A critical investigation of electronic patient records in the NHS in England: tracing an elusive object through its actor network

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Abbreviations and Acronyms

Acronym/ Abbreviation	Name	Definition
DCR	Detailed Care Record	Rich longitudinal electronic patient record held locally by organisations that treat a patient regularly.
DoH	Department of Health	Government department responsible for the NHS.
GP	General Practitioner	Primary care doctors. GPs are the first line of care for patients and act as gatekeepers for secondary care.
HSCIC	Health and Social Care Information Centre	Body established in 2013 as the provider of information, data and IT systems for the NHS.
N3		Secure telecommunications /broadband network for the NHS.
NHS	National Health Service	Publicly funded national healthcare provision for the UK.
NIHCE	National Institute for Health and Care Excellence	Body which provides clinical standards and best practice guidance for the NHS.
PbR	Payment by Results	Tariff based payment system for secondary care.
PCT	Primary Care Trust	Administrative unit comprising multiple GP practices within a given area.
QoF	Quality Outcomes Framework	Reward and incentive programme for GPs for service quality.
SCR	Summary Care Record	Electronic patient record containing limited core information about the patient including information such as allergies and adverse reactions to medications and accessible nationally.
Spine	National Data Spine	Central data store for the NHS.

Abstract

This study is a critical investigation of electronic patient records in the National Health Service in England. It explores whether EPRs benefit clinicians in the context of a technology that has been explicitly designed to fulfil multiple purposes, both clinical and non-clinical, and is critical in its motivation to challenge their apparent sense of inevitability.

Against the backdrop of a government vision of a nationally networked EPR the research takes a meso level perspective using primary data from interviews with users across multiple NHS Trusts and healthcare settings.

The study uses Actor-Network Theory from the outset as both a methodological and theoretical approach with the aim to be revelatory about the interests at work in sustaining this technology and to question whether clinicians bear the costs of network-building for the EPR. This has shaped the trajectory of the research, which is as a consequence highly reflexive and in which theoretical and methodological concerns are given equal weight to investigation of EPRs.

Whilst EPRs undoubtedly benefit clinicians fundamentally through improved access to patient information, benefits are constrained by material and social interests that reproduce existing relations. In particular, non-clinical agendas are strongly inscribed within EPRs, reshaping clinical work practices by defining what may and must be recorded, and shifting attention within clinical care. A performative conception of EPRs acknowledges the messy and multiple realities and enables theorisation of the technology as complicit in a reshaping of reality towards informatized healthcare. EPRs mediate a quantification of clinical practice that implies additional work for clinicians, and new regimes of control based around recording in the EPR.

The study paints a complex and subtle picture of the use of EPRs by mapping its actor-network through the experiences of users and conceptualising the EPR as emerging from a messy, heterogeneous network of socio-material relations.

CHAPTER 1 – EPRS AS A CONTROVERSIAL TECHNOLOGY

1.1   Introduction

This research draws on concepts from Actor-Network Theory to investigate the organisational network of relations associated with the Electronic Patient Record (EPR) in the National Health Service (NHS) in England.

At the time of deciding to research the NHS' Electronic Patient Record as a technology context, the National Programme for IT (NPfIT) was still running. It had a number of strands amongst which were objectives to develop a single electronic patient record for each patient in the country which would be universal across NHS organisations in primary and secondary care (House of Commons Committee of Public Accounts 2011, National Audit Office 2011). This shared record would be accessible nationally within NHS organisations in England to all clinicians with a legitimate care relationship to the patient.

Electronic patient records have been replacing paper medical records in a number of national healthcare systems over recent decades, including the National Health Service in the UK. They are part of a global picture of changing healthcare provision within which a number of countries already have well established infrastructures, notably in Scandinavia, Finland, Australia and a number of public and private healthcare providers in the US and Canada.

The electronic patient record in the NHS provides healthcare professionals in primary and secondary care access to an electronic version of information previously contained in locally held paper or electronic patient medical records wherever the patient was treated. Where these records have been dispersed and disconnected in content and location the EPR aims to exploit the opportunity to create a centralised 'single truth' record which can be accessed from anywhere by NHS healthcare professionals and to integrate this record with other clinical and non-clinical information systems.

The National Programme for IT (NPfIT) was launched in 2002, as part of which electronic patient records are being implemented within the NHS in England, costing, as of May 2011, roughly £6.4 billion and having been criticised as being some years behind schedule having been due to be completed in 2010 (National Audit Office 2011).

Electronic patient records promise to provide safer, quicker and better quality patient care as a key element of modernised information systems within the NHS (Burns 1998, NHS Executive 2001, Parlimentary Office of Science and Technology 2004). Discourses from government and IT suppliers about the promise of this technology hinge on ambitions for modernisation and improved quality of care driven by the pursuit of clinical and management information to evidence performance, reduce errors and achieve efficiencies by supporting information flows to where they are needed (Takian and Cornford 2012).

In this respect EPRs are also part of the World Health Organisation and EU strategies on eHealth (Dobrev, Jones et al. 2009) with long term objectives to enable cross-border sharing and visibility of high level, demographic and core clinical information about individuals as a means to support the healthcare demands of increasingly mobile populations.

1.2 What are Electronic Patient Records?

Electronic patient records are longitudinal health records containing patients' biographic information, a record of their clinical encounters including medical history, diagnoses, medications, treatments and outcomes, and administrative information about episodes of care within a given organisation (Eason 2007).

EPRs are founded on the concept of providing treating clinicians with a more complete picture of the patient through shared (especially enterprise-wide) access to information across departments and professional groups which may previously have been isolated in silos (National Institutes of Health 2006). Moreover clinical information is in a format which can be communicated to other information systems, and some EPRs may import information from external systems (Kalra and Ingram 2006). This entails the potential for exchange of patient record information between healthcare organisations.

The technology is intended to integrate multiple sources of information about the patient in order to be able to reduce rework through collecting data once and reusing it to serve the needs of different stakeholders, thereby reducing duplication (National Institutes of Health 2006, Power of Information Taskforce 2009, NHS 2011, Department of Health 2012). EPRs are therefore founded at least in part on economic ideas about the efficient use of clinical labour (Kalra and Ingram 2006, Mensink and Birrer 2010). Figure 1 below shows a screenshot of a dummy EPR from the GP system supplier TPP (TPP 2012) showing how patient information is typically presented and organised.
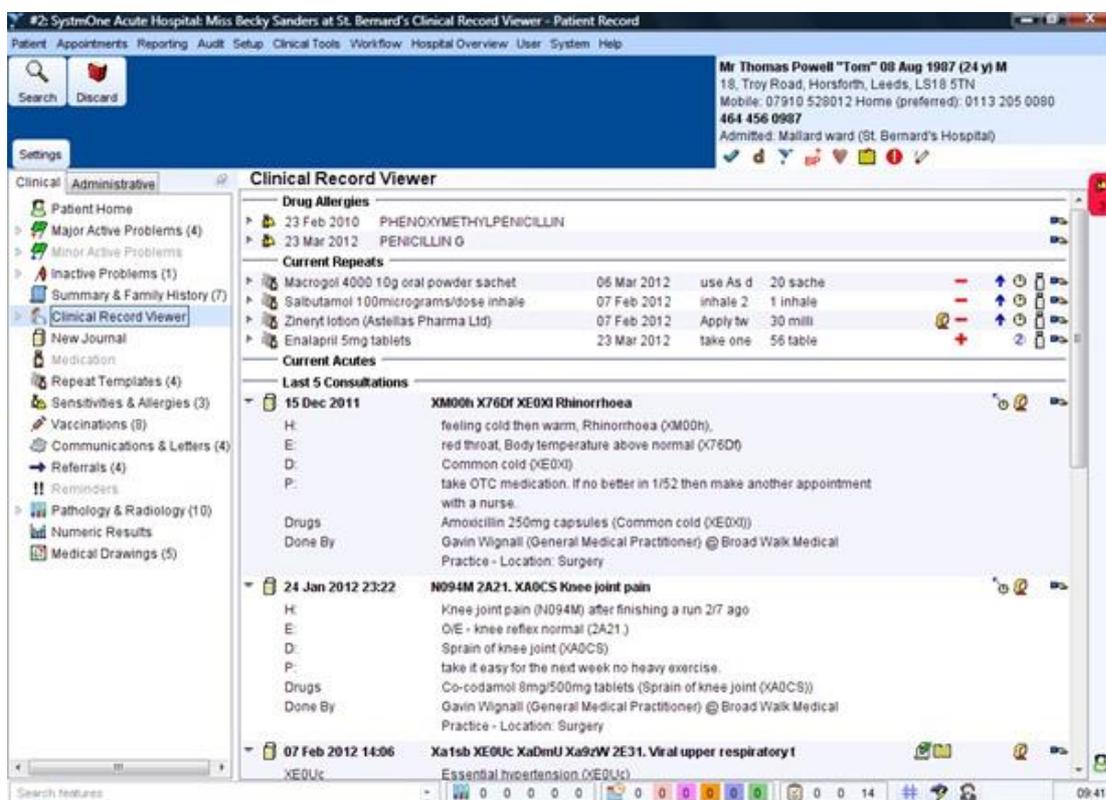
Figure 1. Electronic patient record screenshot (TPP, 2012)

