendors seem to be winning the war on companies and people (195-200).*

As discussed in section 5.2.5 there is no consensus regarding the best approach to EPR implementation with positives and negatives to both megasuite and best of breed approaches. This in conjunction with the lack of universally accepted 'out of the box' approach and the different needs and financial situations of NHS trusts, which makes knowing what approach or system to use to implement EPRs challenging:

072212: *I think the biggest challenge is that there's no out of the box solution for it so you whatever situation you're in your having to do a lot of design...and everyone makes decisions based on where they are at the moment...and the decision I would make for me wouldn't be the right decision for you know someone whose sitting in another large hospital in you know in...or something like that...because they are in a different place (192-198).*

Showing a return of investment:

Interviewees also described how quantifying benefits or showing a return of investment on EPR projects is challenging. This was attributed to the fact that EPR benefits are: multifaceted, subjective and often not realised until the end of the process; which can be a less attractive investment to trust boards than other large scale investments which see immediate returns e.g. hiring frontline staff:

051601: *the focus is very much on return of investment... and return of investment is traditionally financial models...how you...do a financial business case to stop one child's been in a safeguarding sort of incident is again very difficult to model up...and it becomes a bit like an insurance policy...a business case providing an insurance policy [...].I paid 200 pounds a month for my car insurance never claim it but I still think I need it (laughs) so it's when times are hard to have those sorts of systems that support those risk management insurance stuff is very difficult (187-195).*

5.3. Discussion:

This study explores the current status of Electronic Patient Record Systems (EPRs) the various approaches to their implementation and the perceived benefits and challenges associated with their use in England's NHS acute, community care and mental health trusts.

5.3.1. Findings:

Defining EPRs

In this study an EPR was described by interviewees as 'a system that removes the need for paper in the patient pathway, provides clinicians with the information they need when they need it and has clinical decision support'. Nevertheless, there was some disagreement among participants as to what systems and approaches may be considered an EPR. This is largely due to there being no agreed or 'best' approach to implementing EPR's, which when combined with a lack of clear understanding and no uniform definition of an EPR results in confusion and different interpretations of the term. For instance in this study participants reported a variety of different approaches (Best of Breed, In House Developments, Megasuite) and systems (table 16) that are being used to implement EPRs with disagreement ensuing as to what systems and approaches may be called an EPR. The need for clearer definitions of the terms paperless NHS, IDCR and EPR was also reported by the E-Health Insider (EHI) Survey, which reported 90% of its respondents calling for the commissioning board to start by defining its terms (EHI, 2013). The survey which received 300 responses and was conducted by Ehl a commercial website that provides, news comment and analysis on IT in the UK; aimed to discover the key steps and routes necessary for trusts to implement EPRs as well as respondents opinions on what NHS England should do to support trusts. Despite being grey literature, the survey is the only other UK evidence that can be used to aid discussion and comparison in line with the present study's research questions.

A paperless NHS?

The majority of interviewees in this study defined a paperless hospital to equate to the removal of paper in the patient pathway. However, a number of participants stressed that paperless does not mean that paper will be removed completely. In spite of some trusts reporting that they are already paperless, or believe they will achieve this aim, there are some who question the ambition's feasibility. This was echoed by the Ehl

survey whose participants described the ambition as “a red herring” and a “dangerous pipe dream” (Ehl, 2013), suggesting that there is ambiguity surrounding the term ‘paperless hospital’ and how it is defined and interpreted. This is potentially due to NHS England in their latest national strategy Safer Hospitals, Safer Wards (NHS England, 2013) merely describing the journey to becoming paperless’ as being from paper to paper-light to paperless record keeping. Furthermore, there remains a lack of clarity around what the term paperless NHS actually means. This has potentially created a divide between those that define the term literally to mean no paper and those who perceive it as the removal of paper in the patient pathway but not from the organisation entirely. This is problematic as without greater clarity as to which of these targets the NHS ambition relates to, there will continue to be questions around the targets feasibility with trusts striving for their own interpretations of the term rather than one unified goal.

The current status of and approaches to implementing EPRs

This study also determined that there is no consensus as to the approaches or systems used to implement EPRs or IDCRs. Despite a best of breed approach being the most common solution strategy among participants only represented 32% of survey respondents with interviewees also citing pros and cons for the approach. Furthermore, 37 different systems and different combinations of systems were being used with a range and often multiple devices used to deliver EPR. For instance the majority of trusts reported using 3-5 devices as part of their hardware strategy. Whilst, this study is not recommending a one size fits all or national approach to EPRs as this was unsuccessful in the past (NPfIT); the lack of consensus about how to implement and deliver an EPR makes it difficult for trusts to establish what the best routes for them would be and for lessons and knowledge to be shared.

Furthermore, the lack of clarity around approaches, systems and indeed definitions surrounding EPRs makes quantifying the status of EPR implementation a particular challenge for researchers and policymakers alike. This study aimed to gauge EPR status in a number of ways such as by asking participants to indicate whether they had “any form of EPR” within their organisation. However, despite 47/59 of survey respondents responding positively to this question, this figure gives no indication of the day-to-day usage, functionality or stage of implementation. Additionally, participants were asked to describe when they felt their trust would use their EPR as the primary record to replace paper. Yet, there were conflicting responses to this question with some trusts claiming to already be using their EPR as their primary record and others stating this would not be possible. It is therefore difficult to provide an accurate

representation of the number of UK trusts having an EPR not only due to the lack of unanimity in defining an EPR but also as this figure gives no indication of the day-to-day usage, functionality or stage of implementation.

The difficulty in classifying UK EPR status has been acknowledged by NHS England who have begun to address the issue through the development of the Clinical Digital Maturity Index (CDMI) (November 2013) (Appendix 5) (Ehl, 2014; NHS England, 2014a) the first UK model for digital maturity. The index is being developed to highlight the steps (functionality, systems, approaches) required to reach higher levels of digital maturity thereby aiming to inform trusts future decision making. The index also describes what clinical and administrative systems are present within a trust so they can benchmark their current position in comparison to others and considers trusts individual context, with their assets, resources and business requirements to build an IDCR included (Ehl, 2014, NHSEngland, 2014a). The model may provide a platform for UK evidence and help inform UK trusts about the best approach for them to achieve digital records, as currently UK trusts rely on foreign maturity models for quantifying maturity such as the U.S HiMSS model (HiMSS Analytics, 2014). However, CDMI will initially not provide an indication of the day-to-day usage of EPR systems, which may result in trusts being wrongly classified in terms of their digital maturity. For example the model will determine hospitals digital maturity based on what systems and functionality they have implemented. However by not considering usage, a trust that has for example a variety of systems implemented that are not used would potentially be considered more digitally mature than a trust that has a few systems or functionalities in use daily.

Clinician Involvement in trust EPR projects

Clinician involvement was perceived by many to be a key factor affecting the implementation of EPRs. The majority of interviewees acknowledged that clinicians should be involved in trusts digital record projects. However, there were contrasting opinions as to the type (all staff groups vs. senior staff) and the point at which staff should be involved (all project stages, end of project). This study describes a number of ways in which trusts within this sample have achieved clinician involvement in EPR projects. For example through the use of clinical leads or staff champions. The importance of clinician involvement is acknowledged by NHS England in their 'Safer Hospitals, Safer Wards' policy where it is stated that 'clinically led projects with comprehensive buy in from all staff groups are essential with clinical leadership and technical advances needing to be in step' (NHS England, 2013). Clinician involvement

is also commonly cited in change management approaches as a key success factor in organisational change and has been recently deemed crucial to the success of electronic record implementation (Boonstra, Versluis & Vos, 2014). Moreover, of the over 150 factors that have been associated with electronic record implementation, the two that are most consistently associated with successful implementation are “top managerial support and user involvement” (Protti, 2002).

Benefits of implementing EPRs

Interviewees also reported having experienced benefits from reduced diagnostic tests and better availability and accessibility to information as a result of their EPR systems. However, it was trusts who had EPRs with more advanced functionality such as e-NEWS to monitor deteriorating patients and early warning scores that had experienced the most patient safety benefits. The findings in this study reflect previous literature that also reported how benefits are expected around quality and safety, efficiency and the availability of information (chapter 1, section 1.2.1). However this literature is largely based on benefits, which are expected to be realised with empirical research outside of the US or primary care setting is sparse. The benefits surrounding the implementation of EPRs are discussed in more detail in chapters 1, 7 and 8.

Challenges of implementing EPRs

Despite being documented as a key factor affecting EPR success in this study, clinician involvement was not deemed as important by all and was cited as a key challenge to implementation by a number of interviewees. This was largely due to problems with engagement resulting from a lack of perceived willingness from clinicians to be involved and also variation in clinicians IT knowledge. Participants reported the difficulty stemming from the increased societal use of technology meaning individuals have greater computer literacy but also greater expectations about what technology should be available at work. Considering the powerful position of clinicians and their potential for resistance which can delay or even prevent implementation (Boonstra, Versluis & Vos, 2014) there is a need for more guidance and research that focusses on identifying how to successfully engage clinicians in EPR projects and for greater sharing of best practice throughout the NHS.

A number of challenges associated with the lack of a single approach to implementation, as well as the hardware and technology available, were discussed by interviewees. Participants also spoke of how they have to compromise when choosing systems between international systems, which fail to meet the NHS data model or an

imperfect UK system, which does not have all the required functionality. Once an approach is selected, despite having various hardware options available no single device is suitable for all clinical needs meaning clinicians often have to access a range of devices depending on the task at hand. Ultimately, this makes it difficult to provide advice or guidance relating to EPR implementation due to their being no consensus as to the best approach or systems to use; a problem recognised by Protti during his assessment of the 1998 *'IfH'* policy (Protti, 2002). Whilst the CDMI will undoubtedly provide support to trusts implementing EPRs; there is a real need for more empirical evidence, case studies and sharing of knowledge so that trusts from all different contexts and positions can embark on this journey with the knowledge they need to be successful.

An additional challenge was the impact of national policy on the implementation of EPRs. Participants cited *'NPFIT'* (DoH, 2002) as a challenge and considered the policy to still be hindering current digital development in the UK. Interviewees also rendered the current situation a 'political football' with milestones that are not always clinically relevant being enforced upon trusts. Despite research suggesting that health policy does affect the success of EPR implementation (Stroetman et al., 2006; Deutsch, Duftschmid & Dorda, 2010) with the exception of chapters 2 and 3 of this thesis, there is no evidence, which has sought to explore how national policy influences the implementation of EPRs over a period of time. Instead current literature has focused on evaluating *'NPFIT'*, (Hendy et al., 2005; 2007; Cresswell & Sheikh, 2009; Greenhalgh, 2011; Takian, Sheikh & Barber, 2012), something which is also well documented by the media (Mathieson, 2011; Mance, 2013, Syal, 2013).

Previous literature surrounding the costs of electronic record implementation is sparse and predominately US or primary care based (Wang et al., 2003, Hillestad et al., 2005, Gans et al., 2005). The findings of this study have provided insight into the financial challenges surrounding the implementation of EPRs highlighting that an unequal playing field currently exists. *'Safer Hospitals, Safer Wards'* (NHS England, 2013) acknowledged this issue and proposed that its technology fund and CDMI as potential solutions. However, with the current financial challenges facing the NHS and uncertainty as to whether funding will be available to trusts seeking to implement EPRs (chapter 3, section 3.2.1) it is anticipated that financial constraints for NHS IT projects may become a more prevalent issue. It is therefore crucial that in addition to clarifying what funding (if any) will be available, that support particularly for those at the lower

ends of the digital maturity spectrum is provided to prevent the 'playing field' from widening further.

A number of trusts reported showing a return of investment from EPR projects to be a challenge. This is particularly prevalent in light of the first round of technology funding from the "Safer Hospitals, Safer Wards" policy (NHS England, 2013) having £60million of the £260 million originally committed to the policy being unallocated due to trusts failing to show a return of investment (Whitfield, 2014). Participants in this study attributed the challenges around this issue to benefits being largely subjective and being realised only at the end of implementation. Furthermore, the lack of UK empirical evidence around benefits makes it difficult for trusts to show a return of investment, which could be attributed to the reliance of UK business cases for EPRs on US evidence that is not applicable to the 'free at the point of care', tax funded NHS. As a result NHS trusts are reliant on evidence from international systems for their business cases making initial predictions for factors such as cost savings inaccurate (Personal Communication, NHS trust EPR manager).

Applying socio-technical thinking to the study's findings

The findings of this study show that various social and technical factors affect the implementation of EPRs. For instance, participants perceived national IT policy and the importance of engaging clinicians as contributory factors to the implementation of EPRs. Due to the range of systems, challenges, benefits and stages of EPR implementation reported by participants in this study it is apparent that how an EPR system is perceived or implemented in one organisation may not be applicable to another. The sociotechnical approach (chapter 1, section 1.4.2) therefore provides a useful framework to understand the different influences to implementing EPRs.

Table 17 displays the various factors that participants in this study perceive to influence the implementation of EPRs within NHS secondary care organisations. As in chapter 3, due to the variety of factors that have been identified, these are presented as macro, meso and micro level influences on implementation. For the purposes of this study, macro factors related to wider social norms and expectations such as the influence of national policy and government ambitions upon a trusts' ability to implement EPRs, whereas meso level factors were associated with organisational processes and routines such as a trusts ability to show a return of investment. Lastly, the micro level related to particular experiences of professionals or individuals within an organisation, such as the impact of clinicians IT skills. As in chapter 3, the majority of factors operated at the macro level, which was expected as although CIOs of NHS trusts were surveyed and interviewed, their ability to implement EPRs is influenced by national priorities and

'macro level factors' such as the funding and technology that is available to them. The importance of meso and micro level influences on EPR implementation should however not be underestimated, particularly in light of clinician involvement being recognised as critical to the successful implementation of EPRs (Protti, 2002).

Table 17 Influences to the implementation of EPR systems

Macro		Meso		Micro	
Factor	Description	Factor	Description	Factor	Description
National policy, and government influence	Impact of <i>NPfIT</i> and government targets.	Clinician Involvement in EPR projects	Whether trusts involve clinicians and how they involve them.	Clinicians IT knowledge and willingness to be involved in IT projects	Whether clinicians are engaged and/or adopt EPR systems can depend upon their IT skills and willingness to be involved.
Lack of universal definitions	Ambiguity around definitions and interpretations of a paperless NHS and EPRs	Showing a return of investment	Return of Investment and EPR business cases		
Implementation strategies/solution strategies	There is no single best approach to implementing EPRs available.				
Technology and hardware available	The technology that is available is not mature enough to meet clinical needs				
Finance and resources	Variation in funding and resources available to				

5.3.2. Strengths and weaknesses

This is the first empirical UK study to provide national coverage of the approaches to and current status of EPR implementation into NHS secondary care organisations. Despite the political and financial implications of implementing or failing to implement EPRs, the study provides useful insights into what is currently an under-researched topic within the UK.

The mixed methods approach adopted allowed a more detailed understanding of the research questions to be obtained, which would not have been possible if these methods were used in isolation. For example, survey data pertaining to the different approaches used to implement EPRs was supported by qualitative data that provided an understanding of the pros and cons of best of breed and megasuite approaches. Triangulating quantitative and qualitative data and integrating this data within the results section also allowed for congruent and dissonant findings among survey and interview respondents to be identified. For instance, the mixed methods approach not only allowed for quantitative data relating to the number of trusts who felt they would be paperless by 2018 to be obtained but enabled the inconsistencies that emerged within survey data as to whether a paperless NHS is achievable or not to be explained and attributed to the different interpretations of 'a paperless NHS' which emerged during the qualitative interviews.

The study also identified a number of working definitions, and their adoption and use in future research should be encouraged. If common and universally accepted definitions were produced this would make the dissemination and reporting of future research across various academic, industry and health care organisations easier. Furthermore, the ambiguity and complexity around communicating the current status of EPR projects in the UK between trusts might then be alleviated. This is a particular problem as different interpretations of the systems being implemented for example whether trusts are implementing an EPR or IDCR, makes research, the sharing of lessons and comparisons between trusts a challenge. This was an issue in this study where although various questions around EPR status, functionality and usage were asked conflicting responses were given. This was presumably due to the conflicting opinions among participants as to what systems and functionality are required for a system to be considered an EPR. The uncertainty around the terminology for EPRs does however

make survey responses in this study questionable and so could be considered a limitation of this study and indeed the wider EPR literature.

The main limitation of this study was the sample size for both the survey and interviews. This may have affected the study's generalisability across English NHS trusts. The problems experienced with recruitment and sample size may have been affected by the aforementioned EHI survey (EHI, 2013) which, requested information regarding the routes to implementing EPRs under the freedom of information act and reported to NHS England. Participant's willingness to take part may also be attributed to CIOs being difficult to access. This was due to the lack of consistency of job title for those responsible for trusts EPR projects and the lack of centralised record of CIOs available from the DoH; information which should be available under the freedom of information act. However, both survey and interview respondents represented a range of trust types and locations and so the sample may be adequate to meet the study's aims. Given the complexity of implementing EPRs and the variety of benefits, challenges and approaches identified by participants in this study, a higher response rate of both the survey and interviews would not take away from this picture. Whilst the full range of perspectives may not be represented, this is unlikely to have impacted the study's findings.

Another limitation of this study is the potential for response bias within the survey. As indicated in the demographics for the survey (section 5.2.1) respondents were mainly from trusts, which were implementing an electronic system. This is potentially as those who were implementing these systems and are starting to progress towards digital records would be more willing to describe the approaches they have used and challenges they have faced. Conversely, trusts with lower digital maturity may have been less willing to respond, particularly if they had anonymity concerns. It could be argued that some of the challenges, such as finance and resource constraints, which apply to trusts with lower digital maturity, may be underrepresented.

5.3.3. Reflexivity

As described in chapter 4 (section 4.9.3) reflexive notes were taken after each interview. Following the recommendation by Kretting (1991) it is important when considering the credibility of qualitative work for researchers to analyse themselves in the context of the research, reflect on their own characteristics and how they may have influenced data collection and analysis. Whilst the key methodological issues for the study have been outlined in section 5.3.2, the influence of myself as a researcher and

some further challenges recorded in my reflexive notes should be considered. Firstly, this was the first piece of qualitative work, which I have undertaken. A number of notes made throughout the interview process therefore related to anxiety towards conducting and analysing the interviews. This anxiety did however reduce as interviews progressed and to combat this issue the first two interviews were pilots with key informants who were already known to myself and who had helped inform the study.

To reduce the potential for researcher bias, regular discussions were held with a senior qualitative researcher so that themes were not determined by one researcher in isolation. Furthermore, the analytical process was undertaken systematically and in line with the analytic plan outlined in chapter 4. This was particularly important for myself as I had no previous experience in qualitative analysis and so this guidance was essential to ensure credibility and rigour to the research process.

A further issue recorded in my field notes was the time allocated for interviews. I was aware and interviewees often expressed that they had allocated 30 minutes for the telephone interview to take place due to their busy work schedules. It is possible that this may have affected the detail that participants gave and my ability to probe during interviews.

When designing the survey in collaboration with health informatics specialists it was anticipated that by asking participants to indicate whether they had an EPR in place an estimate of the current status of EPR implementation across English NHS trusts could be gathered. However due to the lack of agreement as to the systems, functionalities and approaches that constitute an EPR the response to this question should be taken with caution as the same approach, for instance, best of breed may have been classified as an EPR by some trusts but not others. This question also does not allow for inferences regarding the systems day-to-day usage to be gleaned. However, an open question asking participants to describe their trusts electronic record systems would have also proved problematic as the lack of universally accepted definition for an EPR would have made comparisons difficult. Furthermore, quantifying the status of EPR implementation and indeed usage is not just problematic for researchers but also for policymakers, as illustrated in the development of the CDMI by NHS England.

5.3.4. Recommendations:

Based on the study's findings the following recommendations are proposed. Firstly, based on the lack of universally used definitions for the systems, approaches and functionalities of EPR systems (section 5.1) a clearer taxonomy should be developed to

enhance shared understanding and improve the ease of disseminating and generalising research and policy.

From this study, it is also clear that how CIOs define EPRs varies. Policymakers, academics and NHS staff should work collectively to establish universally accepted definitions for the terms EPR and IDCR. It may also be useful to re-enforce the idea of IDCRs being a term for communicating an ambition for integrated digital records throughout healthcare. This study therefore recommends the use of the term IDCR as an umbrella term describing the various different approaches by trusts as proposed in '*Safer Hospitals, Safer Wards*' (NHS England, 2013). However, the term EPR should not be totally disregarded as it has been viewed as a pre-requisite for a paperless NHS (Ehl, 2013). Instead an EPR should be more clearly defined and be portrayed as one of the ways in which trusts can achieve digital maturity.

In light of the confusion surrounding NHS England's ambition for a 'paperless NHS', policymakers should ensure that this target is more clearly defined and communicated to NHS trusts. For example, does NHS England equate 'a paperless NHS' to HIMSS level 7, where organisations are paperless and use and share patient data to improve the quality and safety of care (HiMSS analytics, 2014), or is it only about replacing paper? Policy would benefit from being more transparent in what the target means in practical terms and should provide a description of what a paperless hospital looks like, to ensure that its vision is consistent with trusts' interpretations. To achieve this, policymakers, academics, industry and NHS staff should collaborate to produce a feasible and accepted definition of a paperless NHS. Furthermore, although previous policies such as '*IfH*' and '*NPfIT*' could be criticised for being too prescriptive in setting out a large number of aims to be achieved by certain time points, current policy appears to have gone the other way with only a few key ambitions and timescales proposed without clear definitions of what these aims mean or how they should be achieved. Additionally, a rationale behind why a paperless NHS is seen as crucial and what this means in practical terms would perhaps discourage some of the skepticism surrounding the ambitions feasibility.

In light of the uncertainty as to how trusts should implement EPRs, work that explores the various approaches to IDCRS and which develops knowledge for NHS trusts with various resourcing and financial capabilities should be prioritised. As with the NHS being a complex adaptive system it is unlikely that one system or approach will be financially viable or appropriate for all trusts. The CDMI could be used to facilitate this

as the index could be used by trusts to assess their digital maturity whilst allowing maturity data to be collected that tracks hospitals' progress using different approaches. Additionally, sharing of lessons learnt and best practice among NHS organisations, could be facilitated through establishing a national community of practice network or the Academic Health Science Networks and should aim to generate a knowledge base surrounding the best routes to IDCR's. Caution should also be adopted in future when outlining national priorities to consider the different stages of EPR development as well as the varying financial and resource capabilities of trusts; with potentially an adjustment of time scales according to trusts digital maturity as opposed to a 'one size fits all' approach to national IT policy as with the paperless by 2018 ambition.

Further UK research in this area with larger sample sizes is also needed to inform future EPR or IDCR implementations and NHS IT policy. Based on the study's findings and the variation that has been identified here, priority areas for future research include: establishing the costs and benefits of different systems and approaches to achieving IDCRs and/or EPRs and quantifying the impact of these systems on the quality and safety of care provided.

5.3.5. Conclusions

The mixed methods approach adopted in this study allowed an understanding of the current status, approaches, benefits and challenges to implementing EPR systems to be explored. The study identified variation in the approaches to implementing EPRs, with no clear best methods being established. There are also a variety of social and technological challenges encountered by trusts implementing EPR systems that are not necessarily experienced by all, with this variation potentially being due to contextual issues such as finance and resources. With the pressure on NHS trusts to implement EPRs better guidance of the best routes to implementation are essential if trusts are expected to create a 'digitised' and 'paperless' NHS. The implications from this study are discussed further in Chapter 8.

Chapter 6. Qualitative interview study exploring the implementation of a maternity information system: methods and analytic plan

The aims and methodology for a qualitative interview study which explored NHS staff's perceptions of the impact of a maternity information system upon practice are outlined in this chapter. Following the rationale and research questions, an overview of Normalisation Process Theory (NPT) is provided. As discussed in chapter 1 (section 1.4.4) NPT aims to address individuals' perceptions of the factors that promote and inhibit the implementation of a maternity information system and so the theory was considered the most appropriate for exploring implementation from the micro (health care professional) perspective. An outline of how NPT has been used to inform the design and interpretation of the study's findings is therefore also presented. The chapter then outlines the study's methodology, design and ethical considerations before concluding with the analytic plan. Here, the thematic approach adopted for the analysis of interview data is described, along with how NPT was used as a framework for interpreting the study's findings.

6.1. Rationale and aims:

This thesis aims to explore the implementation of electronic record systems within the NHS. Socio-technical thinking has been used throughout and provides the main theoretical framework for identifying benefits and barriers to implementing electronic records into secondary care organisations. The previous two studies within this thesis have explored electronic record implementation from the macro (national, chapters 2-3) and meso (organisational, chapters 4-5) perspective. This study represents the micro (individual) level by exploring NHS staff's experiences and perceptions of an electronic record system's implementation at a single NHS trust. Socio-technical thinking is also drawn upon during the study's discussion (chapter 7) where macro, meso and micro level factors affecting the implementation of the maternity information system identified by interviewees are outlined.

The heavy policy and financial pressure on hospitals to implement electronic records suggests a strong UK evidence base supporting the idea that electronic records can improve quality of care and health outcomes. However, in reality the UK evidence surrounding electronic records is sparse, particularly during initial stages of implementation (chapter 1, section 1.2). This study is the first in the UK to explore the perceived and experienced benefits and barriers of implementing a maternity information system into an NHS foundation trust. NPT is also used to interpret the study's findings and identify not only the factors

affecting implementation but also the extent that the system has been embedded into practice.

The study was created in response to discussions with key informants (chapter 1, section 1.4.2) at the trust, which identified a need for research exploring the benefits and barriers of implementing an EPR into general surgery. At that time, an EPR was being implemented into the trust 'by department'; general surgery was to be the first, as part of the trust's wider digital strategy. Delays with this project meant that the implementation did not go ahead. Subsequent discussions with key informants presented the opportunity to explore the implementation of a maternity information system, which documents an obstetric journey electronically (section 7.1.1). Whilst this system is not part of a hospital-wide EPR as yet and is currently a standalone departmental system, the study allowed perceptions and experiences of staff within a single department to be explored, which not only adds to the literature but provides the trust with feedback ahead of their hospital-wide EPR roll out; due to commence in 2016.

This study aimed to qualitatively explore the benefits, barriers and disadvantages of implementing a maternity information system into a single maternity unit. Additionally, the extent that the system has (or has not) been embedded or 'normalised' into routine practice was explored.

6.2. Normalisation Process theory (NPT)

NPT is used to explain the factors that promote or inhibit healthcare interventions or technologies from being embedded into practice (Mair et al., 2008). This theory was developed between 2000 and 2009 as a response to the lack of 'tools' available explaining why technologies have failed to become part of routine practice (May et al., 2000). NPT aims to identify gaps in existing theories for planning and evaluating implementation programmes (May et al 2009) and builds on limitations of diffusion of innovation models which it is argued do not evaluate, why or how interventions become part of clinician's daily practice (May 2006). Greater detail outlining NPT can be found elsewhere (May & Finch 2009; May et al, 2007; May 2006). However, in summary, NPT is an applied theoretical model which aims to understand and evaluate the factors that enable and inhibit complex healthcare interventions from being embedded into routine practice (May et al., 2011). The theory is concerned with:

- *Implementation*, the social organisation of bringing practices into action

- *Embedding*, the process where practices become or do not become a part of daily practice

- *Integration*, maintaining practices in their social contexts.

(May & Finch 2009; May et al., 2009).

NPT addresses how people make sense of a practice, participate in it and evaluate what they do (May et al., 2011) and suggests, that to understand the normalisation of practice what people do and how they work should be explored (May & Finch 2009). NPT proposes that the work of implementing an intervention (or in this instance a maternity information system) is achieved through ‘energising’ four mechanisms (Table 19): coherence (meaning and sense-making work), cognitive participation (commitment and engagement), collective action (enacting work) and reflexive monitoring (appraisal work) (Gallacher et al., 2011).