The structuring of clinical information in the EPR enables individual patient records to be more easily retrieved (Goorman and Berg 2000, Mensink and Birrer 2010), and within the record different types of clinical information can be grouped, for example, under a tab for 'medication', to make them more meaningful, also enabling information to be more easily found within a record (Kalra and Ingram 2006). EPRs are locally configurable so that interfaces and data fields can be made more appropriate to different functions and specialisms (National Institutes of Health 2006). Furthermore the largely structured nature of clinical and other information

within EPRs allows for the mining of large bodies of records held by organisations for purposes related to a range of secondary uses of data (Care Record Development Board 2007, Mensink and Birrer 2010), for example to identify optimal care pathways for particular symptoms (Sauer and Willcocks 2007). In the NHS secondary uses of EPR data now fall under the Health and Social Care Information Centre whose remit includes collection and analysis of a variety of datasets provided by healthcare organisations, which may be used for various purposes (The Information Centre 2012). The NPfIT as an implementation programme originally mandated standard technical systems be implemented across NHS organisations divided into 5, later to become 3 geographic regions in England (Eason 2007, Takian and Cornford 2012), for which IT suppliers bid to become regional Local Service Providers (LSP). Figure 2 below illustrates the programme structure for EPR development as part of the NPfIT by region and IT supplier.
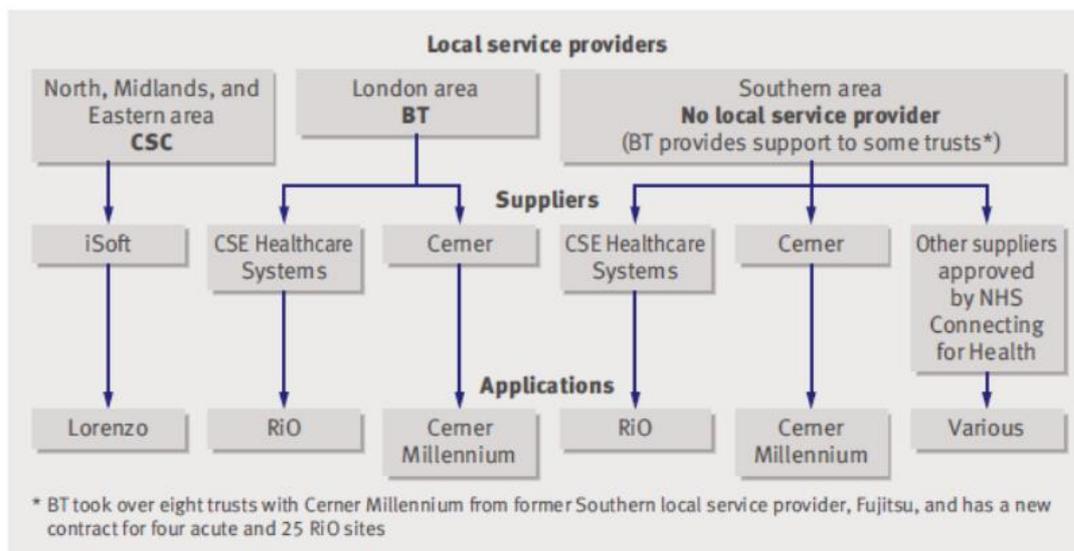
The NHS Care Records Service in secondary care in 2010: local service providers, local service provider suppliers, and NHS Care Records Service applications.

Figure 2. Programme structure for EPR development aspect of NPfIT (Robertson, Cresswell et al. 2010)

The original aim of the National Care Records Service aspect of NPfIT was to develop a Summary Care Record held in a central database, the Spine, accessible to all NHS organisations via the N3 secure extranet that would comprise core clinical and biographic information (Greenhalgh, Stramer et al. 2008), and which would be

enriched over time with more clinical information (House of Commons Health Committee 2007).

Secondly Detailed Care Records would be developed for all NHS organisations which would comprise a detailed longitudinal medical record with the long term aim that these would be integrated between organisations in the context of shared care pathways within a local health economy (House of Commons Health Committee 2007, Cresswell and Sheikh 2009). In secondary care EPRs are based on an underlying Patient Administration System (PAS) that provides the patient index for clinical records, and the first phase of the NPfIT therefore involved implementation of PAS within hospitals. On visits to a healthcare provider patients' biographic details, such as address and GP, are updated within such an index and reconciled against the national patient database so that the centrally held record is up to date.

The strategy for General Practice, where computerized medical records already largely pre-existed the NPfIT, new systems would be implemented by a Local Service Provider (LSP) if existing systems did not comply with the GP Systems of Choice (GPSoC) framework set out to ensure standards across GP systems (Connecting for Health 2008). It is important to note that in secondary care many specialisms and functions had already developed bespoke electronic patient records systems tailored to their needs (Eason 2007), albeit restricted in scope. In this context the National Care Records Programme aimed for enterprise-wide implementation to certain technical and functional standards.

Whilst the national SCR implementation continues, there has been a shift from a top-down, centralised programme of EPR development, largely focused on secondary care settings, with systems development centrally overseen by Connecting for Health (Department of Health 2013) and limited to centrally procured applications, to one where development is locally rather than centrally driven, entailing that Trusts have greater autonomy in the selection of systems and the timing of implementation (Department of Health 2012).

Ambitions for local records to be joined up and shared between healthcare organisations were abandoned by NPfIT, reportedly due to the challenges of developing interoperability standards between NHS systems in different

organisations (National Audit Office 2011). The resulting changes to the programme objectives shifted the focus to implementing organisation level EPR systems where they do not already exist and to specifying and working towards compliance with standards which will facilitate future inter-organisational interoperability (National Audit Office 2011).

1.3 Networkedness as a core focus

The networkedness of the EPR in the NHS in England is of core concern to this study because the increased sharing of information entails changes to how clinical work is done and generates ethical concerns for patients.

The UK government's vision for EPRs in the NHS in England is for a nationally networked electronic patient record that provides the capability for clinicians in any healthcare organisation to view a composite virtual patient record that draws in data from disparate electronic records systems wherever the patient was treated (Department of Health 2002). Moreover this increased scope of patient data sharing is intended not only for clinical purposes but in order to support the management and administration of the NHS (Department of Health 2008).

The drive for EPR development is founded on the problematization of existing healthcare provision in respect of timely and convenient access to information (Takian and Cornford 2012) for both clinical and non-clinical aspects of healthcare delivery. This positions the EPR and the information within them as solutions in the form of an information infrastructure enabling freer flow of granular, manipulable and timely information within and between the NHS-related bodies. Therefore the value of EPRs as conceived within the UK government vision is predicated on increased 'networkedness', in other words the scope of sharing of patient information via EPRs.

As information systems EPRs are networked at least at intra-organizational level and therefore an understanding or acknowledgement of networkedness and the distributed uses of EPR data by multiple stakeholders is fundamental to this as a study situated in the information systems discipline. I choose to make explicit this aspect of EPRs because the scale of the ambition expressed by the UK government will extend the scope of EPR systems beyond the bounds of any single organisation, bringing new opportunities and risks that are worthy of attention. It is my intention,

therefore to investigate the networkedness of EPRs to identify to what extent this vision exists, and how it is experienced by clinician-users, with particular attention to how the networkedness of EPRs influences clinical work.

1.4   Motivations: questioning the vision

Government rhetoric surrounding 'the biggest IT project in the world' (Brennan 2007, Johnson and Abiodun 2011) has been somewhat in contrast to both official reports (Greenhalgh, Stramer et al. 2010, House of Commons Committee of Public Accounts 2011, National Audit Office 2011) and opinion expressed in the media, professional healthcare circles and among patient groups about the delays, costs, risks, and as yet unrealised benefits of electronic patient records (Jones 2003, Williams 2005, Sauer and Willcocks 2007, Paterson and Grant 2010, Todd 2013). Indications from studies to date suggest a more subtle set of benefits emerging than were promised (Aderibigbe, Brooks et al. 2007, Brennan 2007, Currie and Guah 2007, Takian, Sheikh et al. 2012). The current status of the integrated electronic patient record aspect of NPfIT is delayed and partial, and where it has gone live it is questionable whether it could be said to be stabilised (Bruce 2010, Greenhalgh, Stramer et al. 2010, PublicTechnology.net 2010). Similarly the picture regarding electronic patient records worldwide is one of mixed success to date (Ash and Bates 2005, Payton, Pare et al. 2011).

This vision for the EPR entails changes in demands with respect to information inputs at the front line of clinical care and in administrative and data management roles. Some users will have new responsibilities as information providers and some will have increased access to and visibility of patient information, involving changes in accountabilities, risks and control over that information (Vikkelso 2005). Such shifts and redistributions often go unacknowledged for users of health information systems in terms of new responsibilities (Nicolini 2009).

New divisions of labour blur the boundaries between clinical and non-clinical work, redefining roles and altering professional identities (Henwood and Hart 2003, Nicolini 2009). Electronic patient records in the NHS have generated controversy not only in relation to the management of NPfIT, but also in terms of fundamental ethical concerns (Graham and Wood 2003, Anderson 2007, Thomas and Walport 2008). Anticipated concerns for patient privacy (Bomba and de Silva 2001, Andersen,

Brown et al. 2009, Singleton, Pagliari et al. 2009, Williams 2011), for clinicians' professional identities (Halford, Obstfelder et al. 2010, Korica and Molloy 2010) and the quality of patient-clinician relationships (Henwood and Hart 2003) are amongst the areas of disquiet. Changing work practices, roles and professional identities and redistributions of accountabilities, risks and areas of control all beg the question of whose and which agendas this technology benefits.

An infrastructural technology such as the EPR cannot be assumed to simply support existing work practices because it changes what counts as work (Bowker, Timmermans et al. 1996). In this respect a number of studies argue that there is a need to consider the EPR not only with respect to its feasibility as a technical implementation but in terms of the driving rationale of changing a sociotechnical system e.g. (Berg, Langenberg et al. 1998, Barjis 2010, Waterson, Glenn et al. 2011). I am therefore explicitly making my focus the EPR as a socio-technical system and critically attending to the multiple subjective interpretations and experiences of the technology.

I will take a broadly critical stance with the aim of challenging the assumptions underlying the development and use of electronic patient records in order to reveal aspects of the socio-technical system which are hidden and views which are neglected (Doolin and Lowe 2002). By giving weight to the reality of users' experiences of the EPR I also aim to recognise the ways in which power and politics are implicated in the implementation and use of EPRs and consequently be able to say something about their wider social implications (Howcroft and Trauth 2004).

Criticality also entails a general attitude of reflexivity towards the subject matter and the ways in which it is researched as a means to produce new insights (Howcroft and Trauth 2004). For example, my own experience as a patient and as a recipient of publicity campaigns about Summary Care Records and care.data (NHS England 2014) and public debate about the sharing of patient data formed a backdrop to my critical motivations with respect to the ethical and other challenges implied by EPRs. Reflexivity in terms of consideration of my own role within the research and being able to take a meta view of the phenomenon and the research process plays a role in shaping my research methodology.

It has been argued that rather than designating specific theories or approaches as 'critical' it is more useful to define criticality in terms of the researcher being motivated by an aim to support emancipation with respect to challenging assumptions or existing practices, particularly in terms of social relations and ensuing manifestations of power (Stahl 2008, Cecez-Kecmanovic 2011).

I propose, by using this operational definition of criticality, and through being revelatory in the use of ANT, to satisfy a critical intent to reveal the underlying drivers and interests behind EPRs. Attending to aspects of reality which are otherwise overlooked lends ANT not only the potential to be used critically, but also to presenting a more authentic and convincing account of reality.

It is commonly argued in interpretive and critical IS research about IT-enabled change programmes that it is problematic to believe that the technology alone will suffice e.g. (Hartswood, Procter et al. 2003, Jones 2004, Sauer and Willcocks 2007, Halford, Obstfelder et al. 2010, Takian, Sheikh et al. 2012). This appears to be borne out by the difficulties experienced with EPR implementation programmes such as the NHS Care Records Programme, which was a key part of the UK NHS' National Programme for IT. This supports my contention that the EPR cannot be considered unquestionably beneficial, and sets the scene for my research question and objectives as outlined below.

I have elected to use Actor-Network Theory (ANT) as a theoretical methodological approach to researching EPRs, and state this theoretical allegiance up front as a foundational assumption rather than conducting an artificial exploration of alternatives, justifying my choice of approach in Chapters 3 and 4. This enables me to engage more thoroughly with theoretical and methodological concerns. As a consequence of my unapologetic use of ANT it is threaded through and guides the whole research endeavour, and the emphasis I have afforded to theoretical and methodological concerns is reflected in the inclusion of an explicit objective to evaluate Actor-Network Theory as an approach.

1.5   Purpose and Objectives of the Research

1.5.1 Research Question

This research seeks to address the following primary question: How does the electronic patient record produce benefits to users?

1.5.2 Research Objectives

- To map the network of relations which the electronic patient record simultaneously creates and emerges from.
- To identify whether and how the electronic patient record benefits user-stakeholders i.e. individuals and groups who use the EPR as providers or consumers of information for the purposes of healthcare delivery.
- To discover whether it is possible using Actor-Network Theory to give an account of the electronic patient record as an elusive and 'messy' object and as such contribute to the debate on research methodology.
- To produce practical methodological insights for the application of Actor-Network Theory to empirical research.

I will briefly set out my philosophical and disciplinary starting point as an Information Systems researcher as a means of justifying my assumptions.

1.6 Information systems research

Information Systems (IS) as a discipline is concerned with technology *in use* (Underwood 2008), emphasising that both technical and social elements need to be considered. IS has a fundamental objective of enabling successful information systems (Petter, DeLone et al. 2012). This entails theorising information systems to inform practice in ways which can improve the prospects of achieving success, whilst also acknowledging that notions of IS success and failure are contested e.g. (Wilson and Howcroft 2000, Berg 2001, Scott and Wagner 2003). Petter et al (2012) document a shift in the conceptualisation of success in information systems practice from a focus on technical factors to a focus on human factors. The trend in IS research has evolved over time from technologically determinist approaches which investigate the effects of technologies on social systems to research which focuses on human and social factors (De Vaujany 2005).

Within IS it is now something of a cliché to say that systems development is influenced by organisational and social issues (Lines, Andersen et al. 2004) such

that social constructivist approaches to theorising information systems in organisations are no longer radical.