Table 18 NPT mechanisms as described by Gallacher et al., 2011

Coherence (Meaning or sense making by participants)	Cognitive Participation (commitment and engagement of participants)	Collective Action (The work participants do to use the technology)	Reflexive Monitoring (comprehending and appraising the technology)
Differentiation: Defining, dividing up, and categorizing tasks Communal Specification: making sense of shared versions of tasks. Individual specification: making sense of personal versions of tasks. Internalization: learning how to do tasks in context	Enrolment: recruiting the self and others to do tasks. Activation: organising a shared contribution to tasks. Initiation: organising an individual contribution to tasks. Legitimation: making tasks the right thing to do.	Skill set workability: allocating tasks and performances. Contextual integration: supporting and resourcing tasks in their social contexts. Interactional workability: doing tasks and making outcomes in practice. Relational integration: making and communicating reliable knowledge about tasks.	Reconfiguration: changing tasks. Communal appraisal: shared evaluation of contributions and tasks. Individual appraisal: individual evaluation of contributions and tasks. Systemisation: organising a reliable stock of knowledge about tasks.

Despite NPT being a relatively new framework it is considered a ‘*well characterised and middle-range theory of social-technical change*’ (May et al., 2011) and has been applied to evaluate the implementation of tele-health (King, Richards & Godden, 2007; Mair, Hiscock & Beaton, 2008) and e-health technologies (Murray et al., 2011). Given the previous use of NPT in evaluating the implementation of technology in healthcare, and the theory’s focus on understanding implementation from the micro (individual) perspective the mechanisms of NPT have been adapted for use within this study. The four main mechanisms of NPT were

also considered a useful way of identifying factors affecting the systems implementation and for determining the extent that the system has been embedded into clinician's daily practice.

NPT has been used in the design and evaluation of this study as it informed the interview schedule and also provided a theoretical framework to interpret the study's findings, details of which are provided in section 6.5. The previous application of the theory to a range of complex interventions both within and outside its original field of e-health (King, Richards & Godden, 2007; Mair, Hiscock & Beaton, 2008; Murray et al., 2011; McEvoy et al., 2014) illustrates the theory's versatility. The following broad working definitions were created so that the theory could be adapted for use within this study and ensured that the interview schedule included questions relating to all four mechanisms of NPT:

Coherence: Do staff have an understanding of why the system has been implemented?

Cognitive participation: Are staff engaged and committed to using the system and what are the factors that promote and/or inhibit this commitment?

Collective Action: Are participants using the system and what are the factors that promote and/or inhibit them from using the system?

Reflexive Monitoring: Have staff appraised the system and its impact on practice?

Of the literature that has been underpinned by NPT little explanation of how the theory was used in practice was provided. However, Murray et al., (2010) use a number of examples such as the UK ImPACT study which aimed to promote evidence based care of patients with back pain in primary care (Tooth, Ong & Foster, 2010 in Murray et al., 2010) to demonstrate how researchers can apply NPT to the design, evaluation and implementation of studies in healthcare. The paper includes examples set out in tables to show how the questions asked within their studies (e.g. the UK imPACT trial) are mapped onto the four mechanisms of NPT. Table 19, has been adapted from Murray et al., (2010) and aims to demonstrate how the definitions and examples provided by Murray et al., (2010) were used alongside mechanisms of NPT created for this study, to ensure that the study's topic guide (appendix 13) included questions relating to all four mechanisms of NPT.

Table 19 Use of NPT in developing complex interventions (Murray et al., 2010)⁶

NPT Components	Questions to consider within the NPT Framework	Example: NPT evaluation of the ImPACT back pain study	Example questions for use within the present study
Coherence	Do participants have a shared sense of its purpose?	Participating GPs did not differentiate the new intervention from current practice and were unable to perceive the projected benefits to patients, primary care teams and physiotherapists.	Were you made aware of the purpose of the system when you were first introduced to it? If so how and what were you told?
Cognitive participation	Will they be prepared to invest time, energy and work in it?	Participating GPs saw it as research (e.g. recruiting patients to the study), and peripheral to their main task of delivering patient care. Projected benefits were not obvious to the GPs so they were insufficiently motivated to invest thought and energy into changing their practice.	How did you feel about the training or lack of training? Is there on-going training especially for new users or more general computer training that you are aware of?
Collective Action	How will the intervention affect the work of user groups?	GPs already felt under pressure of time in consultations, and felt that using the decision-support tool was an unjustified additional use of time.	How has it affected your practice?
Reflexive Monitoring	Will it be clear what effects the intervention has had?	Despite regular feedback from the research team GPs did not perceive benefits to the new system as they did not use it enough.	Have you seen any patient safety related impact (either positive or negative)? Has this changed over time?

6.3. Methodology

6.3.1. Study Design

Qualitative semi-structured interviews with a range of staff groups (health care assistants, midwives, doctors) and grades (consultants and grades of midwife) within a maternity unit at single NHS teaching hospital were conducted. The topic guide was informed by NPT, (section 6.2) (Murray et al., 2010) and was adjusted following the first 3 participants, which were included in the sample, but considered pilot interviews. Interviews took place between April and November (2014) of the first year of the systems implementation.

⁶ Source obtained and adapted from Murray et al., (2010).

6.3.2. Sampling Strategy

Qualitative research uses non-probability sampling strategies, which rather than aim for statistical representativeness, use the characteristics of the population as a basis for selection (Ritchie, et al., 2013). In purposive sampling, individuals of a sample are selected with a 'purpose' to represent a location or type in relation to a specific criterion, such as age or gender (Ritchie, et al., 2013). In doing so, purposive sampling aims to ensure that the key individuals of relevance to the area under study are represented and that there is some diversity within each of the selected key criteria; so that the impact of these characteristics can be explored (Ritchie, et al., 2013). To achieve this, purposive sampling strategies are often developed at the study design phase and are informed by a range of factors including: the study's aims, existing knowledge or theories about the topic area, hypotheses for the study to explore and gaps in knowledge about the study population (Ritchie, et al., 2013).

In this study, the purposive sampling frame aimed to recruit a range of staff groups and grades as it was anticipated that their perceptions and experiences of the benefits, barriers and disadvantages of the system would differ. This was particularly important, as the system was introduced in stages throughout the maternity unit and interviews were conducted during the first 12 months of the system's implementation, therefore the amount of time that staff had been using the system when interviewed varied (Personal communication, lead midwife, 2014⁷). As well as different grades of midwife, doctors from Senior House Officer to Consultant were recruited. Additionally, despite health care assistants' use of the system being limited, this professional group was recruited as it was expected that their practice would be affected by other clinicians' use of the system. To maximise the variation of the sample further, staff directly involved in the system's implementation were also included as their perceptions and experiences of the system and its implementation were expected to differ from those not actively involved in supporting the implementation.

To reflect this variation, the study's purposive sampling frame recruited a range of staff groups and grades as it was anticipated that their perceptions and experiences of the benefits, barriers and disadvantages to the system would differ. As well as different grades of midwife, doctors from Senior House Officer to Consultant were recruited. Additionally, despite health care assistants' use of the system being limited, this professional group was recruited as it was expected that their practice would be affected by other clinicians' use of the system. To maximise the variation of the sample further, staff directly involved in the

⁷ Source withheld, personal communication with lead midwife for the system's implementation.

system's implementation were also included as their perceptions and experiences of the system and its implementation were expected to differ from those not actively involved in supporting the implementation.

Rather than aim for a pre-determined number of participants, the purposive sampling frame continued until a sample representing the various specialties and professions within the maternity unit was obtained and no new themes emerged. It was felt that using this approach, allowed the views of the maternity unit as a whole to be represented.

6.3.3. Inclusion Criteria

To be included, participants had to be working in the maternity unit at the participating trust.

6.3.4. Recruitment

Meetings were held with the research programme manager for maternal and child health at the trust to discuss the best approach to recruitment. Initially individuals, who had previously participated in research and had shown an interest in future projects, were recruited with the help of the programme manager and formed 3 pilot interviews. Recruitment proceeded in stages, with participants interviewed in groups of approximately 5, to ensure that the staff groups, grades and wards that needed representing were sampled. Potential participants were primarily contacted via email, with reminder emails sent at weekly intervals unless an unwillingness to take part was expressed. Email addresses were obtained through entering potential participants names as suggested by the programme manager into the trust email address directory. In some instances, it was recommended by the research programme manager to contact individuals via telephone or through visiting wards. Additionally, following a suggestion by a colleague who works within the maternity unit, a call for participants was placed on the maternity unit junior doctors 'WhatsApp' group on my behalf.

Initial recruitment emails included information about the study and the participant information sheet (appendix 14). Recruitment undertaken on the wards, via telephone or the doctors WhatsApp group was followed with an email attaching the participant information sheet and reiterating the details of the study. The participant information sheet included information relating to the study's aims, the interview process and details of anonymity, confidentiality and data reporting.

6.3.5. Interview design and content

Interviews were semi-structured and conducted face-to-face at a time and place that was convenient to the participant. At the beginning of each interview the aims of the study were explained and participants were asked if they had read the participant information sheet, with the aims reiterated for those who had not done so beforehand. All participants were reminded that the interview would be audio-recorded and that direct quotations may be used but would be reported anonymously. It was explained to participants that any identifiable personal information would be removed from the interview transcripts and that all interview data would be anonymised with each participant allocated a unique ID. Participants were also informed that their contact details and interview data would be stored confidentially and that direct quotations may be used within this thesis, at conferences and in publications. Prior to providing written informed consent (appendix 15) participants were reminded of their right to withdraw from the study at any time, and were given the opportunity to ask questions they may have relating to the study.

A topic guide (appendix 13) provided the framework for the semi-structured interviews. As the rationale for the study was partly to provide feedback to the trust, regarding the system's implementation, interview questions were sent to the key informant at the trust. The topic guide was informed by the literature, the study's research questions, and NPT as outlined in section (6.2). The mechanisms within NPT (coherence, collective action, cognitive participation and reflexive monitoring) were used to shape the questions within the topic guide following worked examples of questions outlined by Murray et al., (2010) (table 20). To determine whether the system had become a part of staff's daily practice interviewees were asked questions relating to their perceptions and experiences of using the maternity information system and whether they still use paper records. Participant's perceptions of the reasons for the trust introducing the system were also explored to establish why participants believed the system was introduced. Murray et al (2010) suggest that the effect of technology upon staff and patients should be considered, which was incorporated by asking participants to describe their perceptions of the benefits and disadvantages of the system and how staff feel patients have responded to the system's introduction. To help build rapport and to ensure participants were at ease, interviews began with more factual questions. For example, "please could you start by providing some background information about your job title and your years experience". More sensitive questions such as "Do you think the system has had any impact upon patient safety, this could be positive or negative" were asked towards the end of interviews.

The topic guide ensured that all participants were asked the same questions, to allow for comparisons to be made during the analysis. However, the wording of questions was not fixed to allow interviews to flow and probing when more detail was required. Amendments to the topic guide were made throughout the interview process to aid interview flow. For instance, initially participants were asked what they feel the perceived and experienced benefits of the system have been. However, it became apparent that participants either did not understand this question or would only speak of benefits they have experienced. The question was re-phrased and split into two separate questions (appendix 13).

Interviews lasted between 17 and 42 minutes, with participants thanked for their time at the end of each interview. Participants were asked if they would like to receive a summary of the results or whether they had any additional comments or questions. Participants were provided with my contact details, in case they should have any questions after the interview. Interviewees were also reminded about the anonymity and confidentiality of interview data. Following each interview reflective notes about the research process were taken with personal reflections and methodological changes recorded in a word document; for more detail on reflexivity please see chapter 4.

Additionally, an interview with the lead midwife who was responsible for overseeing the maternity information systems implementation was conducted and audio-recorded. This allowed contextual information relating to the systems usage and functionality to be obtained (section 7.1) whilst also allowing for an overview of how the system was implemented to be understood. This interview was also used to draw comparisons between 'the official trust' and staff perspectives during the analysis. As it was anticipated that the official reasons for introducing the system and staff's perceptions of why the system was introduced could differ. A full list of interview questions can be found in appendix 16.

6.4. Ethical Considerations

Ethical approval for the study to be conducted with staff within general surgery was granted from, The University of York, Health Sciences Research Governance Committee in June 2013. However, as previously mentioned due to delays to the procurement and introduction of the EPR and following recommendations from the key informant at the trust, an amendment was made in January 2014 to allow for the study to take place within the maternity unit.

All interview data were anonymised and stored on a password-protected computer within a locked room with identifiable personal information such as references to staff names removed from interview transcripts. Consent forms and contact details for participants were stored separately to interview data, with email addresses and telephone numbers the only contact information obtained. Participants were allocated an individual ID for the study, which was used in data reporting and throughout analysis. To protect the anonymity of participants and the trust, the name of the maternity information system was referred to as 'the system' in all interview transcripts and the results chapter (7) of this thesis. Through the participant information sheet and verbally at the end of interviews anonymity, confidentiality and data storage and reporting processes were explained to all participants. Data for the study will be retained for 5 years to allow the completion of my PhD thesis.

6.5. Analytic Plan

This study used thematic analysis following guidance from Braun and Clarke (2006). As this is the same approach that was undertaken in chapters 2 and 4 only a brief description of the aspects of the analysis that differ from those that have been previously described is provided. As in chapter 4 the analysis followed the stages outlined by Braun and Clarke (2006); Transcription, familiarisation, coding and theme development and data reporting. Transcription was undertaken by myself to aid familiarisation. Due to the volume of participants in this study compared to chapter 4, transcripts were listened to as well as re-read to aid familiarisation and gauge interview flow.

Following transcription and initial familiarisation, interview transcripts were uploaded into the qualitative analysis software programme NVivo. However, as discussed in chapter 2 (section 2.6.1), following initial coding of all transcripts problems with Nvivo were encountered and all data was lost. Despite the number of interviews, I felt more confident using a manual approach as I had analysed both the policy documents (chapter 3) and interviews (chapter 4) manually. Furthermore, re-doing the first part of the analysis allowed an additional 'check' of the initial coding process. Manual coding proceeded with each transcript being coded into broad categories dictated mostly, but not always, by interview questions. For instance initial codes included: benefits and reasons for introducing the system. This initial coding of the data began by re-reading transcripts whilst highlighting and annotating them using the aforementioned broad themes as a guide. For data which did not clearly fit within these broad themes a category of 'unknown' code was developed. During this initial coding, spider diagrams were created to document ideas for potential themes and sub-themes for the whole study. After all transcripts had been coded in this manner, interview data for each

theme was recorded in individual word documents, with each theme having its own ‘thematic table’ which was comprised of three columns; participant ID, line number of quote and a description of the quote (table 21).

Table 20 Example of a thematic table used for the analysis

Disadvantages		
Pseudonym	Line number	Description
150308	p.9.	Made things slower, yesterday 35 minutes late, suddenly had lots of women who were on Medway and only two computers with three midwives trying to input could have handwritten in a few minutes makes women wait slow also as trying to make sure input correctly and not clicked on incorrect box, had to get someone down from admin as something was wrong. Slowing ante natal clinic down also. Also recently introduced a triage system in ante natal which is no longer possible because of computers so having to reorganise whole system again having just found something that worked well so backwards step.

Once all interview data had been entered into thematic tables representing broad themes, these themes were re-fined and sub-themes were created. Refinement of themes and the creation of sub-themes involved analysing the data ‘a theme at a time’. Each table was read individually and multiple times with data organised into sub-themes using highlighters. Spider diagrams were also used to illustrate and aid theme and sub-theme development (figure 9) and not only provided a visual representation of the data but allowed links between sub-themes to be established (figure 9). Tables were then amended to include quotations as opposed to a description of the quote. Whilst in retrospect this was potentially more time consuming, this enabled an additional check that interview data was being coded correctly and in some cases meant that after looking at quotes again data was re-allocated to a different theme. Throughout the process of code and theme development a number of new themes were created or themes and sub-themes were combined. For instance as opposed to one large theme relating to benefits, distinctions were made between expected, future and realised benefits. The ‘unknown’ theme table was also addressed at this stage and resulted in themes relating to: how midwives perceived patients to view the system and reflexivity of participants.

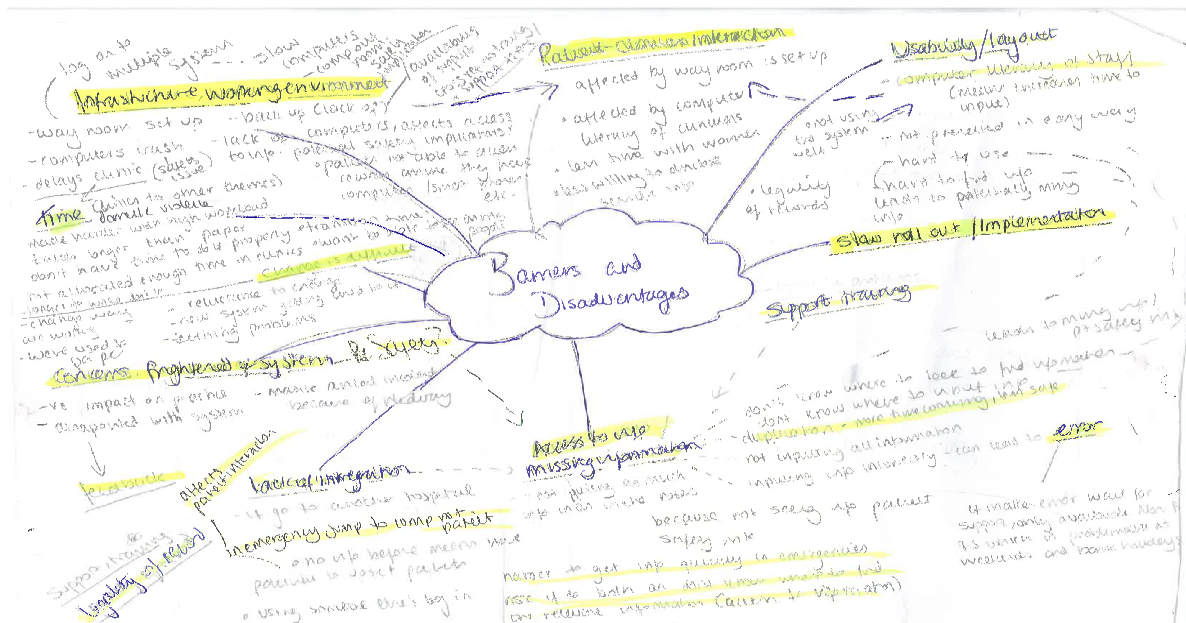


Figure 9: Spider diagram for barriers theme

Further refinement of themes and sub-themes continued during data reporting. For instance during the analysis it was apparent that participants frequently mentioned the impact of the system on patient safety. At this point it was unclear whether to have a sub-theme dedicated to the perceived negative impact upon patient safety of the system or whether this should be reported within other sub-themes. During data reporting it became apparent that the results would be presented more clearly by describing the various barriers and disadvantages such as 'usability of the system' and commenting on their implications for patient safety. Additionally, during data reporting, the interview with the lead midwife was searched to see whether there was any evidence of conflicting or complementary data for any of the study's themes and if so the interview with the lead midwife was used to draw comparisons between the trust and front line staff's perspectives. For instance, it became apparent that whilst the lead midwife could provide a succinct description of the reasons for introducing the system, her staff were less clear as to why the system had been implemented. Any quotations used from the interview with the lead midwife during the results section can be identified by the ID code 'LM'.

Following the thematic analysis a secondary analysis was conducted using techniques derived from NPT. This allowed for greater interpretation, which went beyond a description of the study's findings, whilst also allowing an understanding of whether the system has become embedded into clinicians every day practice to be ascertained. To support the secondary analysis, meetings were held between myself and a senior qualitative researcher

to aid inter-coder reliability. During these meetings, it became clear that despite proving useful for designing the topic guide, Murray et al (2010) evaluated research interventions, which are unlike IT implementation's, being standardised and controlled, making the application of their approach to this study's findings challenging. Detailed descriptions of the four mechanisms of NPT as outlined by May and Finch (2009) were used when mapping the study's themes onto the model. To aid the analysis further, the broad working definitions of the four mechanisms of NPT devised for this study were used when applying NPT to the study's findings:

Coherence: Do staff have an understanding of why the system has been implemented?

Cognitive participation: Are staff engaged and committed to using the system and what are the factors that promote and/or inhibit this commitment?

Collective action: Are participants using the system and what are the factors that promote and or inhibit them from using the system?

Reflexive Monitoring: Have staff appraised the system and its impact upon practice?

These definitions were used to map themes identified during the thematic analysis onto the components of NPT. During this process it was acknowledged that because of the dynamic nature of NPT and the inter-related nature of the four mechanisms a number of the themes identified during interviews could be placed under multiple components. For instance, whether participants have poor computer literacy could impact upon whether they engage with (cognitive participation) and how they use the system (collective action). To illustrate this, where themes are perceived to influence other mechanisms of NPT this is commented on during the results section, with the inter-related nature of the four components also commented on during the study's discussion (chapter 7).The results section which follows (chapter 7) uses the four mechanisms of NPT to describe and present the study's findings.

Chapter 7. Qualitative interview study exploring the implementation of a maternity information system: Results and Discussion

The chapter begins by describing the maternity information system which this study investigates and the environment in which it has been implemented. Following an overview of participant's characteristics, a brief description of how Normalisation Process Theory (NPT) has been used as a framework to interpret the study's findings is provided. The results of the study are then outlined using the four components of NPT; coherence, cognitive participation, collective action and reflexive monitoring. The discussion follows and includes the following sections; study findings, a critique of NPT, an application of the findings using socio-technical thinking, strengths and weaknesses, reflexivity, recommendations, study impact and conclusions.

Throughout the chapter, the name of the system was withheld to protect the anonymity and confidentiality of the participating trust, supplier and interviewees and so is referred to as the 'maternity information system' or 'the system'.

7.1. Context:

It is important that the maternity information system and the environment and context in which it was introduced are described (Murray et al., 2010). A fully implemented maternity information system electronically documents a range of care activities in both the hospital and community setting including: booking appointments, foetal medicine, labour management, discharge and ante and post-natal care (Source withheld, 2015⁸).

The participating trust implemented the system in a staged manner, with it first introduced into the community before being implemented progressively throughout the maternity unit. At the time of the qualitative interviews, the system had been introduced into the community and was being used for antenatal care and within the labour ward. The system was then introduced into postnatal care during the 6 month study period. However, even when introduced, the system was not at full capacity, with the maternity unit considered to have a mixed (paper and electronic) record. For example, in labour ward paper was used for intrapartum care with delivery summaries recorded on the paper record before being entered onto the system. Furthermore, because different wards had been using the system for

⁸ This source has been withheld to maintain the confidentiality of both the system provider and the trust under study. Information was obtained from the maternity information systems website.

different lengths of time, this added to the 'mixed record' as the extent that wards used paper within the maternity unit also varied. At the time interviews were conducted, the system was accessed predominately via desktop computers and a limited number of mobile devices (laptops Computers on wheels) and was being used for a range of activities including: research, delivery and operative procedure documentation, discharge notifications to GPs, recording observations, antenatal care, reviewing patient records, referrals for pregnancy care alerting to risk factors and allergies and post-natal care up until the closure of pregnancy in the community. However, the use of the system varied throughout the maternity unit as different specialties and staff groups had different requirements for using the system. The staged manner of the system's implementation also resulted in the amount of time staff had been using the system when interviewed varying.

Since the 'co-operation card' was introduced in 1956, the paper hand-held record has been essential to maternity care (Hamilton, 1956). Implementing an electronic record system into a maternity unit therefore differs to other specialities as women were previously responsible for carrying their own paper records throughout pregnancy. Although the introduction of the electronic system enables clinicians to have 24 hour access to patients records, it currently removes patient access to their records. It is anticipated that the system will benefit clinicians by enabling them to access patient records but the inability for patients to access their records may have implications for their involvement in the safety of their care and engagement with care in general.

The maternity unit under study has already undergone an electronic system's implementation in 2007. The previous system, which was a product of the Department of Health's Informatics directorate was a precursor to the system under study here and was expected to create a paperless environment within 6 months of its introduction (Personal communication, lead midwife, 2014)⁹. Staff present during this previous implementation have therefore already experienced first-hand one electronic system. The system under study was introduced to replace the previous system, which did not reach its full potential. Additionally, maternity units throughout the NHS have been subject to a vast amount of change in recent years, with the ever increasing requirements for data collection and audits (Personal communication, lead midwife, 2014⁴) in part at least to support the introduction of the maternity pathway payment system (NHS England 2014b). The changes that participants have experienced, should be taken into consideration as their expectations and readiness to

⁹ Source withheld, personal communication with lead midwife for the system's implementation.

⁴ Source withheld, personal communication with lead midwife for the system's implementation.

accept an additional change, such as the introduction of a second electronic record system, may be affected.

7.2. Results

7.2.1. Participants

19 participants took part in the semi-structured interviews, which included; 7 doctors, 1 health care assistant (HCA) and 11 midwives. The sample comprised; 4 consultants, 2 registrars and a senior house officer, with midwives representing a range of wards and departments including; birth centre, labour, antenatal day unit, maternity assessment centre, community and research. The profession and years experience of interviewees is displayed in table 21. The length of participants' employment at the trust is also included, to infer whether they were present for the implementation of the original maternity information system in 2007. Information relating to participant's job-title and their sub-specialty has not been included to protect anonymity. Participants with previous experience of working with EPRs or those with a vested interest in the system's success, are marked with an * or ** respectively. Individuals with a vested interest were either currently, or had at some time during implementation, been members of the support team, which helped clinicians throughout the implementation and in their use of the system.

Table 21 Participant characteristics

Participant ID	Profession	Years Experience	Years at trust
013009	Health Care Assistant	6	6
023010	Midwife	7	7
030211	Midwife	11	9
042202**	Doctor (consultant)	7	7
051610*	Midwife	14	14
062712	Midwife	28	34
070202	Doctor (consultant)	11	11
081203	Midwife	14	10
091203	Midwife	3	3
101310**	Midwife	23	28
111609	Doctor (registrar)	7	8 months
122309	Midwife	15	15
133002**, *	Midwife	7	7
140308	Midwife	25	25
150308	Midwife	23	23
161111	Doctor (registrar)		1
170210	Doctor (registrar)	5	7 months
180703	Doctor (consultant)	16	
191812**	Doctor (consultant)	21	21

*Participants who have previous experience of using electronic patient record systems at other trusts

**Participants with a vested interest in the system

7.2.2. Using NPT as a framework to interpret the study's findings

The analysis of interviews used the four mechanisms within NPT (coherence, cognitive participation, collective action and reflexive monitoring), as a framework to structure and facilitate greater interpretation of the study's findings (chapter 6, section 6.2). It is important when interpreting the study's findings that the dynamic nature of the model is considered. As whether an individual understands the reasons for the system being implemented (coherence) is thought to affect how they engaged with (cognitive participation) and used the system (collective action). Additionally, the model suggests that these three mechanisms relate to how individuals appraised the system (reflexive monitoring). Some themes which may have been described under one mechanism within the results section could also influence other mechanisms of NPT. For example, computer literacy was described as a factor that potentially affected participant's ability to engage with the system (cognitive

participation), however, poor computer literacy could also have influenced how staff used the system (collective action).

Coherence

Participants understanding of why the system has been introduced:

In this study, coherence related to whether participants have an understanding as to why the trust implemented the system. A consultant involved in the system's procurement described how the system was a replacement of the original system that had been implemented in 2007. Other participants that were perceived to understand why the system was implemented were mainly, but not in all instances, those who had direct involvement with the new system's implementation. These individuals primarily attributed the system's implementation to the need for the trust to 'keep up with the times', and follow other NHS trusts in moving towards a paperless environment by implementing electronic systems. Additionally participants felt the system was introduced to improve; accessibility and availability of records, efficiency, communication with other health and care organisations and to aid the conduction of audits and research:

LM: We increasingly need to provide information for things like key performance indicators and nationally required things. So the more we can pull from clinical data and one of the biggest drivers that wasn't a driver at the beginning, but was information that we can gather for financial purposes and in the last 12 months the maternity tariff has been implemented and that is something that the system can now provide.

Contrastingly, a number of interviewees, all but one of which were not directly involved in the systems implementation, described how they were told to 'just start using the system' and were not informed as to why it was introduced. This lack of awareness and choice in the system's introduction caused some clinicians to feel as though the system had been enforced upon them without explanation and that key decisions had been made without their consultation 'by people more important' than them:

Midwife 051602: 'well somebody likes it so that's why we're doing it' that's been said and 'even if it doesn't work we've got no choice' has also been said (327-329).

It is proposed that a reciprocal relationship may have existed between staffs' understanding of the system's purpose and whether they thought the system would lead to benefits for

themselves, patients and the trust. For instance, if staff believed they were benefiting from the system, they may have begun to understand why the system was introduced. Staff were divided as to whether they believed no one or everyone (trust, patients and staff) was experiencing benefits from the system:

Midwife 051602: at a clinical level if the information isn't cascaded down nobody is saying who is benefiting and we are all thinking somebody somewhere is benefiting and...if it is the audit that gets done....I get that all the different tariffs have come in but we managed to put the tariffs on the brief summaries and they put the tariffs in post-natally why...are we doing it I think I'm starting to ask now (314-319)

Section summary:

The level of coherence by interviewees was divided largely between those with and without a vested interest in the system's success. Participants who were members of the system's support team and so were directly involved in its introduction¹⁰ were able to provide reasons that corresponded to the official trust's perspective for the system's introduction. Conversely those without a vested interest felt that they were not informed why the system had been introduced. Participants were also divided regarding whether they felt the system had benefited themselves, patients or the trust since its introduction; with this thought to have influenced whether participants showed an understanding for why the system had been introduced. Lastly, it is proposed that whether participants felt that the system was producing clinical benefits, and their understanding of the reasons behind the systems introduction, may have influenced whether they were prepared to invest their time (cognitive participation) and use the system (collective action).

Cognitive participation

Learning and additional support:

If a technology is to be embedded into routine practice their needs to be engagement or time invested by clinicians. The level of cognitive participation is dependent upon certain factors that 'promote or inhibit' individual's use of the technology, which subsequently impact on whether they 'do the work', or in this case use the system (collective action). One way, in which the trust tried to engage clinical staff was through training; clearly if individuals were

¹⁰ The support team were members of staff responsible for championing and assisting their colleagues whilst using the system and so were directly involved in the systems implementation.

expected to use and be prepared to invest their time into a system, they needed to have an understanding of how to use it. However, it was apparent that the amount of training received varied, with some staff receiving whole day training sessions which in some cases included additional basic IT skills training, whilst others had none or single 30 minute sessions. The conversation held with the lead midwife provided some insight into this variation. She reported that training varied according to individual's previous experience with EPRs, with those who were either working at the trust during the original system's implementation or who had experience with EPRs at other trusts receiving less training. Secondly, the specialty, ward and usage needs of staff influenced the amount of training they received, as midwives have greater use of the system and so theoretically receive more training. However, interviewees attributed the variability in the training received to problems with staff 'fitting-in' training. Despite the trust providing training for staff during office hours on a number of dates, it was not always possible for staff to attend these sessions, due to busy wards, night shifts or absence. This resulted in some individuals being taught how to use the system by their colleagues informally or receiving no training:

Midwife 091203: every so often they'd put a few days in but you've got midwives that work permanent nights so how do you catch them, they are not going to come in during the day for a two hour thing because they need to sleep and go come back to work at night time. So there is quite a few of the night staff that have no idea what they are supposed to be doing (170-173).

The timing of training was also criticised by participants, as it took place either too far in advance of, or after the system had been introduced. This resulted in staff either forgetting what they had learnt when required to use the system, or where training was not provided beforehand, having to use the system 'blind' until they received training. Participants were also unsatisfied with the lack of lead in time given for staff to become accustomed with the system and the failure to reduce the number of patients in clinics, particularly during the early stages of implementation. The delivery of training was criticised for being dogmatic and too simplistic with some questioning whether the full capabilities of the system were covered. Despite being told the basic aspects of using the system, short cuts and the intricacies of the system which would have been helpful when staff became accustomed to the system, were reportedly not taught. Taken together, these factors could have affected staff's willingness to use the system, as even for those who received training, their perceptions of it and the simple content of training meant that when required to use the system they lacked confidence:

Doctor 111609: it was a little bit simplistic actually, slightly dogmatic in the way it was delivered because I got the feeling that the people teaching me weren't massively au-fait with computers and obviously they knew exactly what they were doing if you stuck to a certain script, but actually I think you got the feeling that the system actually more flexible than they were letting on and also when you asked questions about how information related to each other or why doesn't this go in something else they didn't really seem to know so it was thorough I think it was appropriate and I think it was adequate but I'm not entirely sure it was delivered by massively expert people (60-67).

In addition to formal training, throughout the system's implementation a support team was available during office hours Monday to Friday. The team, which comprised a group of individuals, including the lead midwife and other seconded members of clinical staff were responsible for helping clinicians to use the system. This team was also responsible for rectifying inputting errors on the system made by staff, who only had the capacity to input and so could not edit information within the record. The team was supported by 'super-users' who were members of staff that had received extra training. They were required when on duty to provide support and help their colleagues rectify errors made on the system. Despite criticising the support staff for only being available during office hours, participants praised their availability and assistance throughout the early stages of implementation as well as the support they provided to those with poor computer literacy:

Midwife 081203: some of the more senior staff, I think they were called super users so they got additional training, so that was helpful in the unsocial hours, so obviously on a night shift, or bank holidays, or weekends when a team weren't there they could...problem shoot (87-91).

The trust attempted to ensure participants continued commitment to use the system by providing additional resources such as, extra training and emails that included guidance following upgrades or changes to the system. The trust also provided 'lessons learnt' emails describing solutions to common problems experienced by staff as well as guides for complex tasks such as requesting patient records from other hospitals. However, some interviewees described how they learnt to use the system through colleagues, who due to the phased implementation had been using the system for longer. Whilst for some, these periods of sharing and learning with colleagues, were where 'the real learning' took place, for others, this led to them questioning the proficiency and uniformity of training:

Midwife 150308: I am learning more all the time now, new things come up every week that somebody else seems to know how to do that maybe I wasn't shown, maybe she assumed I know, so I think we are all sharing little snippets and bits of advice about oh well if you go on this you can put that in and then I can say to them did you know well actually if you clicked on this you can do this... so there is quite a lot of sharing that goes on (64-69).

Benefits participants expected prior to using the system:

Whether participants expected the system to positively impact their practice is thought to have influenced whether they understand why the system was introduced (coherence) and their initial willingness to engage with the system (cognitive participation). The benefits participants expected prior to using the system, were based upon beliefs that the system would be integrated with other systems within the trust and other health organisations and therefore would mean all patient information would be held in one place. Additionally, expectations that the system would allow staff to see the care provided by other healthcare professionals more easily and would remove the risks associated with patients losing or forgetting to bring their paper records were cited. Participants reported that prior to implementation they expected the system to allow audits and performance outcomes to be conducted more easily:

023010: I thought it would be easier to use and good for auditing purposes, getting the information off, really easy to access if we needed...certain information rather than having to request notes and look through and it's not always easy to track notes down (39-41).

Barriers to engaging with the system:

A number of barriers, which may have affected how staff engaged with the system prior to its implementation, were identified. Experienced staff tended to be reluctant to accept the new system as they were used to paper records and were hesitant about the prospect of a paperless environment. Reluctance to change also emerged from participants feeling that they had already been subjected to vast amounts of change, enforced upon them by the trust and NHS. Lastly, perceptions that the system increased the potential for inputting errors, particularly following system upgrades or when new members of staff that were not used to using the system joined wards, may have contributed to participant's unwillingness to use and embrace the system:

Doctor 191812: our junior medical staff change, anything from every four to every 12 months and when our new staff come then it takes them a while to get used to it. So introducing people to the system takes longer and as I say we just upgraded it to change so all of us go back a step in terms of learning (180-184).

Staff who had been working at the trust for a number of years and so had been affected by the original systems implementation, did not distinguish between the two systems. As these individuals had expected to be working within a paperless environment and using mobile devices to access an 'all singing all dancing' system seven years ago, they viewed the implementation as slow and with scepticism. This is in contradiction to the lead midwife who felt it was acknowledged that the aim for the original system to be implemented within 6 months was inappropriate and unrealistic. This suggests a mismatch between the expectations of staff with and without a vested interest in the system and a lack of communication regarding the implementation to front-line staff:

Midwife 062712: I retire in three years so...with the way it has been rolled out with them saying it will be rolled out in six months and we are now seven years down the line it is probably going to be...I will be retired by the time it comes in (235- 237).

Participants perceived the trust to believe that 'everyone knows how to use a computer' and criticised the lack of basic IT skills training provided. For some, concerns that their computer 'illiteracy' and difficulties typing will lead to spelling mistakes and inputting errors on the system were raised. This was considered problematic, given the potential patient safety implications of these errors and the fact that patient records are legal documents which 'follow' clinicians for a number of years. Consequently, interviewees explained how some staff were frightened to use the system to the extent that they were 'shying' away from it and putting their workload onto other, more computer literate colleagues. The variation in computer literacy was generally related to age, with older clinicians attributing their lack of computer skills to them not having been brought up using computers. Conversely, younger participants and particularly those who had used the system during their training tended not to view computer literacy as a barrier:

Midwife 150308: at school....computer training was for boys. Girls weren't encouraged to do such things never really had a lot to do with computers and computer games, so although I am pretty good at home I have a little notebook I can internet shop and email and things like that, my actual computer skills are pretty rubbish really and it would be useful to have some

kind of typing skills as well because I think that's what takes so long it's the actual physical inputting of data, so I suppose I was a bit scared about it coming in (12-126).

Section summary:

A number of factors that have promoted and inhibited participant's willingness to engage with the system, prior to its implementation were reported. For instance, whether participants expected clinical benefits from the system is considered likely to have influenced whether staff were willing to invest their time and change their practice enough to use the system. However, the barriers and problems with the training and support identified may have affected staff's capacity to engage with the system initially. For instance, should staff with poor computer literacy not have received training they may have felt unprepared and unable to engage with and use the system. The factors identified here that promoted and inhibited participants 'cognitive participation' may therefore have affected staff's ability to use the system or their 'collective action'. Although, only a limited number of benefits were realised (p. 183) participants' main expectation that the system would allow communication between other electronic systems within the trust and other healthcare organisations was not an ambition for the system, further demonstrating poor coherence as to the system's purpose and a lack of understanding regarding the reason for its introduction.

Collective action

Barriers to using the system:

Whether individuals have a sense of why the technology was introduced (coherence) and their willingness to invest their time into the system (cognitive participation) there are additional factors that may have promoted or inhibited the system from being used or 'the work from being done'. As previously mentioned, the trust adopted a staged approach to implementation where the system was introduced into wards progressively, with paper used during this initial implementation. Subsequently, with different wards at different stages of implementation, the extent that paper was used throughout the maternity unit varied. Some participants therefore described their wards as paperless, whilst others remained reliant upon paper or were using both the electronic system and paper records. Staff based on wards using both paper records and the electronic system expressed their frustration at the additional time it was taking them to 'do everything twice' as they were inputting often the same information onto the system that was being written in the paper records. However, due to the time constraints clinicians are working under, they were finding it difficult to keep up

with their documentation, particularly during busy clinics and so in some cases were doing their documentation retrospectively. As a result, at the end of shifts the 'computing aspect' of staffs' workload was handed over to their colleagues who were unfamiliar with the patients and were confronted with various pieces of paper for different patients, which need to be entered onto the system. Staff using both the paper records and the system therefore also raised concerns that potentially important patient information may be being missed, as staff may; not be retrospectively doing their documentation, only look in one of the records or be unaware that a paper record exists if they are from other wards. Additionally some members of staff still considered the paper record as the primary record and so put less information onto the system, which may also have led to patient information being missed:

Doctor 161111: I know that the system team they are stressing on the point that everything should be on the system, however for one reason or another I don't know whether the systems down or whatever, some patients they still do have handheld notes or they have some of the documentation of their history on the paper work and other things on the system, so I think this duplication can cause a big problem so this is one of the negative things it is not a problem with the system because honestly they...regularly check the patients records and they do stress that any patients whose on the system she should have everything on the system, but what I'm talking about is what's happening on the ground so some of the patients, not many but still they do have double system for handheld notes and the system (107-118).

The system is not 'fully up and running' and so not all aspects of care are inputted onto the system e.g. anaesthetic alerts, Intravenous fluid charts; with paper still used in these situations. Paper was also used to communicate with other departments due to the system not being integrated with other trust electronic departmental systems. For instance, despite having an electronic pathology system, results were printed out and stored separately. In addition to being time consuming and frustrating participants perceived the lack of integration between departmental systems and the mix of paper and electronic media to potentially raise the risk that clinical information may be missed. Further implications of this are described by a community midwife:

Midwife 122309: the negative is that ladies change their address on the system at the hospital on the PAS system and nobody updates it on the system, when they get to be discharged it's not changed so we're sending to...wrong addresses and its very time consuming...I mean you see what traffic is like and you have been sent to one address and you've got to spend time ringing up and trying to find.....the women are asked what address

are you going home to supposedly but it doesn't always happen...and the GP is not updated and we are GP linked not geographically linked so the woman may have changed their address and changed the GP and it's not been changed on the system so we are sent to ladies that aren't our women (85-93)

The system can also not communicate or share information with other organisations, an issue, which would not have been encountered with the paper records, as women were previously responsible for their own records during pregnancy. Therefore, unless they forgot their notes, they would have had them on their person should they be admitted to another hospital. Furthermore, the procedures for granting other trusts access to the system were either unknown or considered too complex. One participant described how these issues can be problematic for participants who relocate for safe guarding issues:

Midwife 081203: women who haven't booked with a midwife who may be moved from a different area because they are trying to go under the radar, they might have safe guarding concerns, they might be frightened that their baby is going to be taken away from them and they deliver at other trusts and that's a way to try and escape that and we don't have access to that persons records if they come from somewhere where they don't have our system (177-181).

A range of technical issues affected staff's ability to use the system. For instance, clinicians are required to log in and out of the system and change clinic room for each patient, causing them to frequently exceed the 5 minutes allocated for consultations. Furthermore, logging in and out of the system repeatedly during busy clinics has caused computers to freeze and crash and patient records to be suspended. As well as causing delays and disruptions to clinics, this has in some cases caused patients to be sent home without being seen. Participants described how records being suspended may have implications for patient safety and expressed anxiety regarding who is liable in the event that a patient safety incident occurs due to patient records being inaccessible. Staff also raised concerns as when records are suspended they were reverting to paper, which may increase the risk of information being missed at future appointments if this information is not inputted on to the system, once it is back 'up and running'. Community midwives described how problems they have experienced accessing the system in the community may have implications for patient safety, particularly for high risk patients:

Midwife 051602: I appreciate it's a way forward. I also appreciate that....people are more scared of it then me and I have got better at it and I have got quicker at it...but the thought of

being out at three o'clock in the morning on the community in an emergency situation and not being able to access somebody's records frightens me to death...it absolutely does...because those... poor midwives are massively at risk not just...from the point of view of their registrations if they make a mistake because they can't get hold of those records, something happens to that mum, that baby or to those midwives where will this organisation stand (61-70).

Participants described how there was an insufficient number of computers available which is resulting in clinicians 'fighting over computers and delaying clinics and discharge as staff are required to wait for computers to become available. What is more, of the computers that are available, a number were either not working or were placed in inappropriate places such as over fire escapes. Participants also explained how because computers are positioned at the opposite end of the ward to patients, they have to leave patients to access the system; a problem not experienced with paper notes and worsened by the lack of handheld devices. The impact of having to 'run to a computer instead of the patient' was deemed a particular issue in emergency situations where staff are torn between leaving the patient which is potentially dangerous or staying with them and not knowing anything about them. The implications of this to patient and staff safety are described below:

Midwife 091203: my main concern would be that we would miss women that come in and whether they are MRSA positive and it's stuck to the front of the notes and it won't be any more... simple things like that to...a HIV positive and we are not going to know that until we get to a computer and we might not have time to get to a computer which...could really affect the delivery... of the baby so that would be the biggest issue is not knowing if they come in and they do it quickly, not being able to access the computer its potentially putting them at risk and we can be putting us at risk depending on what they've got but... for most women it shouldn't be a problem most women that we receive are low risk no issues but there is a lot of complications to it and a lot of our women don't speak English so rather than being able to say to them are you allergic to anything they might not be able to understand whereas on the computer it should be documented...(87-97).

Participants also described how in comparison to paper notes where clinicians could 'flick through' the record prior to entering appointments, they are now entering consultations 'blind' as all patient information is on the system. Therefore, until they have logged on, staff have no knowledge of the patient's history or reasons for attending clinics, which for one participant has led to 'some real faux pas':

Doctor 111609: it would be nice to look at somebody's notes on a laptop or something outside the room and see what you are talking about, rather than go into a room cold with a patient and then actually say, who are you, why are you here and then how many times have you been pregnant and they say three times and you say oh how are your three children and they go well actually one of them died (154-159).

Realised benefits:

Since the system's implementation, if participants have experienced clinical benefits from using the system, or are aware that others have experienced benefits this is likely to have influenced whether they continued to engage with (cognitive participation) and use the system (collective action). As participants expected, the system has enabled audits and reliable information relating to performance outcomes and work patterns to be obtained and undertaken more easily than with paper records. The system also enables more reliable information relating to the maternity unit's case mix and work patterns to be obtained and consequently, the trust have received financial benefits as they able to charge the Clinical Commissioning Groups (CCGs) the correct tariffs:

Doctor 180703: I think we were struggling to charge the correct tariffs and we could see that a computer system like this was going to make it easier for us to charge the correct tariffs from the CCGs for the pregnant women and that has proven correct (52-55).

Clinical benefits, from having greater access and availability to patient information were frequently cited. In particular, participants acknowledged that as patient records are no longer the responsibility of patients and are stored on the system, they are seeing benefits from being able to access the patient record without the patient being present. In association with this, the benefit of having 24 hour access to patient records was recognised as it has allowed clinicians to check patient notes prior to their appointments and should patients fail to attend clinics, the importance of that visit can be checked and community midwives can be alerted, which was not possible with paper records. As expected, problems associated with patients forgetting to bring their notes were avoided; a particular issue in emergency situations when patients are too unwell to communicate key information:

Midwife 051602: you can access the records when patients aren't there. One of the issues I think we've had in the past is that because patients carry hand held notes and if they rang up with a query about something or I needed to check something you couldn't do it because they have their records. Whereas now if...for example today the same patients rung me up

and I asked them to come to the day unit I can go back to the office and I can have a look on the system and see where she's been and what she's done (116-121).

In comparison to staff that are using paper records and the system, those working on paperless wards described how the risk of missing information is reduced. Although problems associated with retrospective data entry were cited participants acknowledged that this allows the record to be updated with information, which previously may have been missed or not entered due to time constraints. Additionally, staff praised the ease that information may be inputted onto the system which was attributed to the simplicity of operative notes, tick boxes and the ability of the system to prompt staff to provide different information when alternative care such as water births is provided:

Midwife 140703: what worries me is sometimes you can put things in at a later date which is also good you know like if you've forgotten to write something in and it comes up at a different time so it knows you've put it in later so that's quite good (147-150).

Further benefits of the system in comparison to paper records were reported and included: improved communication with GPs who can now be notified when patients are discharged or prescribed medication and the increased legibility and conciseness of the record which creates more professional documentation for patients such as birth notifications. Clinicians also acknowledged that they no longer have to write the same information into numerous forms as this information is populated into relevant sections of the record by the system:

Midwife 150308: I'm not having to try and read illegible handwriting now because that's always been a major barrier with providing the care that you would be looking at one of the consultant plans and the handwriting was so bad you couldn't understand it might as well have been written in hieroglyphics (143-147).

However, some participants felt that they are yet to see clinical benefits from the system and were divided between those that believed that benefits will be realised in the future and interviewees who felt that the system would never produce clinical benefits that equal or exceed the paper records. The lack of benefits seen thus far was attributed to the system being new and not having been used for long enough:

Midwife 122309: every day I used to come to work and say, 'I hate the system I hate the system I hate the system' and I came in with you are not going to believe this but...I came in and said...I actually quite enjoy doing my booking now. (297-298).

Section summary:

A range of factors that promoted and inhibited whether participants used the system were identified. It is anticipated that by staff beginning to experience benefits, or be aware that colleagues that have been using the system for longer have started to see benefits, these individuals will continue to engage with (cognitive participation) and use (collective action) the system. Conversely, those who are yet to see benefits may become disengaged and may look for alternative practices, for instance they may revert to paper documentation. A number of barriers to using the system, which were largely a result of the continued use of paper were identified and were perceived to have implications for the quality and safety of care provided. Lastly, it is acknowledged that throughout this chapter, by identifying various factors promoting and inhibiting their understanding, engagement with and use of the system, participants have been appraising the use of the system (reflexive monitoring).

Reflexive Monitoring

Reflexive Monitoring relates to 'how the work is understood', or how staff appraised the system (May & Finch, 2009). During interviews, participants appraised the system by identifying a number of additional factors that have promoted (benefits) and inhibited (disadvantages) their use of the system.

Disadvantages:

Some participants perceived it to be more time consuming to enter information onto the system compared with paper records. For instance, one participant explained that it used to take her ten minutes to write a patient history whereas now it takes her half an hour to input the same information onto the system. Staff using both paper records and the system were particularly frustrated at the added time pressures being placed upon them. In addition to being more time consuming to use, participants explained how technical issues such as the system crashing and the time required to log into the system for each patient has lengthened appointments and discharge. Whilst this was acknowledged to be because the system is new, with time pressures in some cases being alleviated with time, staff did feel that this is an issue that has been underestimated by the trust; reflected by the lack of 'lead in time' given to staff during initial implementation:

Midwife 062712 I always thought I don't know how I am going to have time to do it because we had two midwives and usually one other person, we're answering the phones all the time,

we're seeing two or three ladies at once...so ...I can't see it being feasible when it's very busy for me to physically be able to do it and then I'll have concerns over my record keeping...but then they said it's got to come and so if it's got to come then...I have to see less people to physically enable me to do all that then that will have to be it (202-209).

A minority of participants anticipated that the system would negatively affect their interaction with patients and so made a concerted effort to avoid this; for others, their relationship with patients was still affected. Of those that initially experienced a negative impact, a proportion felt that they are now spending as much time with patients as they did when using paper records. However, others felt that they are not giving patients enough attention as they need to concentrate more when using the system and so are spending more time looking at the computer than the patient. The way clinic rooms have been set up was seen to exacerbate this as staff had to physically turn away from patients to input information onto the system. Additionally, participants described how because they are leaving patient to access computers, this reduced the time they were able to spend with patients. These individuals therefore considered the paper records to be better for establishing a rapport with patients as they were able to 'chat and write' at the same time. The detrimental effects of the system upon the patient-clinician relationship was considered to have implications for patient safety:

Doctor 070202: I don't have a midwife in the clinic with me anymore because she has to log in separately and put her information in and there seeing patients separate to us. So particularly when there is a complex psycho-social case, maybe domestic violence, maybe extreme poverty, drug issues whatever, previously you would see them together, so you would establish a bit of a rapport a relationship with the patient and one of you would pick up on some things the other will pick up on others. You need to approach those cases subtly now they'll go to a midwife who just does the blood pressure and the wee make sure they've got the right leaflets and then they come along to me for the medical consultation...and I won't be aware of what's gone on in the midwives room (123-132)

Participants were concerned that particularly during the system's initial implementation, difficulties using and navigating the system, made it difficult to find the information they need; increasing the risk of staff not being able to find, or missing potentially important patient information. Finding patient information for frequent attenders was a particular issue due to the system 'burying' important clinical information under copious amounts of routine information. Despite staff being able to check with patients that they have all the important information in most situations, it was acknowledged that this is not always possible, for instance during emergencies or when English is not the patients first language. Staff also

explained the potential implications of not being able to find important patient information to patient safety:

Midwife 133002: I think we will miss something because we don't know where to look for the information or we'll miss a problem and an alert and it will lead to a baby becoming septic or a mother becoming unwell I have worries that we will miss something one day because we are very busy and we know very quickly where to look for things in paper (107-110).

Some interviewees were also concerned that patient information may be being missed because less detailed information is being entered onto the system, in comparison to what was written within paper records. The added time pressures that the system placed clinician's under, the disjointed nature of typing in comparison to writing and the fact that clinicians were only answering mandatory questions; which may not include all the necessary detail for patients, were all seen to contribute to the lack of detail being entered onto the system. The lack of flexible data entry methods was seen to exacerbate this issue as staff cannot elaborate their typed data entry or draw diagrams describing operative procedures. Concerns that patient information is being presented in a standardised fashion, which although could be seen as a positive thing, it was felt in this instance to result in missing the details of individual patients and procedures. For example, one interviewee explained how a woman with poor obstetric history did not have enough detail describing her previous miscarriages, which was crucial to determine the level of risk to that patient and their baby. The impact of not having enough information relating to patients previous obstetric history's allergies and risk factors to patient safety was discussed:

Doctor 111609: the system will ask some very set questions...but every delivery, every person is different, every delivery is different and unfortunately every injury that is sustained and the way you fix it could be different so... 9 times out of 10 the common questions will stand and actually be relevant and it will actually save you a bit of time rather than writing it out and sometimes it just doesn't and then the comments boxes they just seem to be placed in slightly odd places, they don't logically flow and then also you can't draw a picture...but that's where that irritation comes and then sometimes the yes/no questions are kind of closed questions, they are trying to save time and pull out information that doesn't always make sense to what you've done (120-129).

The inconsistent use of the system by staff was seen to elevate the risk of missing information as the record allows the same information to potentially be inputted into different areas of the system. Participants therefore explained how they need to trust that their

colleagues are entering all the necessary information onto the system and are not making mistakes. Concerns that key information such as risk factors and test results were not being highlighted adequately were also raised which can, as one participant described, make it unclear whether full blood counts have been taken, causing results to be missed or repeated. The accuracy of information entered onto the record was also questioned as participants perceived there to be an increased risk of inputting errors when using the system in comparison to paper. This was largely attributed to the system's use of tick boxes and drop down lists, which make it easy to simply press the wrong button. The implications of these inputting errors can be severe as it can make it appear that a patient has received care or has a condition they do not have, both of which could impact upon length of stay and treatment provided. Further implications of inputting errors are outlined below:

Midwife 081203: I guess the implications could be the wrong information is down, the wrong date of birth or the wrong NHS number, It can cause problems further down the line and I guess the problem is that from a midwife point of view people might not actually be aware of what those implications might be, if the baby doesn't have an NHS number or it hasn't been registered properly they turn up to the registrar's office to get a birth certificate and they've put the wrong gender down, that's quite a common mistake that people make and it's not because they don't know if it's a boy or a girl, it's just they're tired, or the cursor just flips from female to male (151-158).

Interviewees described how the potential impact of inputting errors upon patient safety was elevated as staff cannot rectify their own mistakes and instead are reliant upon members of the system support team or super users. Furthermore, the support team were only available during office hours Monday to Friday, therefore should an error be made on a Friday at 7pm, this would remain on the system until the support team become available on Monday unless a super-user was available. An example of the potential implications that could ensue from incorrect information remaining on the system over a weekend or bank holiday is provided below:

Midwife 091203: it was the number of pregnancies was wrong for this lady and it wouldn't let us save this new baby because it didn't believe that she'd had another pregnancy and it would not let us do it at all and we'd tried all sorts but this was the documentation for the parents to take home that I just couldn't give them because the system wouldn't let me finish it and that was on the Saturday and nobody was in till the Tuesday (182-186).

Throughout interviews, the perceived negative impact of the system upon practice and in some cases patient safety has caused some staff to feel 'frightened' to go to work as they fear 'there will be a massive clinical incident at some point because of the system'. Despite this anxiety, some staff felt that their concerns were underestimated by the trust and that 'no one is listened [to]':

Midwife 051602: they're meetings that I go to for a variety of different reasons one of them was a community forum I have been to some of the meetings directly about the system where concerns have been raised and it has been...it will be alright...and I don't know how to say this really but there is the cynical person in me that has worked for the NHS for a very, very long time... thinks that is there another agenda here because the...clinical staff are finding it very difficult (304-309)

Since using the system, benefits participants are expecting in the future:

In light of the limited benefits and various barriers and disadvantages that participants have experienced since using the system, it may be that as well as being part of their job, staff continued to use the system as they expect benefits to emerge in the long term. Future benefits, were largely focused on an expectation that the system will enable all patient information to be stored in one place, which will allow various benefits from having all patient information available 'at a click of a button'. More specifically participants anticipated that having all information accessible would be beneficial in emergency situations and for alerting clinicians to allergies and risk factors.