Common threads in the historical development of Information Systems and the social sciences as domains of knowledge are associated with social theory coming to be applied by IS researchers and information systems becoming acceptable objects of study for sociologists and anthropologists (Avison and Myers 1995, Howcroft, Mitev et al. 2004, De Vaujany 2005, Woolgar, Coopmans et al. 2009). This highlights an evolution in academic thought within the social sciences which has seen an increase in attention to artefacts, including technologies and information systems, as legitimate objects of study, with acknowledgement of their roles within sociality (De Vaujany 2005). This has led to efforts to theorise digital technologies, information systems and technical infrastructures e.g. (Star 1999, Ciborra, Braa et al. 2000, Kallinikos, Aaltonen et al. 2010, Savage, Ruppert et al. 2010, Tilson, Lyytinen et al. 2010). For these reasons there has been increasing acknowledgement and use of non-positivist approaches and theories within Information Systems which attend to sociality, although it is argued that these still remain in the minority (Chen and Hirschheim 2004).

1.7   Social shaping approaches to theorizing technology

Identifying with a type of IS research that renounces technicist and positivist explanations whilst recognising the social within IS this thesis applies a particular strand of 'social shaping of technology' approach in Actor-Network Theory. Non-positivist approaches counter the positivist tendency to abstract and decontextualize artefacts and phenomena by aiming to 'add the context back in' (Strathern 2002). In this way technological development is seen as contingent on heterogeneous local factors rather than operating independently (Brey 1997).

Faithful to its postmodern heritage Actor-Network Theory rejects the notion of an objective external reality which can be discovered by a detached observer-researcher, and also rejects the positivist agenda to derive universal laws (Calás and Smircich 1999). Instead, in common with other social shaping approaches to technology, it takes a broadly social constructivist stance as a response to and

critique of positivism, and when applied to information systems, as a critique of technologically determinist positions (Howcroft, Mitev et al. 2004).

Social constructivism considers reality, including technological phenomena, as socially constructed and contingent upon multiple heterogeneous factors, and for this reason it aims for understanding of phenomena *within* a specific context (Sismondo 2004). Discussion of what this position means for the generalizability of research is taken up in the Research Methodology chapter.

Social constructivists argue that technology is socially constructed and can be explained by reference to social practices and social context, acknowledging that users shape and influence the technologies they use such that technological innovations may produce different outcomes in different settings and may be used in unexpected ways (Brey 2005); they, may not be accepted by users and their use may be variously resisted, avoided or subverted (Timmons 2003, Aderibigbe, Brooks et al. 2007).

It has been observed that in so far as the focus of social constructivist approaches shifts to the users of technologies and their contexts, the role of the technology itself may be underplayed. Because of previous neglect of the social in IS research by positivist approaches, it became somewhat blasphemous within anti-positivist approaches to discuss the effects of the technology, so that it could be under-theorised or invisible (De Vaujany 2005). As such social constructivist approaches to information systems have been criticised for a tendency to neglect the technological artefact in their eagerness to account for the social aspects of organisational systems (Bloomfield and Vurdubakis 1994, Joerges and Czarniawska 1998, Orlikowski and Iacono 2001, Hanseth, Aanestad et al. 2004, Sawyer and Crowston 2004, Rose, Jones et al. 2005, Østerlund and Bjørn 2011).

Technological determinism and social constructivism, as naïve positions at each end of a spectrum are argued to be equally unpalatable even if they are only 'straw man' positions because they both imply causal relationships reminiscent of positivism (De Vaujany 2005, Rose, Jones et al. 2005). As a result integrative approaches to theorising technology and society have developed (Brey 2005, De Vaujany 2005), of which Actor-Network Theory is one, occupying an intermediate position between

technological determinism and naïve social constructivism (Jones 1998, Brey 2005, Rose, Jones et al. 2005), and rejecting both (Monteiro 2000).

Unlike technologically determinist perspectives Actor-Network Theory (ANT) holds that the attributes of an entity do not exist as inherent properties, making it anti-essentialist (Tatnall and Gilding 1999). Moreover what distinguishes Actor-Network Theory from 'strong' social constructivism is its rejection of the dichotomies widely accepted within social sciences, including the divide between the social and the technical (Tatnall and Gilding 1999).

Whilst approaches to information systems have become more sensitive to social context and more human-centred, they nevertheless retain the dichotomy between the social and the technical (Bloomfield and Vurdubakis 1994, De Vaujany 2005). Actor-Network Theory is distinctive amongst other 'social shaping' approaches in theorising everything as hybrids of technical and social elements; heterogeneous assemblages known as 'actor-networks' (Law 1992).

This introduction sets out my intention to use Actor-Network Theory for the research of EPRs in the NHS in England. The theory is discussed in greater detail and its use in relation to my research question, aim and objectives are justified in chapter 3.

CHAPTER 2 – LITERATURE REVIEW

This chapter reviews the literature related to Electronic Patient Records as a particular breed of health information system, outlining the types of EPR literature considered in the context of my chosen approach.

2.1 Positioning the study in the interpretive & critical traditions

The literature on electronic patient records and on health information systems more broadly is extensive and includes contributions from a range of disciplines including Information Systems, Medicine, Health Informatics, Sociology and Organisation Studies amongst others, cutting across multiple academic traditions, each with their own philosophical assumptions and approaches (Greenhalgh, Potts et al. 2009). In the introduction I took up a position acknowledging the importance of the social within information systems research, and taking a socio-technical systems perspective I situate my research philosophically as interpretivist. My motivations also position this study as fundamentally critical in seeking to provide what Doolin (1998) calls a 'reflective treatment of technology'.

Quantitative studies are often associated with overly-simplistic models of how technologies function and are implicated in bringing about particular changes within organisations, a perspective which is at odds with my underlying interpretivist philosophy. I propose that qualitative approaches are better equipped to produce more complete and coherent accounts of complex and contingent phenomena like electronic patient records.

I will discuss my philosophical perspective, choice of research approach and methodology in detail in the Research Methodology chapter. The implications of this are that I focus primarily on qualitative rather than quantitative literature, with the exception of overview studies about electronic patient records which provide useful scene setting for this topic. Furthermore literature which focuses on the technical and functional aspects of EPRs is also out of scope.

In rejecting positivist approaches I also aim to avoid narrowly defined conceptions of EPR success in terms of expected benefits. It has been noted that much of the literature about EPRs tends to focus in a limited way on functional dimensions in terms of usability and fitness for purpose (Checkland, McDonald et al. 2007), or on

how EPRs have brought about changes to work-related outcomes (Halford, Obstfelder et al. 2010) with little consideration of subjective user experiences or critical analysis of effects, including more emergent and subtle influences (Checkland, McDonald et al. 2007, Halford, Obstfelder et al. 2010).

My starting position for a review of the literature is therefore an interest in studies which recognise the importance of the social systems and local contexts within which technologies are used, and which seek to understand the experiences of the users of information systems rather than starting from idealised, rational perspectives on how information systems work.

2.2   Defining EPRs

The NHS describes the electronic patient record as "a way of viewing a patient's medical record through a computerised interface" (NHS Institute for Innovation and Improvement 2006-2013). This is the fundamental understanding, and depending on the software product it may incorporate a range of functionalities in a more or less modular way (Ellingsen and Monteiro 2000, Khurana, Ogston et al. in press). These elements may be contributed by various suppliers and can include, in addition to medical notes, lab reports and test results; treatment ordering, clinical decision support and radiology images for example (Khurana, Ogston et al. in press). Although the electronic patient record is discussed as a discrete entity it is not a standalone technology; it is often tightly coupled to other parts of the information infrastructure and may lack clear-cut distinction from existing applications, particularly Patient Administration Systems (PAS) which pre-date EPRs in hospital settings (Ellingsen and Monteiro 2000), and in this way its definitions and boundaries become blurred.

A number of studies acknowledge the varied and contested definitions of EPRs, and that the technology is subject to competing representations (Ellingsen and Monteiro 2000, Elberg 2001, Häyrinen, Saranto et al. 2008, Greenhalgh, Potts et al. 2009, Singleton, Pagliari et al. 2009), apparent in the use of a variety of terminology as shown in Figure 3 below.