Doctor 042202: an ideal electronic patient record for me as a clinician...if somebody...coming and seeing me or ends up in A&E or ends up in an emergency situation as soon as I know name and then date of birth or something like that if I open that I know about...yes this women had a road traffic accident and such and such she had a blood transfusion such and such and she got allergy to penicillin and she is now 28 weeks pregnant. If the women is not in a state to talk to me that is one I'm expecting... so that has to be quick able to give me that complex background what I'm dealing with and it should be able to show me this woman has currently who her GP is and what consultation she had with other people for example any complex case I see (128-136).

Participants also anticipated that once the system is integrated with other health care organisations and departmental systems within the trust, improved inter-departmental communication and quicker referrals would ensue as patients will for instance not have to

wait for referral letters. Interviewees also suggested that benefits including improvements to: patient flow, research, audit, performance and planning, record security; accuracy of records and fewer missing records as a result of the system, will be realised in the future:

Midwife 140803: I think it is going to be better for communication with other areas (187).

Staff recommendations and perceptions of what needs to happen for benefits to emerge:

Participants provided a number of recommendations for the trust to consider for future IT implementations and described what needs to happen for benefits from the maternity information system to be realised. Firstly, interviewees raised the importance of all staff undergoing training, which would require more sessions to be available to accommodate the busy work schedules of clinicians, and staff on night shifts. It was also suggested for the content and delivery of training to be standardised, to combat feelings among staff that their colleagues that attended different sessions had been taught different and sometimes more beneficial ways of using the system. Furthermore, staff suggested that to improve the accuracy of information entered onto the system and reduce data entry errors, more detailed and in-depth training to ensure all staff are confident and competent in all aspects of the system should be provided. Additionally, the importance of ensuring that the record is being used universally with all mandatory questions answered was considered crucial in preventing information from being missed or not being inputted onto the system. Those with poor computer literacy also suggested that sessions solely dedicated to providing basic IT and typing skills would be useful and for more support to be available particularly in clinics, 24-7, particularly whilst clinicians are not able to edit inputting errors:

Doctor 161111: I know that they are doing their best to train everyone, but if they can give more chances for training, regular training and updating I think this might be helpful for everyone to try to approach this system and try to make use of it (172-174).

Consultants within the sample suggested that the way clinics are run should be altered, following concerns that the amount of patients seen in clinics will have to be reduced due to the added time pressures being placed on staff by the system. Whilst acknowledging that reducing the number of patients seen in clinics or hiring more staff would be challenging, participants felt that they should be given 'lead in time' in clinics when systems are first implemented and that the number of clinics should be increased. Assigning consultants to their own clinic room was also deemed crucial to prevent consultants wasting time by having to change rooms for each patient. Participants also called for the following to be in place

prior to the systems introduction; sufficient hardware with computers available in every clinic room and where possible mobile devices to prevent staff from leaving patients to access their information:

Doctor 18703: time is a huge issue if they had halved our clinics which they couldn't do but....if we had less numbers going through the clinics (116-118).

For the full potential of the system to be realised, participants felt that all patient information needs to be entered onto the system, which will require a 'fully up and running' system that is integrated with other electronic systems within the trust and with other health care organisations. A few participants also expressed the need for paper records to be replaced to ensure that benefits are realised and the risks associated with the continued use of paper are removed:

Doctor 191812: the real patient safety benefits would come if and when we were able to integrate it with the other information system that would make it....come together as it were so if the pathology results if the ultrasound results were linked into it so it was all there in one system (239-242).

Despite some participants calling for a paperless environment and the various disadvantages that have been experienced from the combined use of paper and the system, over half the participants in the sample were 'daunted' or 'frightened' at the prospect of being paperless. A proportion of these individuals called for a paper-lite system instead, as it was felt that the aspects of care (e.g. scans, anaesthetic alerts and communication between and within hospitals) that have remained on paper due to a lack of integration between systems and organisations, should be stored within handheld patient notes; due to concerns that the system cannot be relied upon as a result of its detrimental effects upon, the patient-clinician relationship and the lack of insufficient hardware, back-up system and integration between trust departmental systems:

Midwife 051602: I am starting to think it is a mistake to go paperless I really do because I think there is no back up and that scares me (159-161).

Given the importance of standards and outcomes in obstetrics and midwifery, participants acknowledged the potential for the system to enable better monitoring and collection of information, relating to individual or ward level outcomes. It was suggested that this information could be used to provide feedback to clinicians about their performance or

change practice should issues be identified. Participants also implied that were they to receive feedback as to how the system had improved practice they would view the system more positively:

Doctor 042202: we need all that information coming back saying since the introduction of the electronic record you know our work pattern got better the flow of seeing the women got better there is less waiting time you tell me them then I will believe but I think you need all that (235-238).

Lastly, participants felt that to see benefits, the system should have a more user friendly design which was more like the paper notes with less extraneous information.

Section summary:

Throughout the interviews participants appraised the system by identifying various benefits and disadvantages to using the system. A number of disadvantages, which had implications for patient safety were identified which were the result of poor design and implementation of the system and so could be potentially avoided. For instance, clinicians were unable to edit inputting errors they made on the system and the design of the system made important clinical information difficult to find. However, other factors such as staff's use of the system and inputting errors, which although may be worsened by the systems design, were due to human error and so are potentially more difficult to prevent. Despite the disadvantages and negative implications of the system to safety, participants did expect benefits to emerge in the future which could account for their continued engagement with (cognitive participation) and use of the system (collective action). Lastly, participants during their appraisal of the system provided a number of recommendations or factors that need to be in place to ensure benefits are realised. Whilst some of these were potentially difficult to achieve in the near future, such as an integrated system within and across health care organisations, other suggestions surrounding training could be achieved relatively simply and provide useful lessons to other trusts implementing electronic systems.

Themes that do not fit within the NPT model:

Despite the utility of NPT in evaluating an array of research interventions and technologies in healthcare, it was unclear how midwives perceptions of how patients responded to the system could be incorporated into the model. Contrary to staff expecting patients to have an opinion of the system due to their being responsible for their handheld notes, some

perceived patients as indifferent. The remainder of participants had polarised views on how they felt patients responded to the system. Of those that felt they responded positively, this was attributed to patients liking the fact that they were no longer responsible for their records and that clinicians could access their records at all times. Despite some participants remaining optimistic that negativity from patients is temporary, due to the system causing increases to the length of discharge and clinic waiting times a number of staff have received complaints from patients either verbally or through the friends and family test; a feedback tool launched in 2013 which asks patients if they would recommend the services they have used (NHS England, 2015a). Complaints surrounding the negative impact of the system upon the patient-clinician relationship were also reported:

Midwife 023010: we do get a lot of complaints from the women in the families from that we used to be able to discharge people in the morning... now it tends to be afternoon, late evening (120-122).

7.3. Discussion:

7.3.1. Findings:

NHS staff's perceptions and experiences of a maternity information system's implementation into a single maternity unit at a single NHS Foundation trust were explored to address the following research questions:

- To qualitatively explore the benefits, barriers and disadvantages of implementing a maternity information system into a maternity unit.
- To explore the extent that the system is (or is not) embedded or 'normalised' into practice.

This is the first UK study to use NPT as a framework to understand the benefits, barriers and challenges of implementing an electronic departmental system into an NHS trust. As with the results section, the four mechanisms of NPT (coherence, cognitive participation, collective action and reflexive monitoring) have been used to describe the study's findings and explore whether the system has become embedded into clinician's daily practice:

Coherence

Whether participants demonstrated an understanding of the reasons for the system being introduced was in most cases dependent on whether they had been involved in the systems implementation; either through being members of the system support team or super-users. It is likely that these individuals, as part of their role were informed of the official reasons for the systems introduction; implying a lack of communication by the trust to staff without a vested interest as these individuals felt the system had been introduced without explanation. Despite participants without a vested interest in the system not having the reasons for the systems introduction formally explained to them, when asked why they felt the system had been introduced a number of these individuals were able to provide reasons which corresponded to the trusts. For instance, they understood that the system was necessary to move towards a paperless environment and to help with audits and research. To my knowledge this is the first study to explore whether participants have an understanding of why an electronic record system is being introduced in the UK. This is somewhat surprising given that NPT suggests that coherence influences whether technologies become normalised, through affecting participant's engagement with (cognitive participation) and use (collective action) of the system.

Cognitive participation:

The training and support provided by the trust is thought to have positively influenced staff's ability and willingness to engage with the system. A number of participants praised the trusts provision of a support team, super-users and additional resources such as 'lessons learnt' emails. This corresponds with the literature (Ovretveit et al., 2007a,b; Evans & Stemple, 2008; Robertson et al., 2010; Holden 2011; Sheikh et al., 2011; Silow-Carroll, Edwards & Rodin, 2012; Takian, Sheikh & Barber, 2012) and national IT policies (NHS England, 2013; DoH, 2014), which recognise the importance of learning and support for staff to ensure successful implementation of electronic systems. However, some aspects of the training and support provided could be improved to ensure that all staff have the training and support necessary to allow them to engage with and use the system effectively. For instance, there were an insufficient number of training sessions, which were not available to all staff and the support team were only available during weekday office hours, which combined with clinicians inability to edit the record had implications for errors made on the system outside of 'normal hours'.

A number of barriers which could affect participant's willingness to invest their time into and ability to use the system (collective action) were identified and included staff's; reluctance to change, computer literacy and the time and approach taken to implement the system. Whilst

these factors did not apply to all staff, they potentially pose a significant barrier to whether those affected are able to engage with and in the instance of computer literacy, use the system. Computer literacy and reluctance to change are commonly cited issues affecting the implementation of electronic systems within the literature (Likourezos et al., 2004; Ovretveit et al., 2007a,b; Evans & Stemple, 2008; Williams & Boren, 2008; Robertson et al., 2010; Waterson, Glenn & Eason, 2011; Takian, Sheikh & Barber, 2012; Silow-Carrol, Edwards & Rodin, 2012; Yu et al., 2013) and national policy (NHS England, 2013) and so it could be argued that more could have been done to reduce the effects of these barriers. For instance, taking computer literacy as an example, 24 hours and/or seven day support during initial implementations and basic IT skills training for all those who need it could have been provided.

Collective action:

Barriers to staff using the system were mainly a result of poor implementation and design of the system. The findings in this study correspond to those within a systematic review which explored barriers to adopting electronic medical records, (Boonstra & Broekhuijs, 2010, Boonstra, Versluis & Vos, 2014), and also identified amongst other factors, technical issues such as the system crashing and insufficient and inappropriate placement of hardware to be an issue. This study also corresponds with existing literature as the system's lack of integration with other departmental systems within the hospital and with other health care organisations (Thakkar et al., 2006; Takian, Sheikh & Barber, 2012) and the continued use of paper (Moody et al., 2004; Furukawa, Ragu & Shao, 2010) were identified as significant barriers to staff using the system in this study. It could be argued that the challenges surrounding integration and achieving a paperless environment are more difficult to overcome than technical issues or system design flaws; particularly as the NHS has been striving for an integrated and paperless NHS since 1998 (NHS Executive, 1998). Trusts should therefore be cautious to manage the expectations of staff, which is related to the need to effectively communicate the aims and reasons for electronic systems being introduced. As in this instance, some participants saw the lack of integration with other electronic systems within and beyond the trust as an aim despite it not being one of the trusts current ambitions or priorities.

Reflexive monitoring:

The effect of computers upon the doctor-patient relationship is well documented, particularly within primary care (Booth, Robinson & Kohnnejad 2004; Noordman et al., 2010; Peerce et

al., 2011). Conflicting opinion as to how the system in this study has impacted upon participants' relationships with patients was provided; with some feeling that their interaction has not been affected and others having experienced a negative impact. This variation may be due to some participants requiring higher levels of concentration to use the system in comparison to paper records. The literature supports this and suggests that the amount of concentration required varies according to what the system is used for, with more complex tasks requiring greater concentration causing, some clinicians to feel as though they are ignoring patients (Booth, Robinson & Kohnnejad, 2004). This study added to the literature by determining that not only the way that clinic rooms are set up, but also where computers are placed within wards can affect the clinician-patient relationship. For example in this study, the placement of computers away from patients and the lack of mobile devices, meant that staff had to leave patients to access the system, causing them to spend less time with patients.

Interviews revealed that NHS staff perceived there to be an increased risk to patient safety during the first 12 months of the system's implementation. Some staff were able to give specific examples of where they thought use of the system had put patient safety at risk. Perceptions of increased risk were largely a result of technological failures and human errors, which have resulted in difficulties accessing the system and an increased risk of inputting errors or patient information being missed. Additionally, a couple of barriers which were perceived to impact staff's ability to use the system (cognitive participation) such as the continuing use of paper and the system's lack of integration with other electronic systems within the trust and between health care organisations were perceived to impact patient safety. It is surprising that there has been so little research into the potential harms of implementing electronic systems into the NHS. Previous research (Likourezos et al., 2004; Moody et al., 2004; Kossman 2006; Thakkar et al., 2006 ; Pollak & Lorch, 2007; Ovretveit et al., 2007a,b ; Evans & Stemple, 2008; De Veer & Francke, 2010; Silow-Carroll, Edwards & Rodin, 2012; Chao et al., 2013; Lee, Kuo & Goodwin., 2013; Meeks et al., 2014) and NHS IT policy (NHS England, 2013; DoH, 2014) has focused on potential benefits of these systems, such as reducing inputting errors and adverse drug events. However, this study's findings correspond with a limited, poorly cited and predominately U.S evidence base, which has identified human errors and technical issues associated with Health Information Technology (Perry et al., 2005; Weiner et al., 2007; Magrabi et al., 2011; Sittig & Singh, 2011) and electronic records (Meeks et al., 2014) to increase the risks and bring new risks to patient safety. Whilst the risks will vary with the different systems and contexts that these systems are placed in, it is crucial that these risks are not underestimated and are well known to NHS trusts. Particularly as hospitals move towards implementing hospital-wide EPR systems,

where the impact of issues such as technology failures are not contained within single departments as with departmental systems, but become a potential problem throughout trusts (Sittig & Singh, 2012).

Perceptions that the system may be increasing risks to patient safety, led some participants to raise the question of who would be liable, should a patient safety incident arise because of the system. This implies that the trust had not made it clear to staff, who would be held responsible should an incident arise. Whilst this information may be held within trust policy documents, staff showed a lack of awareness of this information, which ultimately caused them to feel anxious and frightened to use the system. Recommendations for trusts during future electronic implementations are provided in section (7.3.4).

Whilst appraising the system, participants cited a number of 'things that could be done for benefits to emerge' and recommendations for; training, universal use of the system and changes to clinics. Additionally, despite some participants expressing concerns at the idea of becoming paperless, a call for an integrated paperless environment where all patient information is inputted onto the system, was deemed crucial for benefits to be realised. However, others preferred the idea of a paper-lite system, where some tasks such as communication with other hospitals would remain on paper. The varying opinions given on this issue and concerns at the prospect of becoming paperless, could be due to the ambiguity surrounding what a paperless NHS means and the uncertainty of some participants as to why the system was introduced. This reiterates the importance of the trust and NHS as a whole to define their ambitions when implementing electronic systems and ensure these are explained to all front line staff. Additionally, the nervousness and confusion surrounding a paperless NHS, reiterates similar findings within chapters 3 and 5 therefore raising the question of whether the term paperless is useful and should be aimed for, or whether it should be a by-product of using technology to create a hopefully safer, more efficient NHS (chapter 8).

The majority of literature surrounding the benefits of electronic record systems, is US or primary care based and remains hypothetical, reporting the potential benefits of these systems (chapter 1, section 1.2.1). Of this literature, the potential for electronic systems to improve patient safety is regularly cited (Likourezos et al., 2004; Moody et al., 2004; Kossman 2006; Thakkar et al., 2006 ; Pollak & Lorch, 2007; Ovretveit et al., 2007a,b; Evans & Stemple 2008; De Veer & Francke, 2010; Silow-Carroll, Edwards & Rodin, 2012; Chou et al., 2013; Lee, Kuo & Goodwin., 2013; Meeks et al., 2014). This was supported by participants within this study, who even if benefits were yet to emerge, remained largely

optimistic that the system would bring patient safety benefits in the future. This study has added to the literature, by not only providing empirical evidence within England's NHS of benefits that have been realised since an electronic system has been implemented but has also identified expected benefits prior to the systems implementation and benefits staff are expecting in the future. Depending on how long participants had been using the system, depended on whether benefits had been experienced and so contrasting opinions were provided; with those at the earlier stages of implementation yet to see benefits, whilst staff working in 'paperless' wards were seeing various benefits begin to emerge. Realised benefits identified in this study concord with another UK study which amongst others, reported benefits within the early stages of the NHS care records service to include, improved availability and legibility of records and simplified retrieval and access to information (Sheikh et al., 2011).

Is there evidence that the system has become a part of clinician's daily practice?

NPT has characterised a range of factors that have helped staff to, understand the purpose of, engage with, use and appraise an electronic system. Considering the limited benefits that have been realised, the range of disadvantages cited and their potential implications upon patient safety, the system is not believed to have become embedded into clinicians practice. Furthermore, whilst some clinicians continue to view the paper record as the primary record the system cannot be seen to have been normalised into everyday practice. The variety of recommendations provided by participants is further evidence of discontent with the system and so it is felt that it takes longer than 12 months for clinicians to truly accept a technology and see it is a part of their working lives.

The utility of NPT as a framework for interpreting the study's findings

NPT has allowed a more in-depth interpretation of the study's findings to be obtained and facilitated an analysis that provided a more than descriptive account of themes and allowed interactions between themes and an understanding of whether the maternity information system has become a part of clinician's routine practice to be better understood. The appropriateness of using NPT to help interpret the study's findings is highlighted by the relative ease by which the majority of themes could be mapped onto and interpreted using the model's four mechanisms. Additionally the theory's versatility as evidenced by its

previous application to a range of complex interventions meant NPT could be adapted for use within this study.

Furthermore, considering the model has been designed as a tool to evaluate interventions and technologies within healthcare, it is surprising that patient's perceptions of the technology did not map onto any of the four components. Although it could be argued that this theme could have been placed under reflexive monitoring as participants were reflecting on how they perceive patients to view the system. The literature described reflexive monitoring as 'users' or participant's appraisal of the technology or intervention (May & Finch, 2009; Murray et al., 2010).

Applying socio-technical thinking to the study's findings

As in chapters 3 and 5, the benefits and barriers affecting the system's implementation in this study have been divided into macro, meso and micro level influences, to incorporate socio-technical thinking and to address the overall aim of the thesis, which is to explore the implementation of EPRs. The importance of considering both the social and technical factors affecting the implementation of electronic systems is highlighted in table 22. In contrast to chapters 3 and 5, where predominately macro level influences were identified, as expected, from a study exploring NHS staff's experiences of implementation, the majority of factors identified were meso (organisational) and micro (individual) level influences, such as the provision of training and support and staff's computer literacy respectively.

The interrelated nature of the factors displayed in table 22 should be considered. For instance, staff continue to use paper for a variety of reasons, such as when the system crashes paper is reverted to. However, this increases the chance of information not being retrospectively entered onto the system and being missed at future appointments, thereby increasing risks to patient safety if that information is of clinical importance. Additionally, whilst some of the factors identified in this study are unique to maternity units, such as the system enabling the trust to charge CCGs the correct amount relative to the unit's case mix and so demonstrating financial benefits to using the system, the majority of factors would be common to implementations of electronic systems throughout the NHS. For instance, the need to ensure that all staffs training needs are met prior to using the system and issues stemming from the computer literacy of staff. The implications for the social and technical factors identified within this chapter and chapters 3 and 5 for trusts implementing electronic record systems and the extent that they may explain the varying success of trusts implementing electronic systems is discussed in chapter 8.

Table 22 Macro, meso and micro influences on the implementation of a maternity information system

Macro		Meso		Micro	
Factor	Description	Factor	Description	Factor	Description
<i>Change enforced upon the NHS</i>	Change enforced upon the maternity unit and NHS impacted on staffs' willingness to use the system.	<i>Training and additional learning resources</i>	Training and additional resources e.g. lessons learned emails may increase usage.	<i>Computer literacy</i>	Computer literacy may affect whether staff engaged with and use the system.
<i>Benefits to audits and performance outcomes</i>	Easier conduction of audits and performance outcomes.	<i>Support team and super-users</i>	The support team and super-users helped staff engage with and use the system.	<i>Understanding of why the system has been introduced</i>	Understanding why the system has been introduced may affect staff's willingness to use the system.
<i>Accurate maternity tariffs</i>	The trust can now charge CCG's the correct amount relative to the maternity unit's case mix.	<i>Insufficient hardware</i>	Not enough hardware available.	<i>Reluctance to change</i>	Participants were reluctant to accept the new system.
		<i>Inappropriate placement of computers</i>	Hardware that was available, placed away from patients.	<i>Patients opinion of the system</i>	Contrasting perceptions of patient's opinion of the system.
		<i>Technical issues with the system</i>	Lack of back- up system, difficulties accessing the system in the community and system downtimes caused	<i>Frightened to use the system</i>	Perceived increased risk to safety, led some staff frightened to use the system.

			delayed or postponed clinics.		
		<i>Continuing use of paper</i>	Paper is still in use preventing the maternity unit from becoming truly paperless	<i>Perceptions of the time to implement the system</i>	Staff present for the previous systems' implementation do not distinguish between the systems and feel the implementation has been lengthy.
		<i>Layout of clinic rooms</i>	Way clinic rooms are set up is detrimental to patient-clinician relationship.	<i>Expected benefits prior to implementation, future benefits and realised benefits</i>	Benefits included; perceptions that the system would improve patient safety and greater clarity and access to patient records 24 hours a day.
		<i>Clinic times and processes such as discharged increased</i>	The system has increased clinic times and length of discharge and consultations.	<i>System is time consuming</i>	The system is perceived as more time consuming than the paper records.
		<i>Lack of integration with other departmental systems and health care organisations</i>	Lack of integration increased risks of missing information and means paper is still used.	<i>Difficulties navigating and using the system</i>	Perceived increased risk of missing information as system hard to navigate and use.
				<i>Perceptions and experiences of the system increasing the risk to patient safety</i>	A variety of factors led to concerns that the system has increased risks to patient safety.

7.3.2. Strengths and weaknesses

This study is the first in England to explore NHS staff's perceptions and experiences of the benefits, barriers and impact of introducing an electronic system during the first 12 months of its implementation. The study has added to the limited UK empirical evidence in this area, by not only reporting future or hypothetical benefits but also benefits that have been realised. The study also adds to an emerging but limited evidence base that has reported potential negative impacts of electronic systems upon patient safety, especially during initial implementation.

The study has added to the limited number of UK studies, which have used NPT as a framework to evaluate implementations of technology in healthcare. Furthermore, by using the theory to not only help inform the topic guide but provide a secondary analysis, a more in-depth interpretation of the study's findings that went beyond a thematically devised descriptive list of the data was obtained. Additionally, using NPT as a framework for the analysis allowed for an understanding of how the benefits and barriers identified by participants influenced the extent that the system has become embedded into practice. The study also proposes a set of broad definitions for the four main mechanisms of NPT, which in addition to the methods section outlines how NPT was used for a secondary analysis. These definitions and the use of NPT to inform and interpret the study's findings may help those wishing to use the theory to underpin future qualitative studies.

Interviewees were asked to provide their perceptions and experiences of, training, expected benefits and reasons for the systems introduction, prior to the systems implementation. As interviews took place at just one point in time, there is a possibility that participant's views may have changed, or be representative of only that stage of implementation. However, this was unavoidable as despite originally planning for a before and after study this was not possible due to the system that was to be studied not being implemented. Furthermore, the system that has been studied was already implemented when the study began, with no other electronic systems scheduled for introduction at the participating trust within the time frame of this PhD.

7.3.3. Reflexivity

As in chapter 5 reflexive notes were taken following each interview (Krefting, 1991). I also found that similarly to chapter 5, I was nervous prior to conducting the first few interviews and so my ability to probe interviewees may have been affected. However, as the interviews progressed I became more confident and noticed that the interviews flowed more easily. Something that I perhaps underestimated prior to the study was that interviewees may also be nervous. This was particularly noticeable amongst midwives and those with specialist job titles who when describing patient safety incidents seemed particularly nervous about their anonymity. To reassure these individuals when these concerns were expressed, as well as prior to and at the end of interviews, processes for anonymity when analysing and reporting data were explained. However it is possible that these concerns may have limited the examples or detail given by these participants when describing the impact of the system upon patient safety.

During earlier interviews, I noticed that participants were having problems with a question which asked them to describe, what benefits they expected to see before the system had been introduced and how these compared to benefits they have experienced. Subsequently this question was divided into two separate questions as participants were typically only commenting on those they have (or have not) experienced. Whilst this may account for less information on perceived benefits having been obtained, this was rectified for the majority of participants by the question being separated.

At the end of interviews, when asked if they had any additional comments, the majority of participants stated that 'they did not want to sound too negative' or felt that they had been unhelpful. This was despite prior to all interviews, it being explained to participants that I was not affiliated to the support team and had no vested interest in the system being a success. Following these concerns I ensured that at the start of the remaining interviews I explained to participants that there were no right or wrong answers and emphasised again that it was their experiences of the system that were of interest whether they were positive or negative. It is therefore possible that there was an element of social desirability, as participant may have believed I was associated with the system support team and so felt that I would not want to hear negative opinions. However, given the aforementioned explanations prior to each interview and the extent of the disadvantages and barriers provided by interviewees; this is unlikely to have hindered the study's findings.

7.3.4. Recommendations

On the basis of the study's findings the following recommendations for research and NHS trusts implementing electronic systems are proposed.

The study was conducted with NHS staff from a single maternity unit within a single NHS foundation trust. By exploring the implementation of an electronic record into a single case site, an in-depth exploration of the factors affecting implementation from the micro-perspective was obtained. Whilst it is anticipated that the benefits, barriers and disadvantages of implementing an electronic record that have been identified here, will provide useful insights to other healthcare organisations implementing similar systems, multi-site research that evaluates implementation over a longer time period is required.

The study highlights the need for NHS trusts to ensure that the 'social' aspects of implementing IT systems are given as much consideration as the technical. For instance, the variation in participant's levels of computer literacy is something which is likely to be an issue for NHS trusts implementing electronic systems throughout the UK. To help overcome this, training should not be delivered too far in advance of systems being implemented and undertaken by all members of staff. It is also crucial that training sessions are mandatory and available for all staff. To ensure that those with poor computer literacy are supported basic IT skill sessions and 24 hour support should be available during initial implementation.

To support the change from paper to electronic systems effectively, it is important that staff's expectations are managed and that all staff are made aware of the reasons for the system's introduction and the benefits that are likely to ensue. To avoid staff becoming disengaged with the system and prevent staff from having expectations that will not be initially met, trusts should ensure that staff are made aware that [clinical] benefits are unlikely to be seen in the first instance but will ensue in the long term. Trusts may also find it helpful to explain the barriers and disadvantages that may be encountered during initial implementation and for the system to be viewed not merely as a replacement of paper records (Ash & Bates, 2005) but as a change to working practice.

Participants were uncertain as to who would be liable should a patient safety incident occur as a result of the system. In addition to this being outlined within trust policy documents, trusts should clearly communicate their position on this and ensure that it is understood by all staff so that they are aware of the potential risks of using electronic systems. This study identified staff perceptions of potential adverse consequences and so further research is now needed to determine the actual level and scale of the risk during early implementation of electronic systems. This could be achieved by quantifying errors and harm using robust case note review or through linking qualitative findings around perceptions of increased risk with standardised hospital reporting procedures such as through using incident reports, which would help to ascertain and validate perceptions and experiences of risk. Additionally research that seeks to determine the impact upon patient safety during initial implementation should aim to study a number of different electronic systems across different trusts to identify common risk factors.

The study also highlighted a number of technical issues with the system that were the result of poor system design and implementation. To ensure quality, the functional and non-functional characteristics of a system need to be considered in the development of any 'quality' software system (Chung & Du Prado, Leite, 2009). However, the recommendations emerging from this study largely relate to ensuring that quality attributes such as: usability, reliability, acceptability, interoperability, functionality and documentation (Chung & Du Prado Leite, 2009) are considered when designing systems. These technical issues are however not only important to ensure the quality of the system but to prevent poor system design and technical issues from having detrimental effects on some of the social factors associated with EPR implementation. For instance, it is important to consider the system's usability due to the variation in staff's computer literacy and the potential implications that difficulties navigating the system may have on finding important clinical information and patient safety. It is therefore essential that systems are designed with the user in mind and that when designing and commissioning these systems that the principles of User Centred Design are considered (figure 10) (Bevan & Curson, 1999). Users should be consulted to ensure that systems meet all staff needs. The importance of this is reflected in the lack of drawing function within the maternity system, which has led to staff feeling that the individual details of specific cases and procedures are being missed and not recorded. As trusts move towards full EPRs, which are currently procured as 'off-the-shelf', American systems, the lack of tailoring to NHS staff needs may cause significant

problems, particularly considering that difficulties navigating around the system led to participants raising concerns that patient information was being missed.

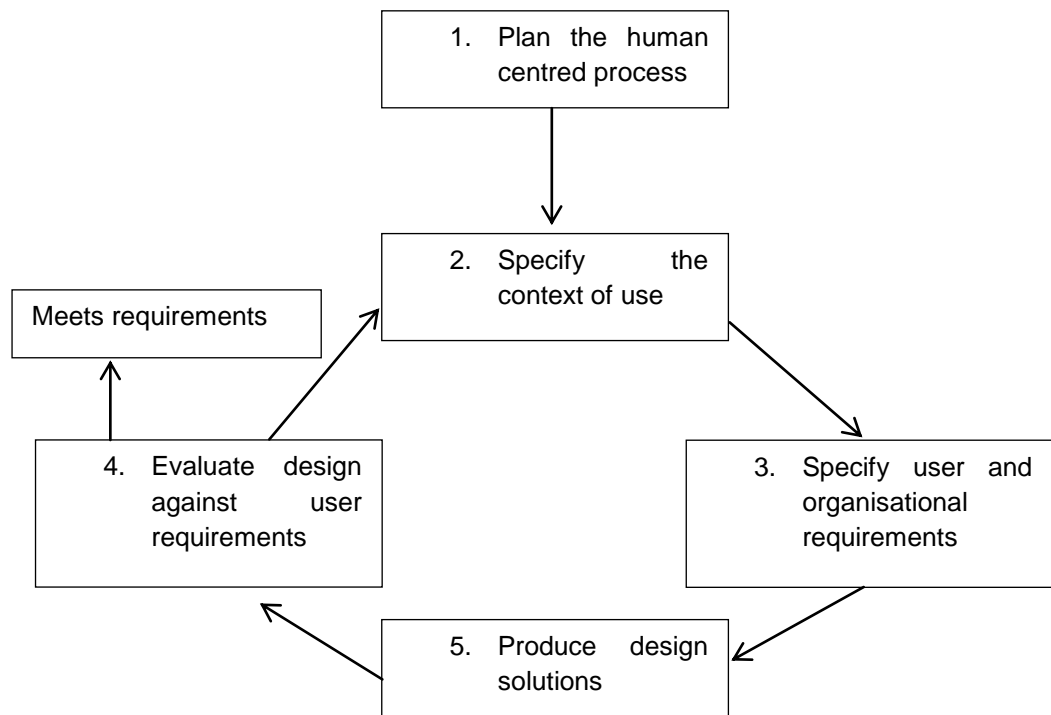


Figure 10: User centered design process adapted from Bevan & Curson (1999)

7.3.5. Conclusions

This is the first UK study to qualitatively explore clinician’s perceptions and experiences of a maternity systems implementation into an NHS trust. The study has expanded on the limited UK evidence surrounding electronic systems, by using NPT as a framework to identify the benefits, barriers and disadvantages of implementing an electronic system during the early stages of its implementation. Lastly, the study has added to a growing body of US literature, which has identified a potential for electronic systems to increase the risk or bring new risks to patient safety. The study’s findings and their implications will be discussed further in chapter 8, which provides an overall discussion of the thesis.

Chapter 8. General Discussion

This thesis provides the first UK study that has explored the approaches to and benefits, barriers and disadvantages of implementing Electronic Patient Records (EPRs) from a socio-technical perspective. The empirical chapters within this thesis (chapters 3-7) include their own independent discussion sections. This chapter provides a summary of the key findings, a description of the challenges associated with conducting research in this area, the strengths and limitations of the thesis and recommendations for policy, NHS hospitals implementing EPRs and future research. Finally, a discussion of the thesis' impact and overall conclusions is provided.

8.1. Key findings:

This thesis has drawn upon socio-technical thinking to explore the implementation of EPRs into NHS secondary care organisations. The empirical chapters within this thesis (chapters 3-7) have employed a range of methods (policy analysis, national survey and qualitative interviews) to explore EPR implementation from macro, meso and micro perspectives. This section summarises the key findings from the empirical chapters and discusses: the progress made by the NHS in implementing EPRs between 1998 and 2015, the current status of and approaches to EPR implementation, the benefits, barriers and disadvantages associated with implementing EPRs and how both EPRs and a paperless NHS are currently defined by CIOs and policymakers. Table 23 summarises the key findings from the empirical chapters within this thesis.

Table 23 Summary of key findings

Study (chapter)	Method used	Summary of findings
An exploration of national NHS IT policy between 1998 and 2015 (3)	Policy analysis	<p>NHS IT and evaluations of NHS IT policy documents provide little evidence of progress being made in implementing EPRs between 1998 and 2015. Definitions and terminology used within policy is inconsistent and poorly defined.</p> <p>Aims of national NHS IT policy have remained unchanged since 1998.</p> <p>A variety of social (reluctance to change) and technical (interoperability) factors were attributed to the limited progress made by national policy.</p> <p>There is little evidence that recommendations proposed by evaluations of NHS IT policy inform subsequent policy.</p>
Investigating the implementation of Electronic Patient Record Systems into NHS trusts (5)	National survey and qualitative interviews with CIOs	<p>Participants disagreed as to what systems and approaches are considered an EPR.</p> <p>Interviewees interpreted the term paperless NHS differently, with the feasibility of the ambition also questioned.</p> <p>A range of approaches systems and devices are being used to implement EPRs, with no clear best method. This makes quantifying the current status of EPRs difficult.</p> <p>A number of challenges and a limited number of (actual) benefits (e.g.improved availability of information) associated with implementing EPRs were identified.</p>
Qualitative interview study exploring the implementation of a maternity information system (7)	Qualitative interviews with NHS staff	<p>NHS Staff described both assumed benefits that are yet to be realised and actual benefits since the introduction of a maternity information system.</p> <p>Staff described a number of social and technical barriers and disadvantages associated with the system's implementation, including a perceived increased risk to patient safety during the initial 12 months of the system's implementation.</p> <p>Due to the limited number of benefits and range of barriers and disadvantages identified, the system is not believed to have become embedded into clinician's routine practice, suggesting it takes longer than 12 months for a system to become truly accepted and a part of clinician's practice.</p>

8.1.1. Has NHS national IT policy made progress in implementing EPRs between 1998 and 2015?

Chapter 3 is the first UK study, to use historical policy analysis to explore whether the NHS has made progress in implementing EPRs. Evaluations of NHS IT policy provide little evidence of significant progress being made in implementing EPRs, aside from some advances in introducing key infrastructure such as the introduction of the Picture Archiving and Communications Service throughout the NHS. The limited progress made by the NHS is highlighted by the fact that the aims of national policy have remained unchanged since *'Information for Health'* in 1998, with successive initiatives stating a

continuing ambition to implement electronic records for all patients in England and provide patients with easy access to their records. Socio-technical thinking was used to describe the various factors which evaluations of NHS IT policy attributed to the limited progress made in relation to EPRs (summarised in table 25). One reason for the limited progress, confirmed by CIOs in chapter 5, is the ambitious nature of policy aims, which are often proposed without an assessment being reported of whether there is the technological capability to achieve them. For instance, the practicalities and knowledge of how to create interoperability (connecting different trust's electronic records) is often unstated. However, this has not stopped NHS England recently proposing the idea of an 'integrated digital care record' which would aim for records to be shared across the entire health and social care system (NHS England, 2013).

Evaluations of national NHS IT policy also proposed a number of recommendations to enhance subsequent policy development. Little evidence could be found that these recommendations have been implemented by policymakers and recurrent reasons for policy failures continue to be given. One reason for this could be because new policy is often published before evaluations of NHS IT policy are completed. This puts the purpose and utility of these documents into questions if their conclusions and recommendations are not being used to inform future policy.

8.1.2. The current status of and approaches to EPR implementation in NHS secondary care organisations

There is a vast amount of pressure on hospitals to implement EPRs and become paperless. Despite this, there is no evidence and little guidance for trusts as to how they should implement these systems. This thesis has addressed this knowledge gap and explored the approaches, systems and hardware being used to deliver EPRs (chapter 5). Despite a best of breed approach being the most common solution strategy among participants, it only represented 32% of survey respondents with interviewees citing both pros and cons of the approach. Furthermore, of the 59 participating trusts, 37 different systems providers of EPRs were used. Whilst the study provides no real insight into the best approach to EPRs, it does provide the first UK account of the various approaches being used and the associated pros and cons of these approaches and devices. For instance, comparisons were made between best of breed and mega-suite approaches. These findings may prove particularly useful to trusts who are at the early design stage or who are planning to implement an EPR in the future. Furthermore, this study provides a first step in generating knowledge in this area, which is essential if

trusts are to make informed decisions and base their investments on directly relevant UK evidence.

Chapter 5 also aimed to quantify the current status of EPR implementation in NHS secondary care organisations. Although 47 out of 59 participants responded positively to the question, 'do you have any form of EPR within your organisation?', it is difficult, based on these findings, to comment on the current status of EPR implementation within the UK with any high degree of certainty. This is primarily due to the relatively low response rate obtained, but also because of the inconsistency in how EPRs are defined and the lack of detail this figure provides in terms of the usage, functionality or stage of implementation of participating trusts.

Monitoring EPR progress in the UK is an acknowledged issue for policymakers and is something that NHS England is starting to address through the Clinical Digital Maturity Index (CDMI) (appendix 5). This aims to highlight the steps (functionality, systems, approaches) required to reach a higher maturity and allows trusts to benchmark their progress in comparison to other trusts based on factors such as the current level of functionality within their EPR system. To support the development of the CDMI, in November 2015 NHS England proposed 'The Digital Maturity Assessment' which aims to establish a current 'baseline' and identify key strengths and gaps in the provision of digital services throughout England (NHS England, 2015b). To achieve this, Chief Executives of NHS acute, mental health, community care and ambulance trusts have been invited to complete a 'Digital Maturity Self-assessment guide (available online, NHS England, Digital Maturity Assessment, 2015c). Elements of this thesis, (chapters 4-5) highlight the complexities of quantifying the progress and status of EPR implementation. Potential issues associated with this include: the current lack of measurement and sharing of information between NHS trusts; the lack of consideration of usage, with current assessments focused on whether systems are implemented rather than their usage; the difficulties in determining the quality of implementations and current uncertainty as to the potential negative effects of ranking trusts based on their progress. For instance, crudely classifying trusts as having poor digital maturity may disengage them towards implementing electronic records.

8.1.3. What are the benefits, barriers and disadvantages of implementing EPRs?

Benefits of EPRs:

Despite UK policy documents (NHS England, 2013; DoH, 2014) stating that EPRs have the potential to improve the quality and safety of healthcare, the literature review (chapter 1) found little empirical evidence to support this, particularly within the UK. A large proportion of existing literature has identified benefits that were assumed or expected to emerge in the future, rather than documenting 'actual' benefits (table 24). This thesis therefore aimed to add to the existing UK evidence by identifying future (chapters 5 and 7), realised (chapters 5 and 7) and expected pre-implementation (chapter 7) benefits. Table 24 summarises these benefits, which were identified through qualitative interviews with CIOs (chapter 5) and NHS staff (chapter 7).

In accordance with existing UK literature (Robertson et al., 2010; Sheikh et al., 2011; Takian, Sheikh & Barber, 2012) the majority of perceived benefits identified during interviews with NHS staff and CIOs related to improved information availability, accessibility, transfer and legibility. For instance, NHS staff spoke positively about the improved legibility and conciseness of patient records, which they felt created more professional documentation for patients (e.g. birth notifications). However, despite claims that EPRs will bring benefits to patient safety and efficiency (NHS England, 2013; DoH, 2014) this thesis found little evidence of this, with quantifiable benefits restricted to a small number of efficiency (time savings, reduced administrative staff and paper note storage) and patient safety benefits (monitoring deteriorating patients, electronic early warning scores and nag features prompting results acknowledgement) that were identified by CIOs in chapter 5.

The reasons for the limited evidence both within this thesis and the wider UK literature are uncertain. One explanation could be attributed to the fact that because of the limited progress made to-date in implementing EPRs within NHS secondary care organisations (chapter 3), this thesis and existing literature has only been able to explore initial implementation. This therefore suggests that for real efficiency and patient safety benefits to emerge, these systems would have to have been implemented and in use for a longer period of time. A conclusion also drawn by Sheikh et al., (2011), who following a qualitative evaluation of NPfIT that identified a few 'clinical benefits' (e.g. increased availability of information), stated that benefits are unlikely to emerge during the initial implementation of EPRs. However, rather than being a product of the length

of time that a system has been implemented, the low evidence of quantifiable benefits could also be due to the approaches being taken to implement EPRs. For instance, in contrast to megasuite systems where entire hospitals become digitised 'overnight', the majority of NHS trusts are choosing to digitise their hospitals gradually, using a 'best of breed approach' (chapter 5). This method could well mean that efficiency savings and patient safety benefits take longer to emerge, as these benefits are largely dependent on all departments using integrated electronic systems. In support of this contention, a number of NHS staff within chapter 7 described how, for real benefits to emerge, systems needed to be fully implemented and integrated throughout the trust.

An alternative explanation for the limited evidence surrounding benefits of EPRs could be because benefits are hard to identify. In addition showing that any advantages or benefits that emerge from EPRs are a direct result of these systems as opposed to other factors or resources (e.g. new policies, changes in staffing levels) which may be being introduced at the same time and which would also affect outcomes such as patient safety and efficiency is challenging. The difficulty of quantifying the benefits of EPRs is partly due to the responsibility for identifying benefits being that of individual NHS trusts and so is constrained to the resources that trusts have to achieve this (unless research is specifically commissioned). Additionally, due to the heterogeneity of EPR implementation the tools and research methods available for identifying benefits for both NHS trusts and researchers is limited (see section 8.3). This is complicated further by the lack of reliable routinely collected data within EPR audit tools. This was highlighted during the PhD where despite originally aiming to explore the usage of EPRs (section 8.2) the inaccuracies and inadequate level of detail of the usage data within the EPR audit tool made it unsuitable for research purposes. For example, the audit tool only gave information pertaining to the number of times clinicians had accessed the system and so these data had to be linked to the hospital records to determine what parts of the record were being accessed. However, when the data were retrieved, data was missing or contained significant inaccuracies (e.g. one clinician was linked to various specialities and was recorded as being both male and female). It followed then that even if the system had been implemented throughout the hospital the data were unreliable for research purposes.

Lastly, although the NHS needs to identify quantifiable benefits to justify its financial and political commitment to EPRs, it is important that the more clinically orientated benefits identified within this thesis (e.g. improved information availability and

accessibility) are also considered; particularly if staff are to be engaged with and accept new technology (and the disruption of its implementation). The difference between what is and is not considered an implementation benefit, is however, something that needs to be addressed. For instance, policymakers tend to equate benefits as financial savings or patient safety benefits given their focus is not only on improving care but also to justify and make a return on their investment. Whereas clinicians, based on the findings of this thesis (chapter 7), appear to take a wider viewpoint and in addition to considering the quality and safety of care provided, interpreting benefits to mean anything that positively impacts on their daily practice (e.g. having the information they need available to them whenever and wherever they need it). Recommendations for how policy and future research should address this issue are outlined in section 8.4.

Table 24 Benefits identified from chapters 5 and 7 during qualitative interviews with CIOs and NHS staff

Benefit	Chapter
Realised	
Patient Safety	5
Efficiency (time and cost saving)	5
Information availability and accessibility	5 & 7
Easier data entry and reduced risk of missing information	7
Improved legibility of records	7
Improved communication between hospitals and GPs	7
Improved and easier research, audit and performance planning	7
Future	
Patient Safety	5
Efficiency (time and cost saving)	5
Information accessibility and availability	5 & 7
Increased inter-departmental communication and quicker referrals within and between organisations	5
Improved and easier research, audit, performance and planning	7
Increased record security and fewer missing records	7
Expected (pre-implementation)	
Integration with other departmental systems within the trust and with other health and care organisations	7
Information would all be in one place	7
Reduce risks associated with patients losing or forgetting to bring their paper handheld notes	7
Improved and easier to conduct audits and performance outcomes	7

Barriers to implementation and disadvantages of EPRs

Socio-technical thinking provided a useful framework for exploring EPR implementation. The empirical chapters within this thesis (chapters 3, 5 and 7) identified a range of social and technical factors affecting the implementation of EPRs; demonstrating the need to give equal weight to social and technical issues when introducing technology

into healthcare organisations (Coiera, 2004). The number of barriers and disadvantages to implementing EPRs identified (table 25) also highlights the complex nature of introducing these systems. However, it is important that these factors are not viewed as a definitive list of critical success factors and/or barriers but rather are considered to represent a range of issues that may affect NHS trusts who are at varying stages of implementation.

Although the literature has identified a number of barriers and disadvantages of implementing EPRs (section 1.2.2 and 1.2.3), this evidence is largely US based and is focused on acute settings. This thesis has therefore added to a limited UK evidence base that has identified barriers and disadvantages of implementing EPRs. As in the independent discussions within each of the thesis' empirical chapters these barriers and disadvantages are discussed and categorised as macro, meso and micro level factors:

Table 25 Factors affecting the implementation of electronic records

Level of socio-technical thinking	Factor affecting the implementation of EPRs	Study (chapter)
Macro	National Policy	Policy analysis (3) Mixed methods study (5)
	Lack of universally accepted definitions of the terms 'electronic records' and 'paperless NHS'.	Policy analysis (3) Mixed methods study (5)
	Lack of best approach to implementation	Policy analysis (3) Mixed methods study (5)
	Technology and hardware available to the NHS	Mixed methods study (5)
	Change enforced upon the NHS	Qualitative interview study (7)
	Management and leadership of National policy	Policy analysis (3)
	Management of contracts and suppliers during NPfIT	Policy analysis (3)
	Investment into electronic records and failure to monitor costs and benefits	Policy analysis (3)
Meso	How trusts involve clinicians in EPR projects	Mixed methods study (5)
	Showing a return of investment	Mixed methods study (5)
	Training and support	Qualitative interview study (7)
	Insufficient hardware and inappropriate placement of hardware	Qualitative interview study (7)
	Technical issues	Qualitative interview study (7)
	Use of paper alongside EPRs	Qualitative interview study (7)
	Added time pressures	Qualitative interview study

		(7)
	Integration within and between organisations- interoperability	Policy analysis (3) Qualitative interview study (7)
	Patient access to electronic records	Policy analysis (3)
	Lack of organisational learning and sharing best practice	Policy analysis (3)
Micro	Computer literacy of NHS staff	Mixed methods study (5) Qualitative interview study (7)
	Staff willingness to be involved in projects	Policy analysis (3) Mixed methods study (5)
	Reluctance to change	Policy analysis (3) Qualitative interview study (7)
	Clinicians understanding of why a system has been introduced	Qualitative interview study (7)
	Clinicians perceptions of how patients responded to the system	Qualitative interview study (7)
	Length of implementation and impact of previous implementations	Qualitative interview study (7)
	Expected benefits prior to implementation, and belief that the system will bring future benefits	Qualitative interview study (7)
	System usability	Qualitative interview study (7)
	Perceptions of increased risk to patient safety with EPRs	Qualitative interview study (7)

Macro

Macro level influences affecting EPR implementation include national and regional policies and priorities as well as wider social norms such as the economic climate and technological developments (Greenhalgh et al., 2010). Of the macro factors identified, the majority related to issues surrounding national policy with both the policy analysis and mixed methods study (chapters 3 and 5) reporting national policy as a barrier to the implementation of EPRs in the NHS. In both studies, the number of IT policies and objectives 'enforced' upon NHS trusts was considered a barrier, with the policy analysis also criticising the overambitious nature of NHS IT priorities and their changing timelines. It is however not only national policy that may be negatively impacting on EPR implementation as the single study site in chapter 7 has over the course of three years (this PhD term) seen two different CIOs and two separate EPR policies (section 8.2). The ambiguity and inconsistency surrounding policy at the national and local level is suggested therefore to at least partially explain the limited progress that the NHS has made in implementing EPRs.

Chapters 3 and 5 also criticised NHS IT policy for the limited guidance available for trusts seeking to implement EPRs and the number of poorly defined terms used to describe EPRs and communicate policy ambitions (e.g. EPR, EHR, IDCR, paperless NHS); which are discussed in sections 8.1.2 and 8.1.4 respectively.

Meso and micro

Meso level influences refer to organisational processes and routines (e.g. training, IT systems), whereas micro level influences relate to experiences of individuals (e.g. NHS staff) (Greenhalgh, et al., 2010). The empirical chapters within this thesis (chapters 3, 5 and 7) identified a wide range of meso and micro factors affecting the implementation of EPRs, a number of which were technical issues that were largely the result of sub-optimal system design and implementation (e.g. parallel use of paper and the system, poor usability, insufficient provision of hardware). Although these issues are well documented within the literature (section 1.2.2), this thesis suggests that when implementing EPRs, NHS trusts continue to be faced with a number of technical barriers; highlighting the importance of ensuring that trusts have sufficient infrastructure to support implementation and that systems are fit for purpose and meet clinical needs. In accordance with existing literature (chapter 1, section 1.2.2.) social factors affecting EPR implementation identified within this thesis include: clinician involvement, training, computer literacy, reluctance to change and expectations of benefits and reasons for the system's introduction (table 25). However, due to the heterogeneity surrounding EPR implementation (different systems, approaches NHS trusts) the extent to which these social and indeed technical factors will affect NHS trusts will inevitably vary.

A key finding within this thesis was NHS staff perceiving and in some cases experiencing that the maternity information system brought new and added risks to patient safety (chapter 7). Perceptions of increased risk were largely a result of technological failures and human errors that resulted in difficulties accessing the system and an increased risk of data entry errors or omission of potentially important clinical information. In comparison to the emphasis both within NHS IT policy (NHS England, 2013; DoH, 2014) and previous research (Likourezos et al., 2004; Moody et al., 2004; Kossman 2006; Thakkar et al., 2006 ; Pollak & Lorch, 2007; Ovretveit et al., 2007; Evans & Stemple 2008; De Veer & Francke, 2010; Silow-Carroll, Edwards & Rodin, 2012; Chao et al., 2013; Lee, Kuo & Goodwin., 2013; Meeks et al., 2014) on potential benefits of implementing EPRs, there is little information surrounding the potential

harms of implementing electronic records into the NHS. However, the findings within chapter 7 are consistent with a limited and largely US evidence base, which has identified human errors and technical issues associated with electronic records to bring new and added risks to patient safety (Myers, Jones & Sittig, 2011; Chou, 2012; Sittig & Singh, 2012; Warm & Edwards, 2012). If hospitals are to implement EPRs, it is essential that these risks are not underestimated and are acknowledged by both policymakers and NHS trusts; particularly given that patient safety incidents have both medical and legal consequences.

8.1.4. Defining EPRs:

Chapter 1 discussed how currently no universally accepted definition of an EPR exists, with the terms Electronic Patient Record/Electronic Medical Record and Electronic Health Record often used loosely and interchangeably within the literature; despite being proposed as different systems by NHS IT policy in 1998 (NHS Executive, 1998). The policy analysis (chapters 2-3) provided insights into the confusion surrounding how EPRs are defined, as since the publication of the 1998 *'Information for Health'* policy, each subsequent NHS IT policy has introduced new terminology for electronic record systems (figure 3, section 3.1.2). This is exacerbated by the failure of policy to provide significant detail regarding the approaches to and content and functionality of these systems. For instance, when proposing the term Integrated Digital Care Record (IDCR) the *'Safer Hospitals Safer Wards'* policy (NHS England, 2013) failed to describe what IDCRs mean in practice (e.g. the systems, approaches and functionality) with NHS England's definition limited to an ambition for:

'local health and care services to use digital technology to ensure that vital patient related information and clinical decision support tools can be viewed by an authorised user in a joined up manner in any single instance. We want information that is shared with or created by social care professionals to be available in the same application to enable true integration of care to be delivered effectively. Going forward patients will share that access to their personal information, which will enable them, and those they trust, to enhance and enrich the record with their personal preferences and insights' (NHS England, 2013).

In chapter 5, an EPR was described by interviewees as: *'a system that enables clinical decision support and which allows clinicians to have the information they need, when they need it whilst removing the need for the management of paper during the patient pathway'*. However, CIOs had different interpretations of the systems, approaches and

functionalities that may be considered an EPR. For example, participants gave polarised opinions as to whether best of breed systems, can even be considered an EPR. Chapter 5 also revealed differences in how the NHS' paperless ambition is being defined, with CIO's questioning the ambition's feasibility. The ambiguity surrounding the term paperless NHS may be attributed to the lack of clarity and description of what this ambition means in practical terms, by policymakers. This ultimately appears to have created a divide between those that equate the term to literally meaning no paper and those who perceive it to be the removal of paper from the patient pathway but not the NHS entirely. The lack of detail and consistency in the definitions of EPRs, IDCRs and current ambitions for NHS IT needs to be addressed if the NHS is to have a shared sense of purpose and work towards common, unified goals.

8.1.5. Summary of key findings:

The findings of this thesis suggest that little progress in implementing EPRs into secondary care in the NHS has been made since 1998. However, the thesis also, through identifying a varied number of macro, meso and micro factors influencing implementation, highlights the difficulty of introducing these systems into a complex adaptive system such as the NHS. The difficulty of successfully implementing EPRs is complicated further by competing terms, limited guidance and overambitious policy; the latter being considered a key barrier to implementing EPRs. Despite policymakers claiming that EPRs will bring significant benefits to the NHS, the findings of this thesis currently provide little evidence to support this and suggest that although benefits are expected in the long term, initial implementation is perceived to bring disadvantages and increased risks to patient safety. In addition to systems needing to have been implemented for longer periods for quantifiable (e.g. efficiency, patient safety, financial) benefits to emerge, it may be that the full benefits of these systems will only be seen if these systems are implemented throughout the NHS and not just at Trust or department level and so are connected as part of a wider NHS network.

8.2. Strengths and weaknesses

The strengths and weaknesses for the empirical chapters within this thesis have been discussed in chapters 3, 5 and 7. This section therefore outlines the strengths and weaknesses of the overall thesis:

Socio-technical thinking provided a framework for exploring the complex change associated with EPR implementation. The thesis utilised a novel way of applying socio-technical thinking as the analysis of the macro, meso and micro level influences of EPR implementation was undertaken in two ways. Firstly, the three empirical chapters each focused on a specific level of influence and explored the implementation of EPRs from macro, meso and micro levels respectively. Secondly, socio-technical thinking was used as a framework for interpreting the various macro, meso and micro level factors associated with EPR implementation within each study.

In addition to exploring technology from the macro, meso and micro level, Greenhalgh et al., (2010) also recommend that technology should be evaluated using qualitative and quantitative methods. The use of different methods throughout this thesis is considered an additional strength as it is believed to have provided a more complete picture of EPR implementation into NHS secondary care organisations (Thurmond, 2001). Triangulation is broadly defined as the 'combination of methodologies in the study of the same phenomenon' (Denzin, 1978). Researchers advocate the use of triangulation for confirmation and completeness, particularly when investigating under-researched and complex phenomenon (e.g. EPR implementation) (Shih, 1998). The value in triangulating findings is exemplified in chapter 5 where contradictory responses to survey questions were explained by qualitative data. For example, survey questions found inconsistency as to whether trusts felt a paperless NHS is a realistic ambition and qualitative data highlighted a lack of understanding and different interpretations of the term paperless. It is therefore felt that by triangulating findings within this thesis an accurate reflection of the complex nature of implementing EPRs has been obtained (Polit & Hungler, 1999 in Thurmond).

Chapters 2 and 3 are the first study to explore using a historical policy analysis whether NHS IT policy has made progress in relation to implementing EPRs. In light of the study finding that little progress has been made and that recommendations within evaluations of NHS IT policy are rarely used to inform future policy, the study raises important questions surrounding the purpose of these evaluations and whether policy should revisit its current ambitions. Given the limited guidance available, chapter 2 may prove useful for others wishing to undertake policy analysis; as a transparent and detailed account of how documents were selected, identified and analysed is provided.