Type of EHR (ISO)	Definition	Reference number
Table 2 – Types of EHR		
Electronic medical record (EMR)	Generally focused on medical care	
Departmental EMR (n = 29)	Contains information entered by a single hospital department	
Picture archiving and communication system (PACS)		[20–22]
Anaesthesia records		[23–26]
Intensive care records		[27–30]
Ambulatory records		[31]
Emergency department systems		[32–36]
Pathology laboratory system		[37]
Oncology records		[38]
Cardiology records		[39]
Operation theatre records		[40]
Gynaecology records		[41]
Internal medicine records		[42]
Pharmacy systems		[43,44]
Geriatric centre records		[45]
Diabetes clinic records		[46]
Radiology reporting system		[47,48]
Inter-departmental EMR (n = 2)	Contains information from two or more hospital departments	
Obstetric records for inpatient and outpatient clinics		[49]
Prescribing system		[50]
Hospital EMR (n = 8)	Contains all or most of patient's clinical information from a particular hospital	[51–58]
Inter-hospital EMR	Contains patient's medical information from two or more hospitals	–
Electronic patient record (EPR) (n = 13)	Contains all or most of patient's clinical information from a particular hospital	[59–71]
Computerized patient record (CPR) (n = 13)	Contains all or most of patient's clinical information from a particular hospital	[72–77,91–97]
Electronic health care record (EHCR) (n = 1)	Contains all patient health information	[78]
Personal health record (n = 8)	Controlled by the patient and contains information at least partly entered by the patient	[79–86]
Computerized medical record	Created by image scanning of a paper-based health record	–
Digital medical record	A web-based record maintained by a health care provider	–
Clinical data repository	An operational data store that holds and manages clinical data collected from health service providers	–
Electronic client record	Scope is defined by health care professionals other than physicians, e.g. by physiotherapists or social workers	–
Virtual EHR	No authoritative definition	–
Population health record	Contains aggregated and usually de-identified data	–

Figure 3. Types of EHR (Häyrinen, Saranto et al. 2008)

Electronic patient records may be variously conceptualised as applications and as organisation-wide information systems (Elberg 2001, Greenhalgh, Potts et al. 2009). Therefore the EPR sits somewhere on a spectrum from a locally-held electronic document that straightforwardly replicates the paper-based medical history of a patient, to a nationally networked and shared set of information storage, communication, categorisation and processing functionalities more akin to an information infrastructure.

For the purposes of this study I consider EPRs to be electronic medical records containing a patient's biographic details and (longitudinal) medical history shared on

an organisation-wide basis within a given healthcare organisation, and potentially with other healthcare organisations within the NHS.

Considering health information systems as information infrastructures, their technical heterogeneity, the diversity of stakeholders, and the complexity arising from integrating multiple technical elements across organisational boundaries make it challenging to predict costs and benefits (Bygstad and Hanseth 2011). This is due in part to the difficulties of understanding the dynamics of large and complex technical systems (Joerges 1988), and their emergent properties and unpredictable consequences (Hanseth and Lyytinen 2010). Furthermore this highlights the methodological difficulty of researching a technology which is multiple and indefinite and, as outlined in my introduction, by rejecting a solely micro level view of EPRs I also reject the possibility of constraining that definition within the bounds of a particular use context. Rather, by cutting across levels of analysis from micro through to macro levels I aim to acknowledge and explore this multiplicity with the intention of achieving new insights. This is discussed further in the Research Methodology chapter.

2.3   Perspectives on EPRs

Electronic patient records are used in different ways by different groups of clinical users (Oborn, Barrett et al. 2011) and implementations in hospitals have produced varied outcomes (Ellingsen and Monteiro 2000). This is indicative of the diversity of use contexts and roles involved in delivering care, and recognises the potential for different perspectives on the same technology. This also reflects the 'interpretive flexibility' of information systems in terms of the notion of different experiences across user constituencies, which is a central theme within qualitative IS literature e.g. (Bloomfield and Coombs 1992, Bloomfield and Vurdubakis 1994, Ellingsen and Monteiro 2000, Dawson and Buchanan 2005), and also recognised specifically in relation to EPRs (Henwood and Hart 2003, Papazafeiropoulou and Gandecha 2007, Sheikh, Cornford et al. 2011).

Diverse user perspectives are reflected in the ways in which EPRs and other health information systems apparently bring benefits to some whilst being resisted by others. The literature reflects the breadth of contexts and potential meanings for electronic patient records. A number of studies examine the use of EPRs from the

perspective of particular clinical roles and types of healthcare setting, including nursing (Goorman and Berg 2000, Henwood and Hart 2003, Timmons 2003, Aderibigbe, Brooks et al. 2007, Stevenson, Nilsson et al. 2010), GPs (Winthereik, Van Der Ploeg et al. 2007, Christensen, Faxvaag et al. 2009), surgery (Jensen and Aanestad 2007, Korica and Molloy 2010), mental health (Hardstone, Hartswood et al. 2004, Takian, Sheikh et al. 2012) and hospital medicine (Halford, Obstfelder et al. 2010, Haland 2012).

There are a number of studies, particularly from the CSCW tradition, which focus on the implications of introducing EPRs at the level of particular wards, departments, or specialisms, which enables discussion of how well they fit, support, change or undermine clinical activities in those contexts, including an Emergency Department e.g. (Vezyridis, Timmons et al. 2011), maternity services e.g. (Henwood and Hart 2003) and community mental health e.g. (Hardstone, Hartswood et al. 2004).

Technicist approaches to EPR implementations tend to conceptualise the technology as a straightforward representation and factual account of the patient and their care (Halford, Obstfelder et al. 2010) based on conceptualising the patient, the body and clinical knowledge and work as fixed and objective (Berg, Langenberg et al. 1998, Halford, Obstfelder et al. 2010). It is argued, however, that this conception is flawed and therefore the promised benefits of EPRs are likely to prove hard to realise (Halford, Obstfelder et al. 2010). Moreover, it is suggested that eHealth studies are mainly conducted at organisational level and tend to narrowly focus on the production of rationalistic accounts of technology use that inevitably neglect to account for the use context or wider contextual influences in which the healthcare organisation operates (Troshani and Wickramasinghe 2014).

This creates an argument for research that presents a more nuanced and realistic view of what the EPR is and how it shapes and is shaped by the organisation and individual users.

2.4 The healthcare context

The literature highlights the complex and heterogeneous nature of healthcare and healthcare organisations, recognising that they present a challenging implementation context that entails particular needs with respect to implementing information

systems e.g. (Hardstone, Hartswood et al. 2004, Cho, Mathiassen et al. 2008, Tjora and Scambler 2009). The inherently collaborative nature of clinical work generates a demand for real time information and support for the coordination of work between different groups (Morrison, Fitzpatrick et al. 2011, Oborn, Barrett et al. 2011, Vezyridis, Timmons et al. 2011).

The medical context is characterised by the distributed and mobile nature of the workforce and the ways in which certain material artefacts and information systems are tied to particular locations (Østerlund 2008). This has resulted in healthcare organisations (in particular large organisations such as hospitals) having an array of disparate information systems (Østerlund 2008), which creates a challenge for attempts to create an authoritative, all-encompassing, integrated information system such as an EPR (Ellingsen and Monteiro 2000).

The EPR may be seen as a means to bring together disparate elements of clinical work within a single 'location' to make them more manageable and accessible (Halford, Obstfelder et al. 2010). However despite the potential to integrate multiple information flows and data processing functionalities there may be problems with trying to make the EPR the single definitive source of clinical information, and it is suggested that allowing for a more 'patchwork' like information ecosystem may be a better strategy (Ellingsen and Monteiro 2000). In this respect the ecological flexibility of paper within collaborative work is recognised (Luff, Heath et al. 1998, Morrison, Fitzpatrick et al. 2011, Vezyridis, Timmons et al. 2011). Within a fragmented information ecosystem the heterogeneous nature of the healthcare environment entails the need for additional work to create shared understandings when diverse groups of people are using the same set of informational artefacts and media (Bossen 2002).

EPRs are intended to capture clinical information about the patient in digital form, 'freeing' it from paper records and by making it more mobile, thereby supporting the information needs of distributed healthcare professionals, and making work processes and communications more efficient (Goorman and Berg 2000, Aderibigbe, Brooks et al. 2007, Takian and Cornford 2012).