Chapters 4 and 5 describe the first empirical study to provide national coverage of the current status of implementing EPRs within English NHS secondary care organisations.

Additionally despite current policy pressure on NHS hospitals to become paperless by 2020, this is the first study to explore the different approaches to implementation and so provide useful insights and guidance for trusts. The study also created a number of working definitions relating to core EPR functionality (e.g. clinical decision support), hardware and solution strategies (e.g best of breed, megasuite) which is essential for disseminating and communicating research and lessons learned across academic, industry and healthcare organisations.

Interviews with NHS staff (chapters 6 and 7) represent the first study in England to explore staff's perceptions and experiences of the benefits, barriers and disadvantages of implementing an electronic record system into a maternity unit. Given the lack of UK evidence in this area (chapter 1) the chapter addresses significant gaps in the literature, which may prove useful to trusts when developing their business cases and benefits realisations plans surrounding EPRs. Additionally, the study along with chapter 5 adds to the limited evidence base that reports realised as well as expected and future benefits of EPRs.

Lastly, the use of Normalisation Process Theory (NPT) as a framework for evaluation and interpretation of the study's findings within chapter 7 provided a greater understanding of the data that went beyond a descriptive list of themes that would not have been obtained by thematic analysis. Broad definitions of the four mechanisms within NPT (coherence, cognitive participation, collective action and reflexive monitoring) and a transparent account of how the theory was used to inform the development of the study's topic guide and analyse and discuss the study's findings (chapter 6) may also help others wishing to use the theory.

The utility of qualitative methods in this area of research was shown particularly within the mixed methods study where interviews provided a more detailed exploration of the approaches to implementation (hardware and solution strategies) to complement the survey data as well as enabling an understanding of the benefits and challenges of implementing an EPR to be obtained. Mays & Pope (1995) proposed a checklist for those wishing to evaluate the quality of qualitative research. The items on this checklist are outlined below along with references to the chapters and sections where these questions have been addressed:

1. Overall, did the researcher make explicit in the account the theoretical framework and methods used at every stage of the research? (chapter 1 section 1.4, chapter 2 section 2.6.1, chapter 3 section 3.2.1, chapter 5, section 5.3.1, chapter 6 section 6.2, 6.5, chapter 7, section 7.2.2, section 7.3.1, chapter 8 section 8.1.2).
2. Was the context clearly described? (chapter 1 sections 1.1-1.3, chapter 2 section 2.1, chapter 4 section 4.1, chapter 6 section 6.1, chapter 7 section 7.1).
3. Was the sampling strategy clearly described and justified? (chapter 2 section 2.4.1, chapter 4 section 4.2.5-4.2.7, chapter 6 section 6.3.2).
4. Was the sampling strategy theoretically comprehensive to ensure the generalisability of the conceptual analyses (diverse range of individuals and settings, for example)? How was the fieldwork undertaken? Was it described in detail? (chapter 2 section 2.4.1, chapter 4 section 4.2.5-4.2.7, chapter 6 section 6.3.2).
5. Could the evidence (fieldwork notes, interview transcripts, recordings, documentary analysis, etc) be inspected independently by others; if relevant, could the process of transcription be independently inspected? Yes available if requested, (chapters 2,4,6).
6. Were the procedures for data analysis clearly described and theoretically justified? Did they relate to the original research questions? How were themes and concepts identified from the data? (chapter 2 section 2.6, chapter 4 section 4.4, chapter 6 section 6.5).
7. Was the analysis repeated by more than one researcher to ensure reliability? (see below).
8. Did the investigator make use of quantitative evidence to test qualitative conclusions where appropriate? (chapter 5).
9. Was a sufficient amount of the original evidence presented systematically in the written account to satisfy the skeptical reader of the relation between the interpretation and the evidence (for example, were quotations numbered and sources given)? (Chapter 3 section 3.1, chapter 5 section 5.2, chapter 7 section 7.2).

Research where a single researcher is responsible for the design, collection, analysis and reporting of data is often viewed with scepticism and considered vulnerable to researcher bias. However, in line with guidance by Mays and Pope, 1995, to overcome this issue and enhance the reliability of the thesis' findings, regular discussions were held throughout with my supervisors who are experienced qualitative researchers.

The generalisability of the findings within this thesis to healthcare organisations in other countries is questionable given the focus here on EPR implementation within the English NHS. However, when considering the range of stakeholders (CIOs, NHS staff, policymakers), EPR systems (table 16, chapter 6) and care settings (acute, mental health, community care) represented and the number of healthcare organisations not only in England but around the world who are implementing EPRs, it is anticipated that some of the benefits, barriers and disadvantages identified would be transferable to other settings. Additionally, the attention that this thesis has received by policymakers and its use to inform an NHS trust's EPR implementation (section 8.5) suggests that the findings within this thesis are generalisable throughout the NHS.

The small sample size supporting the findings within chapters 5 and 7 could be seen as an additional limitation of the thesis. In light of the varied sample obtained, which represented a range of trust types, locations and professional groups, the sample was deemed adequate for meeting the aims of both studies. Whilst additional findings may have provided useful information and new insights, given the range of benefits, challenges and approaches being used by trusts to implement electronic records that have been identified throughout this thesis, it is felt that the study's findings were not negated by the response rate.

Wider challenges encountered throughout this PhD which may reflect the difficulties of conducting research in this area were largely a result of shifting EPR project timescales and inconsistent project management. As discussed in chapter 1 (section 1.4.2) a number of these challenges occurred due to issues at the NHS trust that provided the base for the case study aspect of this thesis. These challenges may also have relevance for other major NHS IT projects and so provide insights into the complexities of introducing technology into the NHS in general.

In 2012, the NHS trust had started to implement an EPR aiming for the system to be introduced progressively throughout the hospital and fully functioning (Electronic document management, e-prescribing, results, discharge, mobile access to EPR using iPads) across all wards by 2016. This presented a unique opportunity for the thesis to explore the benefits, barriers and disadvantages of an EPR pre and post implementation. In addition to the mixed methods study, the thesis originally planned and obtained ethical approval to undertake the following studies:

- A quantitative (EPR audit data) and qualitative (semi-structured interviews) exploration of clinician's usage of EPRs at the trust.
- A qualitative study exploring NHS staff's perceptions and experiences of the benefits, barriers and disadvantages of an EPR, before and after it was implemented into General Surgery.

However, delays to the EPR project meant that after implementing the system into the 'Ear Nose and Throat' directorate the project was terminated in 2013. The IT strategy for the trust was temporarily put on hold and so with the exception of the mixed methods study, the studies originally proposed within this thesis were revised. The introduction of a maternity information system did however present the opportunity to amend ethical approval for the original qualitative study in general surgery and allow for the implementation of a maternity system to be explored (chapters 6 and 7); which also enabled the trust to receive feedback from this research ahead of their new EPR strategy. The termination of the original EPR project was followed by the appointment of a new CIO and EPR strategy for the trust, which still aimed for an EPR solution to be implemented in 2016. Whilst this created challenges for the PhD such as those previously described, it also reflects a wider issue of how NHS IT projects are often implemented under inconsistent management and changing strategy and timescales.

8.3. Recommendations:

Recommendations for NHS IT policy

At present no universally accepted definition of an electronic record and/or EPR exists with a range of terms used by policymakers, academics and CIOs for describing these systems. If the NHS is to implement electronic records then national policy needs to where possible refrain from introducing new terminology and instead should focus on defining and using existing terms consistently. To achieve this, NHS England should work with a range of stakeholders (NHS staff, CIOs, industry experts and academics) to produce universally accepted definitions of the terms EPR and IDCR. To dispel the confusion as to what is and is not an EPR, these definitions should explicitly state the functionality, systems and approaches that are considered an EPR. It is recommended that the term IDCR as suggested by the '*Safer Hospitals, Safer Wards*' policy should be used to communicate an ambition for technology to enable integrated records across health and social care. However the term EPR should not be disregarded but should instead be considered one way of achieving a digitised NHS. It would seem important

that these terms are used consistently by all those involved in EPR implementation including policymakers, frontline staff, academics and industry experts.

This thesis identified a lack of understanding as to what is meant by the term 'paperless NHS', and also raised concerns over the ambitions feasibility. NHS England should revisit the ambition and should provide a more detailed description of what a paperless NHS means in practical terms. To ensure that the ambition is considered feasible, NHS England should devise the definition alongside NHS staff, CIOs and industry experts before ensuring that the ambition is communicated to all NHS trusts and staff.

In light of the current uncertainty surrounding what funding is available to support NHS England's latest policy '*Personalised health and care 2020*' there is a need for clarity as to what funding will be made available to NHS trusts. Additionally, in light of the previous financial wastage and lack of rigorous monitoring it would seem important that any further investment is monitored and that available funds are justified based on assessment of need. Placing vast amounts of investment into achieving interoperability is not currently advisable given the uncertainty as to how to achieve this and the dependency of this ambition on all NHS trusts having implemented EPRs. Instead, future investment should prioritise areas where marked improvements can be shown and where there is a clear need for this investment (e.g. investing in universal Wi-Fi access or other areas of infrastructure), to ensure that all trusts have the capacity to implement EPRs.

Recommendations for future research

Given the heterogeneity of EPR implementation (different NHS trusts, approaches, systems) Randomised Controlled Trials (RCTs) are different in this area. Future research will therefore need to adopt a range of observational and qualitative methods to build on existing UK evidence. Due to the stage of implementation of the majority of NHS trusts, this thesis has inevitably focussed on initial implementation. Future research should therefore seek to identify the benefits of introducing EPRs into the NHS, through longitudinal and/or before and after studies to identify the benefits of these systems throughout implementation and over the longer term. Additionally, research should seek to identify at what stage the quantifiable benefits (patient safety, efficiency) are likely to emerge as this is currently unknown. This thesis also identified that what is considered a benefit or advantage of introducing these systems differs for

different stakeholders. A consistent definition of a benefit is therefore also required which not only focusses on the monetary or 'quantifiable benefits' but which also includes a consideration of more clinically orientated advantages. While it is acknowledged that in the current climate of austerity, there is an obvious need to justify the large financial investment into NHS IT. This thesis shows that the benefits of these systems may be wider than pure monetary gain and so the more clinically orientated benefits (e.g. having all clinical information available and accessible) that are important to clinicians should also be considered and included within any new definitions of benefits.

The absence of any consideration of potential negative impacts of introducing these systems, particularly during initial implementation, could lead to unrealistic expectations and patient safety being jeopardised. Therefore, if benefits are being explored it is also important to evaluate the potential risks associated with introducing EPRs. In light of chapter 7 and a body of predominately US evidence showing that these systems may bring new and added risks to patient safety it is important that the actual level and scale of these risks are quantified. To achieve this risks need to be quantified using robust case note review or through linking qualitative findings around risk with standardised hospital reporting procedures such as incident reports. Additionally to ensure that these risks are not only a product of a single EPR system, research should aim to study a number of different electronic systems to identify common risk factors.

If NHS trusts are to implement EPRs, policymakers and researchers need to work together to produce guidance which includes practical advice and previous experiences of NHS trusts in terms of the different approaches to implementation. More specifically, research that quantifies the costs and benefits of the different approaches (best of breed, megasuite) is needed along with evaluations of the impact of these approaches on the quality and safety of care provided. Additionally, it is essential that this research is disseminated to NHS trusts, something which could be facilitated by academic health science networks. In the interim, policymakers should work with NHS trusts either nationally or regionally to foster a learning environment and ensure that lessons are being learned and that trusts at various stages of implementation are sharing their experiences.

Recommendations for NHS trusts

This thesis highlights a number of technical and social factors that affect the implementation of EPRs into NHS trusts. Recommendations for overcoming technical barriers are provided in chapter 7. However, whilst technical issues could be argued to be a product of a single system's design and implementation, the social factors are influenced by and apply irrespective of the quality of a system's implementation. It is therefore important that when implementing IT systems, NHS trusts consider both social and technical influences. For instance, making training available and mandatory for all staff would seem important, as well as involving clinicians in all stages of implementation from design to implementation. Additionally, to ensure effective change management trusts should ensure that staff's expectations are managed. To achieve this, trusts should be transparent about the reasons for introducing the system, when (clinical) benefits are expected to emerge and what barriers and disadvantages staff may experience particularly during initial implementation. Lastly, chapter 7 identified that NHS staff were uncertain as to who is responsible, should a patient safety incident occur as a result of an electronic system. NHS trust's therefore need to make staff aware of the potential legal risks associated with these systems, potentially during initial implementation and should ensure that their position on this is communicated and understood by all staff.

8.4. Impact:

In addition to impacting on research through the publication and submission of the findings of this thesis to academic journals (appendix 18), this thesis has gained national attention from policymakers. As evidence of this I have been invited to talk at a number of events hosted by the Health and Social Care Information Centre (HSCIC) (appendix 17) and am currently in talks about the thesis' findings with policy staff within the HSCIC and NHS England who are looking to use findings from the thesis to inform a white paper. The findings within chapters 4-7 have been used to inform the development of the NHS trust featured in chapters 6 and 7's EPR strategy. To facilitate this throughout the PhD I have worked closely with the trust's EPR team and CIO, assisting with the development of the business case for the trust's EPR system which is to be implemented in 2016.

The importance of disseminating the findings of this thesis through means other than academic publications was considered of particular importance as the thesis aimed to not only inform the aforementioned NHS trust of its findings to assist with their EPR

strategy, but because those responsible for implementing these systems (e.g. CIOs) may not be aware of, have access to or be readers of academic publications.

8.5. Conclusions:

This thesis has drawn upon socio-technical thinking to explore the implementation of EPRs into NHS secondary care organisations from the macro, meso and micro perspective. The thesis highlights the complexity of implementing EPRs, illustrated by the number of social and technical factors affecting implementation. Additionally, the thesis suggests that little progress in implementing EPRs into secondary care organisations has been made by national NHS IT policy since 1998, attributed in part to competing terms and limited guidance for trusts as to how to implement these systems. Despite significant investment into NHS IT and claims that EPRs will ‘transform the NHS’, this thesis has provided little evidence to support this and instead identified that initial implementation may be associated with increased risks. Longitudinal research is now needed to determine the actual benefits and risks associated with implementing EPRs. Priorities for policy include; defining terms and ambitions, fostering organisational learning and clarifying future funding. The findings from this thesis inform both research and policy and aim to contribute to future EPR implementations.

Appendices

Appendix 1 Summary table of benefits literature

Author (year)	Country	Cited	Study design and methods	Key benefits identified
Chao et al (2013)	China	2	Qualitative interviews	Electronic records perceived to improve communication, encourage information sharing and promote work efficiencies among departments. System gave timely access to results which could speed up decision making and diagnosis. Medication repetition and drug allergies were avoided as patient history is accessible. Availability of information perceived to help with diagnosis.
De Veer & Francke (2010)	Netherlands	19	Survey	Participants generally expected the electronic record to negatively impact care. Staff who work more than 30 hours a week or were managers held more positive attitudes. Staff associated EPR with qualitatively better and safer care but increased costs.
Eden et al (2008)	US	7	Pre-and post-intervention of EHR implementation (EHR and patient records reviewed)	Information on Electronic system viewed as more complete, with a greater likelihood of having information missing on the paper records than electronic system. Activities relating to direct patient care increased after the system had been implemented.
Evans & Stemple (2008)	US	0	Narrative	Electronic record has the potential to improve patient outcomes, increase efficiency, communication, billing and re-imburement,
Furukawa (2011)	US	7	National survey	Fully functional electronic was associated with lower length of stay and diagnosis/treatment time. The Emergency Departments basic electronic record was not more efficient and had a nonlinear relationship with efficiency which varied according to the number of functions used.
Holden (2011)	US	22	Qualitative interviews	Actual benefits included: Improved searching, charting, accessing information anytime, anywhere. Increased information legibility and improved time related efficiencies (not searching for paper charts, reduced time waiting for test results). Allows patients to be monitored and remote

				accessibility of information gives the electronic system an advantage over paper records.
Kossman (2006)	South Korea	17	Qualitative interviews and observations	Nurses preferred electronic record to paper and felt comfortable using it. Electronic record improved information access, organisational efficiency. Alert screens increased safety but not the quality of care.
Lee et al (2013)	US	4	Compared outcomes 2 years before and after electronic record adoption	Hospitals that adopted the EMR had shorter length of stay and lower mortality. However re-hospitalisation increased and the association between electronic record and outcomes varied by admission type.
Likourezos et al (2004)	US	56	Survey	Easy to enter and access information. Nurses found the system more helpful than Doctors as the former believed they were able to save time. Improved ability to monitor patient progress. Believe will improve care in the future.
Lium, Tjora & Faxvaug (2008)	Norway	21	Qualitative interviews	More benefits when everyone used the system. The system supports Junior members of staff. Only perceived EPR better than combined use of paper and EPR, as opposed to better than paper notes.
Meeks et al (2014)	UK	4	Prospective longitudinal and real time case study based evaluation, qualitative interviews	Identified the ability of electronic record to allow safety concerns to be more easily as an advantage.
Moody et al (2004)	US	84	Cross-sectional questionnaire	Positive view of electronic records impact on patient care, improved documentation, less threat to privacy than paper.
Ovretveit et al (2007a)	US, Sweden	55	Qualitative case study: interviews documents.	Improved the completeness of information, time savings, integration in hospital, easy to use. Future benefits to patient safety from having clearer medication information.
Ovretveit et al (2007b)	USA, Sweden	24	Two case studies, qualitative interviews	Time savings, easy access to information, improved monitoring of patients, allowed for new and better ways of working to be discovered and provides more complete and better information. Believe the system will improve patient safety through clearer medication information.

Pollak & Lorch (2007)	US	16	Retrospective analysis of effect of EPR on mortality	Mortality decreased significantly after EPR introduced
Robertson et al (2010)	UK	53	Mixed methods longitudinal multisite sociotechnical case study: interviews, observations, documents, quant data	Made processes quicker and gives more reliable live information.
Sheikh et al (2011)	UK	42	Qualitative case studies; interviews observations, documents	Improved legibility, availability of data and data management tools and sharing of information with GPs. Electronic system gave opportunity for organisational learning and reflection and improved the availability retrieval and access of information by multiple users whenever and wherever required.
Silow-carroll Edwards, Rodin (2012)	US	15	Qualitative interviews	Numerous examples of how the system improved the quality and safety of care were provided. The system improved communication among providers, gave more co-ordinated care, promoted patient involvement, evidence based care, saved time, led to efficiency savings and gave a return of investment that exceeded expectations.
Takian, Sheikh & Barber (2012)	UK	9	Longitudinal real-time case study evaluation: interviews, observations, documents	Improved ability to check progress and monitor staff activities and the safety and quality of care through increased legibility and shared records across the hospital respectively.
Thakkar et al (2006)	US	7	National survey	Benefits ranked in order included: interoperability with other departments, quality of care, clinical workflow, efficiency and time management, patient safety, patient privacy and confidentiality, business process, patient-doctor relationship, cost of care.
Waterson,	UK	7	Qualitative	Broadly positive about EPR and its potential to deliver efficiencies (decrease workload and reliance

Glenn & Eason (2011)			interviews	on paper), however participants did not believe a rapid change to paperless is possible.
Williams & Boren (2008)	US	12	Qualitative survey	Electronic record perceived to facilitate effective and efficient data collection, data entry, information retrieval and benefit research.

Appendix 2 Summary table of barriers literature

Author (year)	Country	Cited	Study design and methods	Key barriers identified
Chao et al (2013)	China	2	Qualitative interviews	Barriers for health institutes include patient privacy concerns, whilst challenges for clinicians include using multiple systems, unfamiliarity with the system and the added time to type and enter information electronically.
De Veer & Francke (2010)	Netherlands	19	Survey	1/5 nurses didn't want EPR introduced. 45% found it desirable. Staff that believe EPR will improve quality, cost, number of patients that can be cared for showed positive attitudes towards the system. Staff with more positive attitudes had previous experience of EPRs, were in management, had higher levels of education, worked 30+ hours a week and worked in acute settings.
Evans & Stemple (2008)	US	0	Narrative	Costs of implementation can be a problem for small to medium organisations. Concerns relating to initial return of investment, liability and security. Other potential barriers include; integrating technology into clinical workflow, training and change management.
Furukawa Raghu & Shao (2010)	US	34	Descriptive cross-sectional survey	Barriers to using the system; not enough space to use system in patient's room, having to do paper and electronic documentation, too many interruptions, change of shifts disruptive to documentation, electronic system slow, downtimes, not enough computers, technical issues with laptops, unable to log on, frustration with multiple systems, software and system problems (61%)
Holden (2011)	US	22	Qualitative interviews	System brings new demands and remote log in adds steps into work processes, system is hard to use and navigate, using multiple systems, less personal and poorly presented information, computers are slow, using and learning how to use the system is time consuming.
Kossman (2006)	South Korea	17	Qualitative interviews and observations	System down time, computer is slow, lack of working computers, tick boxes limit accuracy and detail in records.

Lium, Tjora & Faxvaug (2008)	Norway	21	Qualitative interviews	System does not meet all needs; lack of mobile devices; laptops cumbersome and impractical; technical issues (system downtime); paper workarounds (staff printed patient summaries); free text and lack of structure made finding key information difficult. The more senior the participant the less support and perceived usefulness of the electronic records. Senior clinicians avoided using the system when they did not have to.
Likourezos et al (2004)	US	56	Survey	System is confusing to use and hard to navigate around, computer literacy, system downtime, logging in and out of the system (increased time on computer), security and confidentiality concerns.
Overtveit et al (2007a)	US, Norway	55	Qualitative case study, interviews documents	Speed of implementation prevented staff developing and adjusting their work practices and gave them little time to prepare. Hard to get staff to training and help adapt system due to time constraints, previous implementation, cost, recent hospital merger.
Ovretveit et al (2007b)	US, Sweden	24	Qualitative interviews	Speed of implementation prevented staff developing and adjusting their work practices, little time to prepare. Hard to get staff to training and help adapt system due to time constraints, previous implementation, cost, recent hospital merger. Additional barriers included: extra time entering data, processing lab reports, navigation, staff resistance, poorly designed, cumbersome, not developed for clinical needs, earlier (unsuccessful) implementation, hospital merger, difficulties involving staff due to time constraints, cost, poor educational information for staff, lack of feedback opportunities for staff.
Moody et al (2004)	US	84	Cross sectional survey	44% said system was optimally functional, 61% frustrated with using multiple systems. Additional barriers included: software and system problems (downtimes, slow, insufficient memory) not enough computers, unable to log on, some physicians refuse to use computers and put workload onto nurses, parallel use of paper and the system, patient rooms too crowded, too many distractions to document at the bedside, interruptions when documenting. Younger and more experienced computer users held more favorable attitudes towards electronic records.
Robertson et al (2010)	UK	53	Mixed methods longitudinal multisite case study qualitative interviews,	Factors affecting implementation included: want electronic record but type and scale of data sharing unclear, uncertainty around the future of NPfIT, contract issues, change management, infrastructure, planning, leadership, trust resources, teamwork, communication, sharing of lessons, perceived risks and benefits, realistic expectations,

			observations, documents and quantitative data	vision for care records, needs of stakeholders, interactions between stakeholders, attitudes/expectations/motivation, integration of system with work practices, ownership and resistance, workarounds, end user input to design, user engagement, patient views, IT literacy in NHS, training and support for users, realistic timelines, features and functionality of the system, customisability of the system, integration with existing system, stability, benefits, performance and usability of hardware and software, security and confidentiality, smartcard log in, role-based access.
Sheikh et al (2011)	US	42	Qualitative case study; interviews observations, documents	Barriers included: different interpretations of the NHS' vision for care records service meant lack of common goal, different approaches to implementation and different levels of maturity added to uncertainty and delays in process. Initial issues experienced by early adopters included: difficulty of putting software into practice; usability, connectivity, training, data quality, system downtime. Additional barriers included: complex supply chains and communication between hospitals, suppliers and DoH; contract tensions hindered engagement with staff and local ownership; hospitals lacked budget control; little information about contracts and lacked ability to configure software or engage directly with suppliers. Contracts focused on delivery of product not quality; staff dis-engagement; dysfunctional communication between clinicians and developer; top down approach of NPfIT restricted pragmatic problem solving of issues with systems; media negatively portrayed NPfIT added to disengagement and skepticism. Standardisation vs. localisation during NPfIT more localised and customised software became, further it was from original vision; software lacked understanding of clinical process; inflexible software had to push hard for every single change; software initially more useful for administrative staff; senior clinicians less affected on a daily basis than juniors by the system, managed to adapt working practices over time and developed workarounds to combat usability issues (tricked system to overcome its constraints but may lead to data quality issues with time); redistribution of work, clinicians felt were doing more data entry than clerks, which they felt undermined their professionalism; data entry longer on computer than paper; did not become paperless but paper light

				staff documented on paper by bedside and retrospectively documented on computer; slow progress on NPfIT; change in political and economic climate; uncertainty of NPfIT future and change in leadership made it hard for hospitals to develop a long term plan. NB: some barriers were specific to the National Programme for IT in the NHS (NPfIT).
Silow-Carroll Edwards & Rodin (2012)	US	15	Qualitative interviews	Hospital 1: speed of implementation prevented developing new procedures (didn't get time to adjust routines), difficulties training staff and involving staff in adapting and designing the system. Previous experience of poor IT implementation increased reluctance to change, recent merge of hospital made new change difficult, hard to involve Drs due to lack of time, finance disagreements, education and information for staff poor. Hospital 2: lower productivity, poor design, cumbersome, not designed for all clinical needs, resistance to change from staff, lack of clinical involvement in system selection and implementation, system required extra time and development for clinical work and lack of feedback opportunities for staff.
Takian, Sheikh & Barber (2012)	UK	9	Longitudinal real-time case study evaluation, interviews, observations, documents	Lack of integration between hospital system and local authority database seen as a major barrier to integrated mental health and social care. Additional barriers included: parallel use of paper and system negatively affected users attitudes towards the system; less interaction with colleagues as more time is spent on the computer; poor training; difficulties using the system; system not designed around clinical need; too simplistic/lacked some functionalities; change; not suitable or adapted for mental health setting; technical issues (e.g. automatically logs staff out after 30 minutes); using multiple systems is time consuming; variation in how staff use the system.
Thakkar et al (2006)	US	7	National survey	Main barriers identified were around data security, access and concerns about the accuracy of information. Other barriers included: software and hardware costs, physician participation, interoperability, inability to find software that meets requirements of a true electronic record, organisational culture, nurse participation, standards, return of investment, personnel cost.
Waterson, Glenn & Eason (2011)	UK	7	Qualitative interviews	Participants were skeptical that the hospital would receive the system as trust had been reduced after NPfIT. Perceived barriers included change in work practice and roles and difficulty of digitising current paper records.

Williams & Boren (2008)	US	12	Exploratory descriptive qualitative survey	EPR not implemented because of: lack of money and resources (e.g. personnel, infrastructure) , lack of leadership and prioritisation of EPR, reluctance to change, lack of awareness of importance of EPRs, poor electricity, costs of training and systems and lack of technical knowledge.
Yu et al (2013)	Australia	4	Qualitative interviews	Barriers identified included: staff resistance, increased complexity of information management, concerns regarding access to records, increased documentation, decreased communication, lack of space for computers, increased difficulty in delivering care services. These barriers were attributed to the nature of the system and the way it was implemented and being used.