2.5 The National Health Service context

By comparison with national healthcare systems which are largely private, or that mix public and private provision, the NHS, as the universal healthcare provider in the UK is usually perceived as a single organisation serving the whole population. In addition to the peculiarities of the healthcare context generally, it is acknowledged that the National Health Service in the UK is a particularly complex context for information systems implementations because it operates in practice as multiple, largely autonomous organisations (Greenhalgh, Stramer et al. 2010, Robertson, Cresswell et al. 2010, Currie and Finnegan 2011, Takian and Cornford 2012) even though it tends to be presented to the public as a monolithic entity.

The NHS has proved to be a popular focus for IS research not least because of this complexity. That the NHS is one of the world's largest employers (Booth 2003) is an indication of the scale of the project to provide healthcare within the UK. Against this backdrop the National Programme for IT (NPfIT) was claimed to be the largest public IT project in the world (Williams 2005, Brennan 2007) which, because of its scale and uniqueness has also made it an attractive and important focus for research. Moreover centralised IS implementation programmes in large and complex organisations, like that planned as part of NPfIT, are inevitably challenging.

A number of authors have observed the mixed success of EPR systems worldwide with successful uptake of EPRs in global terms generally low (Sauer and Willcocks 2007, McGrath, Hendy et al. 2008, Tjora and Scambler 2009, Zwaanswijk, Verheij et al. 2011). This picture is borne out by the difficulties experienced by the UK National Programme for IT, of which development of EPRs under the National Care Records Service was a central aspect.

The NPfIT was intended to deliver EPRs throughout the NHS according to a relatively prescriptive centralized vision, which ended with the NPfIT's unravelling and eventual abandonment announced in 2011 (Mathieson 2011, National Audit Office 2011, Whitfield 2011, Takian and Cornford 2012, Khurana, Ogston et al. in press), completed in March 2013 with the dismantling of Connecting for Health, the agency responsible (House of Commons Committee of Public Accounts 2013).

Whilst the majority of GP practices already have an organisational EPR system (Jones 2003, Khurana, Ogston et al. in press) EPR implementation projects in hospitals in particular have met with limited success (Jones 2004, Sheikh, Cornford et al. 2011). Recent research has found that amongst UK hospitals only 11% have a basic electronic patient record, 3.4% have an EPR with clinical notes (which could be considered the 'core' of an EPR) and none have what could be called a comprehensive record (Khurana, Ogston et al. in press). This presents an NHS landscape characterised by significant differences in uptake and maturity of EPRs, particularly in hospitals (Robertson, Cresswell et al. 2010, Khurana, Ogston et al. in press).

The NPfIT objective for secondary care planned a phased approach starting with implementation of Patient Administration Systems. The original aim set out in "Information for Health" (Burns 1998) aimed for all Trusts to have implemented EPRs by 2002, with the target later changed to all *acute* Trusts to have implemented EPRs by 2005 (Hendy, Reeves et al. 2005), providing an indication of the delays and shifting objectives that have beset the development of EPRs.

Considering this picture of mixed success in the context of the theory-practice gap in IS, the well-worn arguments for greater attention to be paid to users' work practices and organisational context have not necessarily changed the ways in which large scale IT implementations are approached (Eason 2007).

It is recognised that a more locally sensitive bottom-up approach in the NHS could reduce the likelihood of achieving a nationally shared record due to lack of interoperability standards (Robertson, Cresswell et al. 2010, Eason, Dent et al. 2012). In terms of responsiveness to local needs a number of authors commenting on the vagaries of the NPfIT have advocated an evolution towards a 'middle-out' approach e.g. (Coiera 2009, Morrison, Robertson et al. 2011, Eason, Dent et al. 2012). Indeed the eventual abandonment of NPfIT as a centralised programme signals a move away from the original top-down strategy.

2.6 The UK government vision

Electronic patient records are discussed in a number of studies of IT-enabled organisational change in terms of the ways in which they can support new

organisational structures and processes in healthcare (Elberg 2001, McGrath, Hendy et al. 2008, Waterson, Glenn et al. 2011). They are central to long-term healthcare strategies as a supporting technology for a range of objectives related the changing nature of healthcare provision in the contemporary context. This includes, for example, the reconfiguring of relationships with patients in order to both empower them as 'expert patients', building capacity for self-managed care, and making healthcare more patient-centred (Department of Health 2004, Department of Health 2012). Furthermore certain aspects of healthcare strategy such as telehealth and patient access to electronic records presuppose an electronic patient record infrastructure, therefore they can be seen as a foundation for other healthcare innovations and technologies e.g. (Iakovidis 1998, Nicolini 2006).

The coordination of work between diverse professional groups and domains of expertise across multiple locations has long been characteristic of healthcare provision and in this context communications have been seen as being slow, inefficient and prone to errors, miscommunications and data losses (Burton, Anderson et al. 2004, Parlimentary Office of Science and Technology 2004). The concept of the EPR therefore rests on the idea of supporting and improving interdisciplinary communications, coordination and collaboration between different clinical functions and specialisms (Halford, Obstfelder et al. 2010, Oborn, Barrett et al. 2011) by enabling central recording and visibility of the various accounts of patient interactions within a 'single truth' record.

Support for care coordination is particularly important for patients with chronic conditions such as diabetes, and/or multiple conditions, known as co-morbidities, where patients are likely to experience care pathways which cut across multiple organisations (Burton, Anderson et al. 2004). As a tool for standardised communications electronic patient records are seen as a means to enable 'seamless' patient care across multiple healthcare contexts (Cresswell and Sheikh 2009) enabling all healthcare professionals involved in a patient's care to be able to see the same and most up to date information about the patient, which is expected to enhance the quality of care and the patient's experience (Winthereik and Vikkelsø 2005, Department of Health 2012).

2.7   The marketized and informatized public sector

The public sector context in the UK in which EPR implementations are taking place is one which is being played out in a broadly similar fashion in a number of other European countries (Iakovidis 1998, Tjora and Scambler 2009). There are a number of common themes related to the reform of healthcare systems, including reorientation towards more market-based models, pressures from inelastic patient demand, increasing patient expectations and decreasing financial resources that are driving efficiency-based agendas (Department of Health 1997a, Department of Health 1997b, Cullen 1998, Darzi and Britain 2007, Halford, Lotherington et al. 2010).

There has been a trend over the past 30 – 40 years in the UK and other developed countries of successive reforms in health services, and it is clear that this is now the norm rather than the means to reach a new long lasting and stable state, and moreover that EPRs have been designated a central role within current reforms e.g.(Takian and Cornford 2012). The large scale development of EPRs signals a potentially far-reaching set of changes to the fundamental shape of healthcare (Checkland, McDonald et al. 2007), even though they cannot be said to be a wholly new innovation.

The broad flavour of these 'new public management' reforms is of bringing management ideas into public services so that they become more 'business-like' (Doolin 2002, Doolin 2003, Winthereik, Van Der Ploeg et al. 2007, Halford, Obstfelder et al. 2009). It has involved increasing the role of management within healthcare and embedding the idea that managers and managerial control are required to engender the new ideology (Bloomfield 1991, Bolton 2003, Currie and Guah 2007).

The new discourses are those of economic rationalism, emphasising the efficient management of resources, clinical effectiveness and accountability (May 2006, Jensen, Kjærgaard et al. 2009). As such management agendas, with their focus on control and cost efficiency, are arguably at odds with the ideology and values underpinning healthcare, which emphasise professional clinical autonomy in decisions about how to treat the patient (Bloomfield 1991, Harrison and Dowswell 2002, Haland 2012, Reich 2012), caring and cooperation (Doolin 2003, Guah,

Hackney et al. 2009), and quality of care (Bloomfield 1991, Haland 2012, Reich 2012).

The 'hard' rationalities which prevail in healthcare can be the source of design-reality gaps with respect to information systems such that technology-driven worldviews, managerial objectives that prioritise cost efficiency, and medical rationalities which encourage conceptions of healthcare provision as rational and objective tend to dominate (Heeks 2006).

It is recognised in the IS literature that information systems tend to reflect and reproduce a particular take on organisational reality, often that of dominant groups (Bloomfield and Coombs 1992, Suchman 1995). Information systems can be seen as focal points through which institutions influence social practices and values and within organisations as "sociotechnologies of calculation and control" (Doolin and Lowe 2002). In this respect they are said to embody the values and objectives of those implementing them (Bloomfield and Coombs 1992, Doolin 2003), which support the ideology and practices associated with the economic market view of healthcare through those rationalist viewpoints becoming inscribed within the design of health information systems (Bloomfield and Coombs 1992). This is manifested, for example, through EPR systems enabling NHS managers to collect data about clinical activities and their outcomes, which can be used for performance management (Timmons 2003, Care Record Development Board 2007, Reich 2012).

Studies recognise the dual clinical and management benefits promised by EPRs (Winthereik, Van Der Ploeg et al. 2007, Halford, Obstfelder et al. 2010) where secondary uses of patient data captured in EPRs offer advantages to non-clinical aspects of healthcare provision, including for example administration, research, audit and planning (Parlimentary Office of Science and Technology 2004, Thorp 2007, Morrison, Robertson et al. 2011). The EPR affords significant opportunities in these respects and is part of a wider government strategy to exploit the potential of public sector information as a by-product of public services provision (Abd Hadi and McBride 2000, Thorp 2007, Power of Information Taskforce 2009, Cabinet Office 2011).

In the UK NHS (Checkland, McDonald et al. 2007) and other Western healthcare systems (Winthereik, Van Der Ploeg et al. 2007)standardised data sets are routinely collected by the bodies in charge of healthcare management and administration (Checkland, McDonald et al. 2007, Winthereik, Van Der Ploeg et al. 2007). Ongoing reforms of healthcare in the UK are generating more exacting demands for clinical information for 'central returns' datasets, which must be supplied by all NHS organisations (NHS England and the Health and Social Care Information Centre 2013).

Government imposed performance targets linked with measures of care quality strongly shape the information requirements of NHS organisations such that EPRs are seen as an unavoidable and necessary means to support the management of patients and to meet externally driven information needs in a way which using paper-based systems cannot (Vezyridis, Timmons et al. 2011). For example, the introduction by the Department of Health of the Quality Outcomes Framework (QoF) targets for GPs in 2004 (updated in 2006) put in place reporting requirements which generated a need for more structured and sophisticated EPRs for GPs in primary care (Checkland, McDonald et al. 2007).

The size and value of the market in supplying health information systems is considerable (Brennan 2007, Sugden, Wilson et al. 2008). This is also apparent in the attention drawn by the substantial financial investments in EPR implementation programmes and the implication that the stakes are high e.g. (Brennan 2007, Currie and Guah 2007, Morrison, Robertson et al. 2011, Khurana, Ogston et al. in press). A significant gap is perceived between the beneficial potential of health information systems and the costs involved in developing them, with a high risk of failing to realise value for money (Parlimentary Office of Science and Technology 2004, Heeks 2006, Sidorov 2006, McGrath, Hendy et al. 2008, Khurana, Ogston et al. in press). Moreover benefits to the quality of healthcare, one of the objectives of the NPfIT as originally outlined by the UK government (Burns 1998, NHS Executive 2001), are as yet arguably inconclusive (Uslu and Stausberg 2008, Greenhalgh, Stramer et al. 2010, Khurana, Ogston et al. in press). It is perhaps to be expected from a long term and multi-faceted strategy that benefits to healthcare will take time to become evident, if indeed they do and are amenable to evaluation.

2.8   EPRs and the National Programme for IT

As a part of the NPfIT's prescriptive, top-down 'push' strategy, EPR developments have been criticised as not having been led by local Trust needs (Eason 2007). The 'one size fits all' approach does not necessarily entail good alignment with the requirements of highly diverse Trusts because of a lack of sensitivity to local needs and priorities (Eason 2007, Bjørn, Burgoyne et al. 2009, Robertson, Cresswell et al. 2010) and as such critics question the ability of EPRs to fit the work practices of diverse groups of users (Oborn, Barrett et al. 2011). It is argued that the EPR has different meanings and uses amongst different user and stakeholder groups which entail the need to consider and accommodate disparate and potentially conflicting requirements within the design (Greenhalgh, Potts et al. 2009, Oborn, Barrett et al. 2011).

In this respect it has been found that where end users do not see any benefits from using the technology then they will tend to find ways in which to restrict the extent to which the new system affects existing work practices by avoiding use or finding workarounds (Timmons 2003, Aderibigbe, Brooks et al. 2007, Eason 2007). Sheikh, Cornford et al. (2011) suggest, in their evaluation of EPRs within secondary care early adopter sites, that although early benefits were noted in terms of legibility and 'anytime, anywhere' accessibility' of records, the main users at that stage were administrative staff and Allied Healthcare Professionals (AHPs), and it was not clear whether there were other benefits to clinical users and to organisations overall. Furthermore the extent to which EPRs are used varies according to the clinical work practices in different healthcare settings, and how much the technology supports or fails to support those work practices (McGrath, Hendy et al. 2008). Moreover top-down EPR development may be a backwards step for some where sophisticated and well-aligned information systems already serve particular specialisms and clinical functions (McGrath, Hendy et al. 2008).

There is a tendency for information systems models driven by rationalistic agendas to be based on abstract and idealised views of users' roles and work practices and this can entail a poor fit and may have unintended negative consequences (Berg, Langenberg et al. 1998, Waterson 2014). This kind of mismatch is arguably apparent in the NHS implementations, for example in relation to lack of user consultation,

particularly of nurses, who constitute the vast majority of the healthcare workforce but who have had little input into the design of EPR systems (Henwood and Hart 2003, Stevenson, Nilsson et al. 2010).

2.9   The design-reality gap

Studies in the NHS which have focussed on user experiences and opinions about in-use EPRs suggest a mismatch between what users want and expect in terms of an abstract idealised view of the potential of the technology based on top-down communications about the system's purposes and functions, and how these are realised in practice at local level (Heeks 2006, Robertson, Cresswell et al. 2010, Stevenson, Nilsson et al. 2010, Takian, Sheikh et al. 2012). It has been suggested that, despite the unfulfilled promises of EPRs as envisioned by NPfIT, NHS staff nevertheless continue to be supportive of the broad aspirations of the programme (Takian and Cornford 2012). In one study anticipated benefits of EPRs amongst clinicians related to expectations of a local level longitudinal electronic patient record rather than a nationally or regionally shared Summary Care Record or Detailed Care Record which were objectives of the NPfIT (Robertson, Cresswell et al. 2010).

Whilst there is always work which has to be done by users to square technology with local practices, because fit is never perfect (and indeed a perfect fit would entail little benefit in terms of transforming work practices) (Heeks 2006), not adequately addressing gaps between design and users' practices is to risk engendering resistance, and making workarounds necessary in order to maintain a coherent flow of work (Nicolini 2006, Stevenson, Nilsson et al. 2010). New types of medical error may be introduced (Harrison, Koppel et al. 2007, Waterson 2014), and workarounds needed to mitigate poor fit (Ash, Berg et al. 2004, Takian, Sheikh et al. 2012). In particular, poor consideration of real work practices in the design may generate considerable hidden articulation work to maintain coherent processes (Berg and Goorman 1999). This work may be masked by the impression of greater efficiency associated with the use of the technology and anticipate a failure to realise promised benefits.

2.10   EPRs and clinical work practices

At the heart of the rhetoric about the role of EPRs in modernising the health service is the aim of establishing new ways of working which can better support such a

diverse and distributed workforce (Halford, Obstfelder et al. 2010). That electronic patient records have a role in changing clinical work practices in substantial ways is widely acknowledged, e.g. (Ellingsen and Monteiro 2000, Bruni 2005, Vikkelso 2005, Morrison, Fitzpatrick et al. 2011, Haland 2012). In this respect unintended consequences of information systems in organisations are a common theme in interpretivist and critical IS literature, with numerous studies focussing on the healthcare context e.g. (Ash, Berg et al. 2004, Vikkelso 2005, Aderibigbe, Brooks et al. 2007, Harrison, Koppel et al. 2007).