Appendix 3 Summary table of disadvantages literature

Author (year)	Country	Cited	Study design and methods	Key disadvantages identified
Chao et al (2013)	China	2	Qualitative interviews	Slow to type and numerous systems and unfamiliarity with the system affects efficiency. High cost, risks of data loss with software errors, hard to retrieve information
Furukawa, Raghu & Shao (2010)	US	34	Data of EPR implementation from HiMSS analytics database. Data on cost from annual financial disclosure reports.	EPR implementation associated with significantly higher cost inefficiency scores in hospital medical-surgical units.
Holden (2011)	US	22	Qualitative interviews	Information can be difficult to find, with accessibility of information reliant on knowing where to find it. Ordering medications can increase time as the process is complex. Additional disadvantages included: can direct away from patient care as spend lots of time typing, reduced communication.
Kennebeck et al (2012)	US	7	Reviewed electronic data of patients to Emergency Department, before during and after implementation.	Despite additional staffing and availability of an overflow clinic, Emergency Department metrics were negatively affected during electronic record implementation. Length of stay increased during implementation. Increases in time to doctor returned to pre-implementation baselines within three months of implementation.
Kossman (2006)	South Korea	17	Qualitative interviews and observations	System down time-frustrating and negative impact on time and cannot access records in time. Less time spent with the patient as have less time and even when have a computer at the bedside feel distanced. Sense decreased effectiveness in job performance and patient care. Increased time spent retrieving documentation interferes with inter-disciplinary communications.
Lee et al (2013)	US	4	Compare outcomes 2 years before and after EPR adoption	Although EPR was associated with reduced mortality and LOS (appendix 1) the system was associated with increased rehospitalisation rates, which the authors suggest could be due to decreased length of stay.

Magrabi et al (2015)	UK		Retrospective analysis of safety events managed by IT safety team	68% of events described hazardous circumstances of which 24% had observable impact on care delivery. 14% were near misses and 3% associated with patient harm. 92% of these issues associated with technical rather than human factors.
Mathison & Chamberlain (2011)	US	4	Retrospective analysis of paper (pre implementation) and electronic (post implementation) data sets.	Clinician hours increased because of number of patients but was also associated with EHR implementation. Following implementation Length of stay remained unchanged. Triage to provider time increased but after controlled for variables such as patient census and practitioner hours electronic record didn't affect outcomes. Patient flow was worsened with electronic record during days with high volumes of patients.
Meeks et al (2014)	UK	4	Prospective longitudinal and real time case study based evaluation qualitative Interviews	3 phases of safety concerns: Concerns to safety as a result of electronic record related to those specific to technology, unsafe use of technology.
Menon, Singh, Meyer & Sittig (2015)	US	0	Survey	More than half of the participants reported at least 1 serious electronic record related safety event in the last five years; 10% of which had experienced 20 events. The most common events were: data display/incomplete orders, failure to follow up on abnormal test results, wrong patient identification, errors due to unavailable patient information during downtime. Variables affecting type and frequency of events included: training, user familiarity, electronic record workflow processes degree of integration with new electronic record. More than half of the sample said they had moderate to serious concerns about the potential for future incidents.
Morrison et al (2008)	England	15	Qualitative interviews and observations	Physical set-up of EPR gave unequal access to patients data and consultants reaction to the data which could lead to decreased interaction and openness for discussion and understanding of patient goals. Team made adjustments once were aware EPR caused lack of interaction, changed formation around the bedside.
Nowinski et al (2007)	US	5	Survey and ongoing corporate data collection methods (e.g. patient satisfaction survey)	Initial results evaluating changes in organisational culture and quality during conversion from paper to electronic record. Organisational became more hierarchical and significant associations showed negative impacts of electronic record on quality of care (e.g. length of discharge, patient satisfaction).

Tall, Hurd & Gifford (2015)	US	0	Retrospective data review assessing monthly census reports of all patients registered and treated during transition from paper.	Emergency Department length of stay not affected by implementation of an electronic record.
Yu et al (2013)	Australia	4	Qualitative interviews	Increased documentation time.

Appendix 4 Glossary of terms for chapter 3

Choose and Book: a national electronic referral service that allows patients to choose the location, date and time for their first outpatient appointment in a hospital or clinic (The national archives, 2012).

Electronic Prescription Service: allows prescribers (e.g. GPs, practice nurses) to send prescriptions electronically to a pharmacy of the patient's choice (HSCIC, 2015b)

Local Implementation Strategy: collaboratively developed by Health Authorities, NHS trusts and GPs and outline priority areas, investment and objectives for electronic records (NHS Executive, 1998).

NHS number: A unique number allocated to and used to identify patients (NHS Executive, 1998).

NHSnet: a network designed to enable quick and secure electronic communications between NHS staff (NHS Executive, 1998).

Pathology messaging: facilitates electronic communications between laboratories and GPs (HSCIC, 2015c).

Personal Demographics Service: is the national electronic database of NHS patient demographic details e.g. name, address, date of birth and NHS number (HSCIC, 2015d).

Picture Archiving and Communications Service (PACS): aid diagnoses by enabling x-ray and scan images to be stored electronically and viewed on screens (HSCIC, 2015e).

Smartcards: are used by health professionals for secure access to confidential information (HSCIC, 2015f).

Systemised Nomenclature of Human and Veterinary Medicine (SNOMED): SNOMED was created for indexing the entire health record, including signs and symptoms, diagnoses and procedures (NHS Executive, 1998).

Spine: Is a collection of national applications systems and directories that support the NHS in exchanging information across national and local systems (HSCIC, 2015g).

Appendix 5 The Clinical Digital Maturity Index (CDMI) (Ehl, 2014)

9	Advanced e-prescribing	Inpatient e-prescribing ward None	Oncology e-prescribing None	CDSS in use on e-prescribing None	
8	Simple e-prescribing	Outpatient (TTO) e-prescribing None			
7	Enterprise scheduling	Scheduling Lorenzo	Clinical workflow engine/integrated pathways Lorenzo	Blood tracking None	
6	Clinical noting and document management	Document management ECM	Clinical noting Lorenzo	Observations vital signs Lorenzo	
5	Order comms and diagnostic reporting	Order comms None	Diagnostic reporting None	Bed management Lorenzo	
4	Specialist departments	Cardiology None	Oncology Somerset Cancer Register	Critical care Lorenzo	
3	Departmentals	A+E None	Theatres ORMIS	Maternity Guardian/Athena	
2	Core ancillary	Pharmacy None	Pathology i.Lab	RIS CRIS	PACS Centricity
1	Foundation	PAS Lorenzo	Discharge letters None	Community PAS N/A	Simple BI None

Appendix 6 Participant information sheet for online survey

Assessing the implementation of EPR systems across NHS Trusts in England

Invitation

We are conducting research to investigate the implementation of Electronic Patient Record (EPR) systems across NHS acute, community care and mental health trusts throughout England. We are inviting you to take part in a research survey. Before you decide if you would like to take part you will need to understand why the research is being done and what it will involve. I would be grateful if you could read the following information. Feel free to discuss this with others if you would like to. Please ask the researchers Arabella Clarke (07791795982) and Ian Watt (01904 32(1341) if there is anything that is unclear or if you would like more information. Take time to decide whether or not you would like to take part.

The purpose of the study

In light of Jeremy Hunts recent call for a paperless NHS and the publication of the Safer Hospitals Safer Wards Technology Fund NHS Trusts are coming under increased pressure to 'modernise' their organisations. There is little rigorous research or guidance for introducing EPR systems. The information you give us will help to inform Trusts throughout England of the progress being made towards the paperless ambition. Information will also be provided as to the different strategies and technologies being used to create this modernisation.

Why have I been chosen?

We would like to hear from CIOs (or those with equivalent titles) to investigate the implementation of EPR across NHS acute, mental health and community care trusts.

Do I have to take part?

Your participation in this study is entirely voluntary. If you decide to take part then please complete the online survey. If you do not wish to complete the survey there will be no consequences and you are not required to provide a reason. Although, if you do not want to participate it would be helpful to let the chief investigator know (via email) and you will not receive reminders relating to the survey.

What is involved?

If you decide to take part then please complete the online survey accessible via the link provided in the email within which you received this information sheet. The survey will take approximately

10minutes to complete. The survey asks a variety of questions around the implementation of IT at your Trust including whether you are implementing any EPR, your implementation strategy and the stage of implementation you have reached. Please note that if you are not implementing any IT systems then the time to complete the survey will be significantly reduced. The survey will be completed online via survey monkey (Available at: www.surveymonkey.com). All information provided is confidential; you do not have to answer any questions you do not wish to answer.

How will I benefit from the study?

The study cannot directly benefit you. However, the research information we get and the approaches we take may help to inform other trusts, research groups and policymakers looking at the implementation of IT in the NHS.

What will happen to the information I give?

Survey data will be analysed and the information erased at the end of the study. All data will be anonymised and no identifying information of you or your trust will be included in the analysis. Your contact details will be stored separately from all data. We may use data in the chief investigators PhD thesis or in articles for academic and professional journals. Information will be stored securely at the Bradford Institute for Health Research and destroyed upon completion of the chief investigators PhD.

Who is reviewing this research?

This research has been reviewed and given favorable opinion by the University of York Health Sciences Research Governance Committee.

Who is organising and funding this research?

The research is funded by the NIHR as part of a PhD studentship at the University of York. It is organised by a collaboration of researchers at the University of York and Bradford Institute for Health Research.

What if there is a problem?

The study researchers will be available to resolve any minor problems (contact details below). If you are unhappy with the way you have been dealt with during the study and wish to complain formally you can do this via the chief investigators supervisor: Professor Ian Watt, Department of Health Sciences, University of York, Area 2 Seebohm Rowntree Building, York YO10 5DD. ian.watt@york.ac.uk

Contact Details

If you require further information or would like to discuss any aspect of this study please contact the project researchers during office hours (or leave a message at other times).

Arabella Clarke tel 07791795982 alc545@york.ac.uk

Ian Watt tel 01904 32(1341) ian.watt@york.ac.uk

Thank you for taking the time to read this information sheet.

Appendix 7 Survey used with CIOs

1. Which of the following options best describes your trust? (Please tick all that apply)

- Foundation trusts
- Acute trusts
- Mental health trusts
- Community Care trusts
- Yorkshire and the Humber
- London
- West Midlands
- South West
- South East
- South Central
- North West
- North East
- East England
- East Midlands

2. Do you currently have any form of Electronic Patient Record?

Yes

No

3. What systems do you currently use to provide the EPR?

4. Will this system allow you to go paperless by 2018?

Yes

No

If No what is your plan for achieving this goal?

5. What functions does your EPR currently include?

Clinical Decision Support

Results

Ordering Drugs

Words

Numeric

Other (please specify)

6. When will your trusts EPR be authorised as a definitive record, so the paper record will no longer be required or used?

7. What is or will be your solution strategy for your EPR system?

- Best of Breed
- Write it yourself
- Someone else to write it
- Megasuite system
- Clinical EPR, separate interfaced PAS

Other (please specify)

8. Do you see your EPR as being:

- Only for your organisation with an interface required to outside systems
- Part of a multi organisation shared system

Other (please specify)

9. What is your hardware strategy for enabling EPR and how useful have you found it? Please rate 1-5 where 1 = Useless, 5= Very Useful

Not Used 1 2 3 4 5

	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COW	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*What is your hardware	COW 1	COW 2	COW 3	COW 4	COW 5

Not Used 1 2 3 4 5

strategy for enabling EPR and how useful have you found it? Please rate 1-5 where 1 = Useless, 5= Very Useful
COW Not Used

Handheld PCs Handheld PCs Not Used Handheld PCs 1 Handheld PCs 2 Handheld PCs 3 Handheld PCs 4 Handheld PCs 5

Fixed desktops Fixed desktops Not Used Fixed desktops 1 Fixed desktops 2 Fixed desktops 3 Fixed desktops 4 Fixed desktops 5

iOS devices iOS devices Not Used iOS devices 1 iOS devices 2 iOS devices 3 iOS devices 4 iOS devices 5

Android devices Android devices Not Used Android devices 1 Android devices 2 Android devices 3 Android devices 4 Android devices 5

PDAs PDAs Not Used PDAs 1 PDAs 2 PDAs 3 PDAs 4 PDAs 5

Tablets Tablets Tablets 1 Tablets 2 Tablets 3 Tablets 4 Tablets 5

Not Used 1 2 3 4 5

Not Used

Smartpho Smartph Smartph Smartph Smartph Smartph Smartph
nes ones Not ones 1 ones 2 ones 3 ones 4 ones 5
Used

Comment field

10. Would you be happy to take part in a follow up telephone interview?

Yes

No

If Yes please provide an email address
below

Appendix 8 Participant information sheet for interviews with CIOs

Invitation

We are conducting research to investigate the implementation of Electronic Patient Record (EPR) systems across NHS acute, community care and mental health trusts throughout England. We are inviting you to take part in a research telephone interview. Before you decide if you would like to take part you will need to understand why the research is being done and what it will involve. I would be grateful if you could read the following information. Feel free to discuss this with others if you would like to. Please ask the researchers Arabella Clarke (07791795982) and Ian Watt (01904 32(1341) if there is anything that is unclear or if you would like more information. Take time to decide whether or not you would like to take part.

The purpose of the study

In light of Jeremy Hunts recent call for a paperless NHS and the publication of the Safer Hospitals Safer Wards Technology Fund NHS Trusts are coming under increased pressure to 'modernise' their organisations. There is little rigorous research or guidance for introducing EPR systems. The information you give us will help to inform Trusts throughout England of the progress being made towards the paperless ambition. Information will also be provided as to the different strategies and technologies being used to create this modernisation.

Why have I been chosen?

We would like to hear from CIOs (or those with equivalent titles) to investigate the implementation of Electronic patient records (EPR) across NHS acute, mental health and community care trusts.

Do I have to take part?

Your participation in this study is entirely voluntary. If you decide to take part you will be asked to sign a consent form. You will still be free to withdraw at any time and you do not have to give a reason.

What is involved?

We will invite you to take part in an individual telephone interview with a researcher from the University of York. This will last approximately 20-30 minutes. It can take part at a time that is convenient to you. We would like to audio-record the conversation, but we will be careful to

make sure that only members of the research team can hear what you say. (The study findings are based on the views of all the people who take part, but we will not name people individually).

During the interviews we will be interested to hear about the challenges and benefits of implementing an EPR, your trusts vision and what you feel a paperless NHS means and some more detail about your EPR system. The information collected from the interview will be used to gain an understanding of the potential benefits and challenges of implementing an EPR system into an English NHS trust.

How will I benefit from the study?

The study cannot directly benefit you. However, the research information we get and the approaches we take may help to inform other trusts, research groups and policymakers looking at the implementation of IT in the NHS.

What will happen to the information I give?

The study will collect information from you during a single telephone interview. The information from interviews will be audio-recorded. All interview data will be transcribed and stored as written accounts on a password protected computer. These will be identified by a pseudonym name unique to each participant. Your contact details will be stored in a separate location to avoid you being identified from the research information. All research information will only be accessible to the chief investigator and her supervisors to check the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and nothing that could reveal your identity will be disclosed outside the research site. When the study is finished the information will be securely stored for up to 5 years to allow the chief investigator to complete their PhD. We may use data in the chief investigators PhD thesis or in articles for academic and professional journals.

Who is reviewing this research?

This research has been reviewed and given favourable opinion by the University of York Health Sciences Research Governance Committee.

Who is organising and funding this research?

The research is funded by the NIHR as part of a PhD studentship at the University of York. It is organised by a collaboration of researchers at the University of York and Bradford Institute for Health Research.

What if there is a problem?

The study researchers will be available to resolve any minor problems (contact details below). If you are unhappy with the way you have been dealt with during the study and wish to complain formally you can do this via the chief investigators supervisor: Professor Ian Watt, Department of Health Sciences, University of York, Area 2 Seebohm Rowntree Building, York Y010 5DD. ian.watt@york.ac.uk

Contact Details

If you require further information or would like to discuss any aspect of this study please contact the project researchers during office hours (or leave a message at other times).

Arabella Clarke tel 07791795982 alc545@york.ac.uk

Ian Watt tel 01904 32(1341) ian.watt@york.ac.uk

Thank you for taking the time to read this information sheet.

Appendix 9 Consent form for interviews with CIOs

Please Initial
Box

1. I confirm that I have read and understood the information sheet dated... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.
3. I agree to the use of audio-recording during the interviews and understand That where direct quotations are used in the final report or publications it will not be possible to recognise me.
4. I agree that data collected for this study may be audited by individuals from the University of York and the NHS trust where relevant.
5. I agree to take part in the above study.

Name of Participant	Date	Signature

Name of Researcher	Date	Signature

When completed, 1 for participant, 1 (original) for researcher file.

Appendix 10 Topic guide for interviews with CIOs

At the beginning of all interviews:

1. Introduce self
2. Introduce study
3. About audio recording/anonymity/confidentiality
4. Explain how data will be used

The interviews are semi-structured to ensure that the interview covers issues important to the participants. This outline is to be used as a general guide:

Interview:

1. Please could you tell me about your involvement in setting up your trusts EPR system

- 2 What does a paperless hospital mean to you?

3. What is your Trusts vision and how is defined?

4. Please could you outline your trusts processes for setting up the EPR system e.g. the drivers for the project, the team involved, whether there was any clinician involvement?

5. According to the survey your solution and hardware strategies were X and Y please could you tell me about more about why you decided upon these methods?

6. What explicit benefits and outcomes are you expecting to achieve as a result of your hospitals vision, (including non-cash related benefits)?

7. Have you realised any of the benefits you predicted in your business case?

8. Are there any benefits you are yet to realise and if so how are you hoping to achieve this?

9. What challenges have you faced so far throughout the design and implementation of your IT strategy?

End the interview:

1. Thank participant
2. Explain again about how data will be used and reiterate about anonymity and confidentiality
3. Provide opportunity for questions and states that the chief investigator is contactable after the interview should questions arise.

Appendix 11 Data dictionary for survey data

Variable	Description
ID	Respondent Number
Type of Trust	1: Foundation Trust 2: Non-Foundation Acute Trusts 3: Mental Health Trust/Community Care Trust 4: Combined
Location of Trust	1:North England 2 East England and the Midlands 3 London and South England
Have an EPR	1: yes 0: No
paperless by 2018	1: yes 0: No
Function EPR	
Clinical Decision Support	Yes 1 No 0
Results	Yes 1 No 0
Ordering Drugs	Yes 1 No 0
Words	Yes 1 No 0
Numeric Function	Yes 1 No 0
Solution Strategy	1: Best of Breed 2: write it yourself 3: Someone else to write it 4: Megasuite System 5: clinical EPR and separate interfaced Pas 6: Other 7: In development 8: Combined
Do you see your EPR as	1: Only for your organisation 2: Part of a multi organisation 3: both
Hardware strategy	
COW	Yes 1 No 0
Handheld PCs	Yes 1 No 0
Fixed Desktops	Yes 1 No 0

IOS Devices	Yes 1 No 0
Android	Yes 1 No 0
PDA	Yes 1 No 0
Tablets	Yes 1 No 0
Smartphones	Yes 1 No 0
Usefulness of Hardware Strategy	
COW	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
Handheld PCs	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
Fixed Desktops	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
IOS Devices	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
Android	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
PDA	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
Tablets	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable
Smartphones	1: Useless 2: below average 3: Average 4: Useful 5: very useful 6: not applicable

Appendix 12 Trusts responses to the devices used and their perceived or experience usefulness

Device (n,%)			Usefulness of Device (n, %)					
			Useless	Below Average	Average	Useful	Very Useful	No Rating Provided
COW	Yes	39 (66)	4 (6.8)	7 (11.9)	9(15.3)	10 (16.9)	9 (15.3)	20 (33.9)
	No	13 (22)						
	Not applicable	2 (3.4)						
	Missing Data	5 (8.5)						
Handheld PCs	Yes	47 (79.7)	3 (5.1)	8 (13.6)	15 (25.4)	13 (22)	8 (13.6)	12 (20.3)
	No	7 (11.9)						
	Not applicable	2 (3.4)						
	Missing Data	3 (5.1)						
Fixed Desktops	Yes	55 (93.2)	1 (1.7)	2 (3.4)	16 (27.1)	21 (35.6)	3 (5.1)	3 (5.1)
	No	1 (1.7)						
	Not applicable	2 (3.4)						

	Missing Data	1 (1.7)						
IOS	Yes	34 (57.6)	5 (8.5)	2 (3.4)	9 (15.3)	9 (15.3)	10 (16.9)	24 (40.7)
	No	17 (28.8)						
	Not applicable	2 (3.4)						
	Missing Data	6 (10.2)						
Android	Yes	28 (47.5)	6 (10.2)	8 (13.6)	3 (5.1)	5 (8.5)	5 (8.5)	32 (54.2)
	No	25 (42.4)						
	Not applicable	2 (3.4)						
	Missing Data	4 (6.8)						
PDA	Yes	26 (44.1)	8 (13.6)	8 (13.6)	3 (5.1)	4 (6.8)	3 (5.1)	33 (55.9)
	No	26 (44.1)						
	Not applicable	2 (3.4)						
	Missing Data	4 (6.8)						
Tablet	Yes	41 (69.5)	3 (5.1)	6 (10.2)	12 (20.3)	8 (13.6)	11 (18.6)	19 (32.2)

	No	12 (20.3)						
	Not applicabl e	2 (3.4)						
	Missing Data	4 (6.8)						
Smartphon e	Yes	38 (64.4)	5 (8.5)	7 (11.9)	7 (11.9)	8 (13.6)	10 (16.9)	22 (37.3)
	No	15 (25.4)						
	Not applicabl e	2 (3.4)						

Appendix 13 Topic guide for interviews with NHS staff

At the beginning of all interviews:

5. Introduce self
6. Introduce study
7. About audio recording/anonymity/confidentiality
8. Explain how data will be used
9. Obtain Verbal Consent

The interview questions are grouped into the factors of Normalisation Process Theory

Interview:

1. Background information (how long have you been in your speciality, years' experience etc.)

Coherence

2. Were you made aware or are you aware of the purpose of the technology?
 - a. What is the purpose of the technology to you?
3. When the technology was introduced what benefits did you think would result?
 - Who did you think the technology would benefit most?

Cognitive Participation

4. When the technology was first introduced how did you feel?
 - a. Is it a good idea?
 - b. Did you or do you still have any concerns?
 - c. And what about now?
5. Can you tell me how you were introduced to Eclipse (any training etc)
 - Did you have any training, how did you feel about the training
 - How much time did you have to invest in the new system how did this make you feel?

Collective Action

6. How did you think the introduction of the technology would impact upon your practice?
 - a. Will it help or impede you
 - b. How has it affected your practice
7. How compatible was the new technology to your previous methods?

Reflexive Monitoring

8. What benefits have you seen to using the new system?
9. Have there been any barriers to using the system
10. Have you experienced any disadvantages to using the system?
11. Have you seen any patient safety related impact both positive or negative?
12. How do you feel the patients have responded to the technology?
 - a. Do you think it has affected your interaction with them?

End the interview:

4. Thank participant ask if they have any other comments

5. Explain again about how data will be used and reiterate about anonymity and confidentiality
6. Provide opportunity for questions and states that the chief investigator is contactable after the interview should questions arise.
7. Ask the participant if they would like to receive a summary of the results of the study

Appendix 14 Participant information sheet for interviews with NHS staff

Invitation

We are conducting research exploring the benefits, barriers and impact of implementing an Electronic Medical Record into an NHS trust. We are inviting you to take part in a research interview. Before you decide if you would like to take part you will need to understand why the research is being done and what it will involve. I would be grateful if you could read the following information. Feel free to discuss this with others if you would like to. Please ask the researchers Arabella Clarke (01274383945) John Wright (01274383430) if there is anything that is unclear or if you would like more information. Take time to decide whether you would like to take part.

The purpose of the study

The study aims to find out: 1) what are the perceived and experienced benefits, barriers and disadvantages of using the EPR during practice? 2) how has the EPR impacted upon practice? 3) How do staff feel about the introduction and use of the EPR?

Why have I been chosen?

We would like to hear from staff groups within the maternity department who have been provided with and are using the EPR during practice.

Do I have to take part?

Your participation in this study is entirely voluntary. If you decide to take part you will be asked to sign a consent form. You will still be free to withdraw at any time and you do not have to give a reason.

What is involved?

We will invite you to take part in an individual face to face interview with a researcher from the Bradford Institute for Health Research (BIHR). This will last approximately 40 minutes. It can take place at a time and place that is convenient to you. We would like to audio-record the conversation, but we will be careful to make sure that only members

of the research team will hear what you say. (The study findings are based on the views of all the people who take part, but we will not name anyone individually).

During the interviews we will be interested to hear about your views surrounding the benefits, barriers, disadvantages and impact of introducing EPR into your practice.

How will I benefit from the study?

The study cannot directly benefit you. However the overall research findings we get will provide direct feedback to the Chief Information Officer at BTHFT and may be used to inform the future introduction of EPR at BTHFT. The research information and the approaches we take may also help to inform other trusts and research groups exploring the implementation and impact of IT and EMRs in the NHS.

What will happen to the information I give?

The study will collect information from you during a single face to face interview. The information from interviews will be audio-recorded. All interview data will be transcribed and stored as written accounts on a password protected computer. These will be identified by pseudonyms unique to each participant. Your contact details will be stored in a separate location to avoid you being identified from the research information. All research information will only be accessed by the chief investigator and her supervisors to check the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and nothing that could reveal your identity will be disclosed outside the research site. When the study is finished the information will be securely stored for up to 5 years to allow the chief investigator to complete their PhD. We may use data in the chief investigators PhD thesis or in articles for academic and professional journals.

Who is reviewing the research?

This research has been reviewed and given favourable opinion by the University of York Health Sciences Research Governance Committee and (name of site removed).

Who is organising and funding the research?

The research is funded by (name of site removed). It is organised by a collaboration of researchers at the University of York and Bradford Institute for Health Research.

What if there is a problem?

The study researchers will be available to resolve any minor problems (contact details below). If you are unhappy with the way you have been dealt with during the study and wish to complain formally you can do this via the chief investigators supervisors. Professor John Wrigh, Director of Research, Bradford Institute for Health Research, Bradford Royal Infirmary, BD9 6RJ John.Wright@bthft.nhs.uk or Professor Ian Watt, Department of Health Sciences, University of York, Area 2, Seebohm Rowntree Building, York, Y010 5DD. Ian Watt@york.ac.uk

Contact Details

If you require further information or would like to discuss any aspect of this study please contact the project researchers during office hours (or leave a message at other times)

Arabella Clarke tel 01274383945 email Arabella.clarke@bthft.nhs.uk

Ian Watt tel 01904321341 email ian.watt@york.ac.uk

John Wright tel 01274383430 email John.Wright@bthft.nhs.uk

Thank you for taking the time to read this information sheet

Appendix 15 Consent form for interviews with NHS staff

Please Initial Box

I confirm that I have read and understood the information sheet dated... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

I agree to the use of audio-recording during the interviews and understand that where direct quotations are used in the final report or publications it will not be possible to recognise me.

I agree to take part in the above study.

Name of Participant

Date

Signature

Name of Researcher

Date

Signature

When completed , 1 for participant, 1 (original) for researcher file.

Appendix 16 Interview questions for lead midwife

Interview questions for lead midwife

1. Was there an official policy document when the software was introduced?
2. When was the system introduced?
3. Background on the technology, describe it, how it can be accessed, it's functionality
4. How was the technology introduced, was it phased in?
5. How long did the trust think implementation would take and how long has it taken?
6. How was the technology introduced to staff, any training if so what did this involve, when was it available and to whom. Were they told how to use it, benefits, how long implementation will take.
7. What was the official purpose of the technology from the trusts perspective?
 - a. Was the purpose of the technology communicated to staff formally and if so how?
8. How is the software currently being used, how is it accessed, who can access it and for what purpose/tasks?

Appendix 17 Impact and dissemination

National impact:

- Yorkshire and Humber benefits management group, The Health and Social Care Information Centre, August, 2015.
- Lorenzo business change and benefits community meeting, November, 2015.
- Benefits management workshop, September, 2015

As a result of the presentation to the Yorkshire and Humber benefits management group, I was asked to conduct a workshop at the Health and Social Care Information Centre with senior benefits managers and NHS England representatives to 'create ideas for driving action' from this thesis. Recommendations for action following the workshop included: holding regional focus groups with NHS hospitals to encourage sharing of the approaches and benefits and barriers to implementation electronic records, using the studies in this thesis to inform a white paper around benefits of electronic records, encouraging policy to create more consistent and accepted definitions for benefits, EPRs and a paperless NHS, benefits training for those implementing electronic records. The workshop also created some more indirect recommendations for ensuring benefits of EPRs including: a workbook on how to design, implement and measure success of EPRs and guidance for trusts in developing business cases and ensuring a return of investment.

Local and regional impact:

- Member of mobile device user group at NHS trust
- Involved in development of trusts business case, formulation of evidence for benefits
- Regular feedback to EPR benefits team
- Designing the Digital Economy, developing ideas for a Yorkshire based digital catapult centre aimed at increasing patient and public engagement with technology and their health records, August 2015.

Appendix 18 Published paper

Clarke et al. *BMC Medical Informatics and Decision Making* (2015) 15:85
DOI 10.1186/s12911-015-0204-0



RESEARCH ARTICLE

Open Access



Implementing electronic patient record systems (EPRs) into England's acute, mental health and community care trusts: a mixed methods study

Arabella Clarke^{1,2*}, Joy Adamson¹, Laura Sheard^{2†}, Paul Cairns^{2†}, Ian Watt¹ and John Wright²

Abstract

Background: Our aim was to explore the approaches to and the challenges and benefits of implementing Electronic Patient Record systems (EPRs) into NHS acute, mental health and community care hospitals throughout England.

Methods: A mixed methods approach was adopted that comprised an online survey ($n = 59$) and semi-structured telephone interviews ($n = 8$) with chief information officers (or heads of EPR projects) at NHS trusts throughout England. Survey analysis was descriptive, whilst the qualitative interviews were analysed thematically.

Results: A range of devices and approaches to implementing EPRs were described with 32 % of survey respondents utilising a best of breed approach. Interviewees' perceived and expected benefits of implementing an EPR included efficiency, availability and accessibility of clinical information, and patient safety. Key challenges to EPR implementation were securing clinician involvement, difficulties posed by government and national policy and limited availability of financial and human resources.

Conclusions: There was no single approach regarding the approaches taken to implementing EPRs among participating English NHS trusts, with various benefits and challenges cited. Policymakers and researchers need to provide clearer guidance for trusts at various stages of implementation ensuring intelligence is shared across England's NHS trusts.

Background

Political pressure for hospitals in the English National Health Service (NHS) to implement Electronic Patient Record systems (EPRs) has been mounting over recent years, notably through Department of Health (DoH) initiatives such as, 'Safer hospitals, Safer wards; achieving an integrated digital care record' [1] and the Secretary of State's call for a paperless NHS by 2018 [2]. What is more, previous failures of national Information Technology (IT) policy such as the national programme for IT in the NHS (NPIIT) [3] add to the pressure on NHS hospitals to 'get it right'. National NHS IT policies are often costly with a lack of demonstrable benefits. For example, the 'Safer hospitals, Safer wards: achieving an

integrated digital care record' [1] initiative has cost the NHS £500mn since its publication in 2013, with £60mn of the first instalment being unallocated due to trusts failure to demonstrate a return of investment [4].

The political and financial support from NHS England and DoH for trusts to implement these systems implies there is a strong evidence base supporting the idea that EPRs can improve health outcomes and quality of care. In reality, literature, supporting these claims is either predominately from the U.S. whose health service has different economic, organisational and structural foundations from the UK, or from reports listing 'potential' future benefits, rather than empirical evidence [5–7]. The literature is focussed on proposed benefits of implementing these systems once they are fully 'up and running' and so little evidence currently exists which reports benefits that have been realised and the challenges of implementing these systems into NHS organisations.

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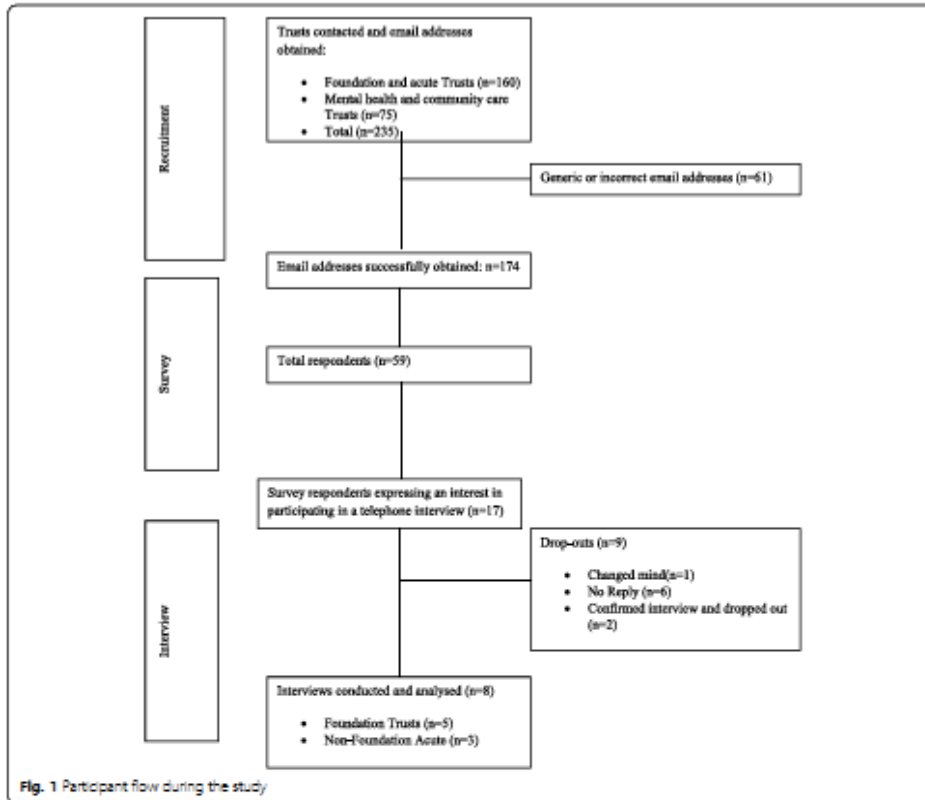


Fig. 1 Participant flow during the study

Furthermore, despite the political and financial implications of implementing EPRs, there is a lack of empirical evidence surrounding EPR implementation in the UK. A recent systematic review [8] examined Electronic Health Record (EHR) implementation, which included EPR literature showing U.S. hospitals to be at different stages of implementation with varying levels of EPR functionality [9]. The EPR literature also found a number of challenges and disadvantages to EPR implementation including: reduced doctor productivity, technological issues such as software design [9, 10] and information sharing and confidentiality [8]. Whilst the literature included in the systematic review [8] was primarily from the US there were some studies from the UK but these focussed on EHR implementation [11, 12]. There is a degree of uncertainty as to the differences between EHRs and EPRs. Historically an EHR was a longitudinal record of a patient's health care from cradle to grave which combines information regarding patient contact with primary care

and periodic care held within EPRs [13]. An EPR (or EMRs as they are known in the U.S.) was therefore a separate system to an EHR, and is for the purposes of this paper defined as a record containing episodic care typically by one institution relating to patient information such as personal details, diagnosis and treatment [13]. However over time, these terms have been used interchangeably, making the dissemination and use of literature in this area difficult as it is unclear what type of system is being investigated. This lack of guidance from research arguably makes achieving government targets such as 'a paperless NHS by 2018' more challenging. Therefore, this study explores the approaches to and benefits and challenges of implementing EPRs into English acute, mental health and community care NHS trusts.

Methods

A mixed methods approach was taken involving an on-line survey and qualitative interviews with Chief

Information Officers (CIOs). The online survey was distributed between October and November 2013 via email and was a census of all 235 acute, community care and mental health trusts in England. As there is no centralised record held by the Department of Health (DoH) of contact details for CIOs (or heads of EPR) and following DoH guidance a list of all NHS acute, community care and mental health trusts switchboard telephone numbers were obtained via the NHS Choices website. All 235 trusts were then contacted to obtain email addresses for their CIO or equivalent individual. However, a lack of consistency in job title and in some cases inability or unwillingness to provide this information meant that email addresses for communications, human resources or IT departments were often obtained rather than for a specific individual. When generic email addresses were obtained, an email including a link to the survey was sent indicating that the survey should be sent to the CIO or equivalent person in that trust. Reminder emails, which included the link to the survey, were sent to all participants (unless they expressed disinterest) 2 weeks after the initial email was sent and again in the final week of the one month period for which the survey was available.

The survey (Additional file 1) which was developed using SurveyMonkey [14] comprised fixed questions relating to trust demographics (trust type and geographical location) and the hardware and solution strategies used to implement EPRs. Hardware strategies are devices through which an EPR may be accessed i.e. computers on wheels (COWs) or fixed desktops. Solution strategies are the approaches or 'architecture' trusts are using to implement EPR systems (Additional file 2). The survey was informed and piloted with Chief Information Officers (CIOs) at two NHS trusts in the North of England. Survey questions were analysed using SPSS for windows version 19 and descriptive analysis was undertaken.

For the qualitative interviews, individuals were recruited using convenience sampling of those who indicated they would be happy to participate in a telephone interview at the end of the survey. A topic guide (Additional file 3) provided a framework for the semi-structured interviews and was informed and piloted with the same CIOs as the survey. Interviews aimed to provide more detailed exploration of the approaches to implementation (hardware and solution strategies) to complement the survey data as well as to gain an understanding of the benefits and challenges of implementing an EPR. Telephone interviews were conducted between November 2013 and January 2014 and lasted between 20 and 40 min. Interviews were transcribed verbatim with all participants assigned a unique ID code. Interviews were analysed using the five stages of thematic analysis as outlined by Braun and Clarke [15]; transcription, familiarisation, coding, theme development and data reporting. Coding and theme development was deductive

with themes driven by the topic guide. Members of the research group were consulted throughout the analysis of interviews and theme and code development to enhance plausibility of the findings. Reflective notes [16] were taken following each interview and throughout the analysis with methodological, analytical and personal reflections noted and considered during the interpretation of the study's findings.

After the initial analysis had been completed for both the qualitative and quantitative material the data were integrated. A list of themes from both the preliminary analyses was created and where both types of data were available for the same theme this has been presented together. For some themes only quantitative or qualitative data were available (i.e. the benefits of implementing an EPR) and so these themes are presented separately. During the process of data integration some themes were re-named or re-fined. For example, the theme hardware and solution strategies was re-structured and re-named so as to combine both quantitative and qualitative data reflecting the approaches and systems used by trusts implementing EPRs. Quotations were selected from the interviews that were illustrative of the point being [15].

The sociotechnical approach was used to inform data integration and to facilitate the interpretation of study findings. The approach challenges the notion that IT system implementations fail solely due to technical reasons and can be used to understand why an implementation strategy may be successful in one organisation yet not in another [17]. The use of the approach in this study is based upon the work of Greenhalgh et al. [18] who used the approach to evaluate electronic summary care records in England. During their evaluation Greenhalgh et al., [18] suggest that when evaluating technology programs quantitative and qualitative methods should be used to study the macro (National policy, wider social norms) meso (organisational processes) and micro (particular experiences of patients and professionals) level sociotechnical influences [18]. As the approach is predominately used to understand why IT implementations fail, the three levels of sociotechnical thinking have provided a useful means of organising and understanding the various challenges affecting the implementation of EPRs in this study.

Ethical approval was granted by the University of York, Health Sciences Research Governance Committee (11/10/2013). Informed written consent was obtained for the interviews, for the survey implicit consent was taken from those who completed the questionnaire.

Results

Participants

Fifty nine of the 235 trusts invited to participate in the survey responded (25%). However, assuming that the response rate was differential with 63 email addresses being

either generic departmental email addresses or incorrect an adjusted response rate of 59 participants from 174 correct emails would ensue (34 %). A flow diagram illustrating the number of trusts recruited and included in the survey and interviews are shown in Fig. 1. The majority of survey and interview respondents were implementing an EPR, $n = 47$ and $n = 6$ respectively. Survey respondents represented a range of locations: North England ($n = 16$); East England and the Midlands ($n = 3$) and London and South England ($n = 15$) with 25 respondents not specifying their location. Survey and interview respondents also represented a range of NHS trust types including: Foundation Trust ($n = 26$, ($n = 3$); Non Foundation Acute Trust ($n = 13$), ($n = 5$), Mental Health and Community Care Trust ($n = 11$) and Combined ($n = 9$). Trusts within the combined category were those that indicated that they were Mental Health, Community Care and Foundation Trust. Demographic characteristics for survey and interview respondents are displayed in Additional file 4.

The approaches and systems used by trusts to implement EPRs

There was no consensus among survey respondents as to the type of systems used to deliver EPRs with 37 different systems cited. Additional file 5 displays the most frequently (2 or more trusts) used electronic systems adopted.

Hardware strategies mainly included fixed desktops ($n = 55$, 93.2 %), with trusts also incorporating COWs ($n = 39$, 66 %), handheld PCs ($n = 47$, 79.7 %), tablets ($n = 41$, 69.5 %) and smartphones ($n = 38$, 64.4 %). Additionally, 58 % ($n = 34$) of trusts were using five or more types of devices to deliver their EPRs.

Interviewees commented on their experiences of using these devices, with positive experiences of laptops and mobile devices reported and the benefits of these devices including: mobility, flexibility and data capturing. In relation to tablets, these were not being used extensively, or were being trialled with concerns expressed over confidentiality, security, maturity; battery life and compatibility with existing software. Contrasting experiences of COWs were reported with the devices used mainly for their mobility and to enable the use of computers at the bedside:

Respondent 020401: *so people love the COWs... that tends to be the most...popular item here (laughs) mostly because they round with them...and they round with... medical students and residents and they pull up on the screen everything that they need to see on a patient chart and then do what they need to do...I love COWs I think everywhere I have worked people have liked them (Respondent 020401).*

Respondent 010301: *our experience with both sets of COWs has been very negative in that there is a huge problem with the battery life and the speed of access*

and everything on the computers and so the COWs and there also big...difficult to move around and so they tend to even though there mobile they tend to be moved to one bit of a ward and or just left there.

A range of approaches to EPR implementation were cited by survey respondents, with the most popular approach being 'best of breed' (32 % $n = 19$) (Additional file 2). Furthermore, of the 28 % ($n = 17$) of participants using a combination of solution strategies, nine of the 11 combinations included a best of breed approach. Interviewees were also largely utilising a best of breed approach, with a variety of reasons including that trusts cannot afford or are unable to identify a lack of suitable megasuite system. Despite the popularity of the best of breed approach, a number of interviewees raised concerns regarding the layout and usability of best of breed systems which was seen as complex and inconsistent. When comparisons were made between megasuite and best of breed approaches, benefits and challenges were attributed to both. Furthermore, the trusts that had adopted a megasuite approach were better resourced, had substantial clinician involvement within their projects and tended to have higher digital maturity.

Respondent 082404: *when we were doing the procurement we did look at whether it's best of breed or whether it's a megasuite I'm with you now...actually there's quite a lot of published evidence to say that best of breed is not necessarily the best solution and the interfaces can become quite complex...and we have experienced some really bad interfacing problems and actually as it turns out even with what you call a megasuite there are still interfaces.*

Benefits of implementing EPRs

Perceived benefits were centred around patient safety, efficiency and information availability and accessibility, with both future benefits and benefits that had already been realised mentioned. Only two interviewees referred to benefit realisation plans or business cases. EPRs were viewed to have the potential for a host of patient safety benefits centred around e-prescribing and advanced decision support including reduced prescribing errors, and prompting for best practice respectively. Whether patient safety benefits were considered to have been realised depended on a trust's digital maturity, with more mature trusts citing benefits such as the ability to better monitor deteriorating patients. In contrast, less mature trusts reported often failing to see benefits to the extent they expected. Trusts maturity was determined in a number of ways, including whether interviewees directly mentioned digital maturity indexes such as HIMSS and their position on these scales and also at what stage of

implementing EPRs they were at for instance, pre-procurement, procurement, implementation, full EPR implemented:

Respondent 061803: *to accrue better and more substantial benefits electronic pharmacy having been the most obvious example where that will start to stop having situations of repeat prescribing and when there's a necessary appropriate control of prescribing which is contraindicated.*

Efficiency benefits were expected as a result of EPRs, enabling speedier flows of information, data entry and completion of tasks such as discharges. In addition to time saving, not having paper reduced prescribing costs from e-prescribing and reduced diagnostic tests were perceived to bring the potential for cost saving efficiencies. Efficiency benefits that had been realised were mainly from the reduced storage of notes and administrative staff, as well as having all clinical information accessible:

Respondent 051601: *we're...able to turn around things like pathology and radiology reports much faster.*

Interviewees also suggested that there will be, and in some instances have been, benefits from EPRs improving the quality, availability and accessibility of information. These benefits are expected to result from having all patient information in one place, whilst also enabling the use and sharing of information within and across health and social care organisations.

Respondent 030608: *the ability to share that sort of information and turn that information into working knowledge that we use again for new patients...I mean that's what it's all about really*

Challenges to implementing EPRs

The majority of interviewees reported engaging clinicians in trust EPR projects to be a challenge. This was attributed to clinicians having varied IT skills or willingness to be involved. Interviewees also mentioned the difficulty of managing clinicians' expectations in terms of what can be achieved within projects. Clinicians were perceived to expect projects to have a clear point of completion, whereas in reality participants explained how the 'shifting landscape of technology' creates new technological possibilities and means projects are rarely 'complete'. The increased societal use of technology was also perceived to have raised clinicians expectations of what technology should be available at work, due to the sophistication of technology that individuals are used to at home to complete a range of daily tasks:

Respondent 010301: *actually you have a huge variation in those who are keen to use IT and those that are not keen to use IT and so engagement with the staff and getting them to understand the importance of utilising the technology that we have has been a big challenge...that's probably one of the biggest challenges we have.*

For a number but not all interviewees, a lack of finance and other resources such as time or trusts current technological capability was a challenge to implementing EPRs. More specifically, there was talk surrounding financial instability and constraints preventing trusts from achieving their EPR ambitions. The different financial and resourcing situations of NHS trusts was also perceived to have created an 'unequal playing field' exacerbated by national policy which sets the same aims for trusts irrespective of their digital maturity or financial and resourcing capabilities leaving some trusts to play 'catch up':

Respondent 061803: *if we'd had greater continuity of management and more resources available to us in the first place instead of having to fight for each and every project, whilst we had two or three reasonable years the last two years have been fairly dire in terms of resource because of the situation we are in financially.*

Government and national IT policy was cited as a challenge, with participants explaining how they feel as though they are 'battling' against 'political milestones' that are enforced upon them, despite these milestones not always viewed as clinically relevant. There was also tension surrounding The National Program for IT (NPfIT) [3] with participants still considering the program to be hindering the innovation and implementation of EPRs, to the extent that the NHS is perceived to be behind other countries such as the U.S. Whilst the program was considered by participants initially to be a good idea, it is now viewed as a lost opportunity that is still hindering innovation and development of EPRs to the extent that the UK and NHS are behind other countries.

Respondent 071212: *lack of foresight because actually when a lot of these things come out of number 10 or wherever they come out of there is people on the ground that are going oh no and yet somebody still thinks this is a good idea...I mean who thinks the friends and family test is a good idea [laughs] collecting that and reporting it by ward it's a terrible idea but we have to waste our time doing it...so the reality is that we waste a lot of our time doing things that are completely useless and add no value to the*

clinical service whatsoever so there's something that I would change.

A further challenge was perceived to be quantifying benefits of implementing an EPR or showing a return of investment. Reasons for this include the multifaceted and often subjective nature of benefits that are often not realised for some time:

Respondent 051601: like any sort of other large business the focus is very much on return of investment... and return of investment is traditionally financial models...how you...do a financial business case to stop one child's been in a safeguarding sort of incident is again very difficult to model up...and it becomes a bit like an insurance policy...a business case providing an insurance policy [...]I paid 200 pounds a month for my car insurance never claim it but I still think I need it (laughs) so it's when times are hard to have those sorts of systems that support those risk management insurance stuff is very difficult.

It was also suggested that software and technology is behind trusts ambitions as despite wanting clinicians to have access to records through one device, there is currently no device that can provide this or that is suitable for all clinical requirements. Ultimately resulting in clinicians carrying or accessing multiple devices. Moreover, the lack of universally accepted or out of the box solution or approach to implementing EPRs is an additional technological challenge when implementing EPRs:

Respondent 051601: one of the real challenges we've got is people and we want clinicians to be mobile so as to have access to information they need from wherever

they are but what we find is software vendors or solution providers are a little bit behind on that curve.

A summary of the challenges to EPR implementation using the three levels of sociotechnical influence; meso, macro and micro can be found in Table 1.

Discussion

This study highlights that there is no consensus as to the approaches being used to implement EPRs into English NHS trusts. Despite a best of breed approach being the most common solution strategy among participants, this only represented 32 % of survey respondents with interviewees citing pros and cons to the approach. Furthermore, of the 59 participating trusts 37 different systems providers of EPRs were used. Whilst the study respondents provide no real insight into the 'best' approach to EPRs the study does provide the first account of the various approaches being used and the associated pros and cons to these approaches and devices. For instance, comparisons were made between best of breed and megasuite approaches with participants criticising the usability of a best of breed approach, but acknowledging that there is a lack of suitable megasuite systems available for use within the NHS. Furthermore, this is the first empirical English study to explore the approaches to and benefits and challenges of implementing an EPR into an English NHS trust and may therefore be useful to NHS trusts of varied digital maturity and stages of implementation.

This study provides English empirical evidence of both realised and expected benefits of implementing EPRs. The findings support those of a recent qualitative interview study that reported, 'anytime anywhere access to patient information' and 'time and human resource

Table 1 Macro, meso and micro factors affecting the implementation of EPRs

Macro		Meso		Micro	
Factor	Description	Factor	Description	Factor	Description
National policy, and government influence	Impact of NPfIT and impact of government targets that are not clinically focussed.	Showing a return of investment	Trusts are failing to show a return of investment. Business cases were rarely mentioned.	Clinicians IT knowledge and willingness to be involved in IT projects	Whether clinicians are engaged and/or adopt EPR systems can depend upon their IT skills and willingness to be involved.
Implementation strategies/solution strategies	There is no single best approach to implementing EPRs available with trusts utilising a range of devices, systems and strategies when implementing EPRs.	Finance and resources	Trusts have varying finance and resources available despite being required to reach the same government targets.	Clinician involvement in EPR projects	At an organisational level, whether trusts involve clinicians and how they involve them.
Technology and hardware available	The technology available is not mature enough to meet clinical needs and to enable one device to be used for all tasks.			Managing Clinician expectations	Clinicians often expect EPR projects to be completed or have high expectations of what can be achieved within the scope of EPR projects.

related efficiency savings to be benefits experienced by clinicians of an EPR within the NHS [19]. However, despite both UK policy documents [1] and the academic literature surrounding EPRs stating that EPRs are implemented as they have the potential to improve the quality and safety of healthcare [13], there remains little empirical evidence on the realised benefits of EPR systems within the NHS. Whilst this is perhaps a reflection of the stage of implementation at which NHS hospitals are at in comparison to other countries, the necessity of establishing UK benefits at all stages of EPR implementation should not be underestimated. This is of particular importance given that benefits literature is used in the formulation of trusts business cases and applications for funding which at present are reliant on US literature that would not be necessarily applicable to the NHS.

The lack of guidance and evidence surrounding the implementation of EPRs has been acknowledged by previous policies such as safer hospitals safer wards: integrating a digital care record [1]. This is exacerbated by the failure of policy to adopt either a top down approach or decentralisation, causing confusion as to which aspects of EPR implementation is the responsibility of NHS organisations or that of central government. NHS England are starting to address this issue through the Clinical Digital Maturity Index (CDMI) [20], however it is important that the CDMI is clear and provides enough detail to help trusts progress to digital record keeping in a realistic and unambiguous fashion. Moreover, there is a risk of the CDMI crudely classifying trusts as being high or low in terms of maturity, which could cause those at the lower end of the spectrum from being disenfranchised and the 'unequal playing field' from widening.

The use of both quantitative and qualitative methods underpinned by sociotechnical thinking builds on the recommendation by Greenhalgh et al., [18] that a technology programme should be studied at the meso, macro and micro level and both quantitatively and qualitatively in order to understand complex change. The approach also provides a useful way of organising and interpreting the various social and technical influences affecting the implementation of EPRs. Whilst the majority of challenges to implementation identified in this study were at the macro level, it would seem important that all three levels are considered and that they are addressed at national, organisational and individual level. Equal weight should therefore be given to sociological and technological issues, something which informatics literature has received criticism for previously [17].

The main limitation for the study was the small number of survey respondents. This was in part due to the lack of centralised record of CIOs available from the DoH or consistency of job title for those responsible for trusts EPR projects, making recruitment a particular

challenge. However of the sample obtained varying levels of EPR maturity and a range of trust types and locations were represented (Additional file 4). In relation to the qualitative interviews, despite 8 being a relatively small number given the range of participants and trusts interviewed, this sample may be adequate to meet the aims of the study. Furthermore, due to the complexity of implementing EPRs and the variety of benefits, challenges and approaches being used by trusts, a higher response rate of both the survey and interviews would not take away from this picture. Therefore, whilst the full range of viewpoints may not be represented this is unlikely to have impacted on the study's findings.

Another finding from the study was the lack of centralised record of CIOs, or indeed consistency of job title. Given the lack of a universal approach to the implementation of EPRs and the recent acknowledgement of the need for NHS trusts to share insights, knowledge and experience with one another as they move towards EPRs by NHS England [1]; a centralised record either nationally or regionally would help to facilitate intelligence sharing and assisting one another in the implementation and development of EPR systems.

Lastly, the aim of this paper was not to create an overly negative portrayal of EPRs, as these systems will undoubtedly bring benefits to the NHS in the future. However, our findings suggest that for the individuals who are implementing these systems, the challenges currently outweigh the benefits. Given the amount of literature that focuses on the potential benefits of these systems, which is based on limited empirical evidence, it is important that the challenges associated with implementing EPRs are also documented.

Conclusions

With the rising pressure on NHS trusts to implement EPRs, there is a need for policymakers to provide better guidance as to the best routes to implementation. To achieve this, policymakers need more UK evidence in larger samples, especially surrounding the approaches, challenges and benefits of implementing EPRs in NHS organisation. Furthermore, greater sharing of lessons among NHS organisations should be encouraged and facilitated by Academic Health Science Networks and the CDMI if NHS trusts are expected to move up the digital maturity ladder.

Additional files

Additional file 1: Survey questions. (PDF 42 kb)

Additional file 2: Solution strategies adopted by participants. The approaches or solution strategies (e.g. best of breed) adopted by participating trusts to implement EPRs. (PDF 86 kb)

Additional file 3: Topic guide for semi structured interviews. Topic guide used for semi structured interviews with Chief Information Officers. (PDF 45 kb)

Additional file 4: Demographic characteristics. Demographic characteristics for survey and interview respondents (EPR status, trust type, location and interviewees job title). (PDF 14 kb)

Additional file 5: The different EPR systems being implemented by trusts in the sample. The different EPR systems (i.e. RIG, Millenium) being implemented by participating trusts. (PDF 138 kb)

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

AC drafted the manuscript, undertook recruitment, data collection and analysis, conceived the study and conducted the design of the study. JA, participated in the design of the study, conceived of the study and helped to draft the manuscript. IW, participated in the design of the study, conceived of the study and helped to draft the manuscript. LS, assisted with the thematic analysis and participated with the design of the study. PC, assisted with the thematic analysis and participated with the design of the study. JW, conceived of the study, participated with the design of the study and helped to draft the manuscript. All authors read and approved the final manuscript.

Authors' information

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Abbreviations

A&E: Accident and Emergency

CCGs: Clinical Commissioning Groups

CDMI: The Clinical Digital Maturity Index

CIO: Chief Information Officer

CfH: Connecting for Health

COW: Computers on Wheels

DoH: Department of Health

ED: Emergency Department

EhI: E-health Insider

EHR(s): Electronic Health Records

EMR(s): Electronic Medical Records

EPR(s): Electronic Patient Records

ERDIP: Electronic Record Development and Implementation Program

GP: General Practice

HES: Hospital Episode Statistics

HiMSS- Healthcare and Information Management Systems Society

HISS: Hospital Information Support System

HSCIC: The Health and Social Care Information Centre

HSR: Health Services Research

IDCR: Integrated Digital Care Record

IM&T: Information Management and Technology

IfH: Information for Health

IOS: iPhone OS

IT: Information technology

NAO: National Audit Office

NHS: National Health Service

NICE: The National Institute for Clinical Excellence

NPfIT: The National Programme for IT in the NHS

NPT: Normalisation Process Theory

PACS: The Picture Archiving and Communications System

PAS: Patient Administration System

PDA: Personal Digital Assistant

RCT: Randomised Controlled Trial

RMI: The Resource Management Initiative

SRO: Senior Responsible Owner

U.K: United Kingdom

U.S: United States of America

WHO: World Health Organisation

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