A more subtle conceptualisation of the organisational consequences of EPRs is that there are not only transformations of individuals' roles and work practices as aspects of the socio-technical system, but that these entail *redistributions* of responsibilities, risks and organisational attention (Star and Strauss 1999, Vikkelso 2005). In the context of EPRs, whilst there is a much reduced risk of losing patients' records as compared with paper case notes, there is now greater risk of unauthorised access to them in electronic form. Redistributions of work serve to create new divisions of labour (Vikkelso 2005, Haland 2012) so that across different professional groups certain work tasks are taken away whilst new responsibilities are gained and this implies a redefinition of professional identities with respect to what any role means (Haland 2012). This means that healthcare is not so much improved but rather reconfigured and altered in nature (Vikkelso 2005), and this brings both benefits in terms of solutions to the 'old' problems but also generates new challenges (Stevenson, Nilsson et al. 2010).

2.10.1 Invisible work

The redistribution of work responsibilities introduces new forms of invisible work, which are needed in order to make technology related processes and practices 'work' and to integrate the technology with existing practices, much of which goes unacknowledged (Star and Strauss 1999, Vikkelso 2005). This includes the embodied 'silent' knowledge and practices which make work 'flow' (Halford, Lotherington et al. 2010) and therefore challenges the notion that EPRs necessarily make work more efficient.

By prioritising certain accounts of care electronic patient records also manifest power relations through the stratification of individuals into roles as providers of information,

decision-makers and executors of instructions, thereby acting to reproduce institutional hierarchies (Halford, Obstfelder et al. 2010). This may serve to make the work of those who respond to instructions and requests rather than generating them, and those who read rather than record less visible (Halford, Obstfelder et al. 2010).

2.10.2 Redundancy

The new public management ideology incorporates the notion of 'quality management' which asserts that successful organisational operations are predicated on continual process improvements to bring about the reduction or elimination of waste (Wilkinson and Willmott 1995). Whilst there is an inclination within the rationalising models driving EPR development to reduce redundancy (Hanseth, Jacucci et al. 2007, Tjora and Scambler 2009), through minimising double recording of patient information for example, what are generally seen as inefficiencies may also serve a useful purpose (Berg, Langenberg et al. 1998, Ellingsen and Monteiro 2000, Tjora and Scambler 2009), for example where redundancy in medication ordering processes allows medications to be re-checked before being issued (Ash, Berg et al. 2004).

It is suggested that redundancy may support organisational resilience to errors (Ellingsen and Monteiro 2000, Tjora and Scambler 2009). It is also argued that because EPRs entail tighter coupling of processes within clinical workflows, they may increase the risk of unpredictable and serious errors, for example by making digital test results easier to overlook and prescribing errors harder to detect (Vikkelso 2005).

Moreover paper records for all their flaws may provide valuable occasions for interaction with colleagues and opportunities to build relationships and receive support (Vikkelso 2005, Vezyridis, Timmons et al. 2011). These interactions, ostensibly made unnecessary by the EPR's presumption of 'self-service' can facilitate greater contextual awareness of situations (Vezyridis, Timmons et al. 2011) and also contribute to checking and coordination mechanisms (Vikkelso 2005, Vezyridis, Timmons et al. 2011). Other studies suggest, however, that EPR use contributes to increased professional interaction where hospital doctors have to use shared computer workstations for inputting into records, bringing them into proximity

with colleagues and drawing them into office life (Vikkelso 2005), indicating that local variations in how the EPR fits into material arrangements and practices influence how it may be experienced by users.

2.10.3 Recording practices

The increased visibility of patient record contents in EPRs implies a broader audience for them, and in fact the potential audience may be unlimited and unknown if one considers both the system's organisational scope and the digital record's permanence, which may therefore influence the ways in which information about the patient is recorded (Hardstone, Hartswood et al. 2004, Vikkelso 2005).

Information systems fix information in particular forms, which may be limiting because it means representing accounts as authoritative and final where paper records enable a degree of flexibility in allowing for accounts to be provisional and incomplete (Hardstone, Hartswood et al. 2004).

Consciousness of the more widely shared nature of electronic records may positively influence collaborative efforts between different professional groups by encouraging clinicians to tailor their inputs to the EPR towards their colleagues (Oborn, Barrett et al. 2011, Zwaanswijk, Verheij et al. 2011). They may also promote negotiation, joint work, learning and reflective practice in patient care through providing greater opportunities for multiple and collaborative inputs (Vikkelso 2005).

Recording information about care in a shared record can be seen as a form of publication, however with paper records, unlike EPRs, this is done with an audience in mind who are somewhat known and defined and whose purposes are also broadly understood (Berg, Langenberg et al. 1998, Hardstone, Hartswood et al. 2004). Recording in an EPR for a broader and more ill-defined audience out with the knowledge or influence of the author and whose purposes in accessing the record may also be unknown could tend to make clinicians more wary about how and what they record, because the more formal, public nature of the EPR is associated with individuals being held more formally accountable for its contents (Hardstone, Hartswood et al. 2004, Eason 2007). This may result in more sanitised and impoverished versions of events (Winthereik, de Bont et al. 2000), or clinicians may tend to minimise the amount of information recorded in the EPR (Eason 2007).

Changes in recording behaviour may also arise because clinicians are particularly wary of recording sensitive details about a patient within the EPR because of its wider readership (Zwaanswijk, Verheij et al. 2011). Indeed patients themselves may become reluctant to divulge sensitive details for fear that their privacy may be compromised (Rogerson and Fairweather 2001) and this could undermine the patient-clinician relationship and ultimately the effective delivery of healthcare.

Clinicians often want to maintain informal, unstructured notes about the patient, particularly when cases are not clear cut and they are inclined to consider, gather more information or to discuss with colleagues before formulating conclusions, particularly because of the awareness of being held to account for clinical decisions and judgements (Hardstone, Hartswood et al. 2004).This situation reflects the EPR's status as a legal document as well as a recording and communication tool and coordination device (Bossen 2002). In contrast, paper tolerates the partialness and transience inherent in certain kinds of clinical work, accommodating the dynamic and revisable nature of knowledge about the patient and actions to be taken (Hardstone, Hartswood et al. 2004).

A number of authors recognise that in healthcare organisations EPRs tend to co-exist alongside paper records because they remain indispensable in maintaining the coherence of work processes e.g.(Luff, Heath et al. 1998, Vikkelso 2005). This is borne out by a number of studies that have noted that expectations that the EPR would make organisations 'paperless' have not been realised, with paper continuing to play a crucial role e.g. (Eason 2007, Vezyridis, Timmons et al. 2011).

The primacy given to codified information about the patient and their care frames medical matters in objective terms. EPRs may pressurise users into black and white diagnoses, for example through the use of tick boxes, precluding the possibility of accommodating grey areas and that which is complex, subtle and uncertain, and in doing so giving the impression that clinical work and clinical information are more clear cut than they actually are (Henwood and Hart 2003, Oborn, Barrett et al. 2011). This illusion of objectivity may obscure the true nature of clinical issues (Berg, Langenberg et al. 1998, Hardstone, Hartswood et al. 2004). It is suggested, therefore, that paper documents and records, by allowing for greater ambiguity, help to support interpretive flexibility across use contexts (Ellingsen and Monteiro 2000). It

is noted moreover that there is no 'space' for intuitions and hunches about patients to be recorded within EPRs, wedded as they are to highly structured and definitive formats, and instead these are sidelined into informal interactions (Vikkelso 2005).

As a document that demands information inputs from and interpretation of those inputs by an ever wider group of people, data quality and quality of coding therefore become crucial (Zwaanswijk, Verheij et al. 2011, Morrison, Fernando et al. 2013). It is already clear that clinical recording is a complex art, far from being a plain statement of facts about diagnoses, treatment decisions and outcomes (Berg and Goorman 1999, Winthereik and Vikkelsø 2005, Morrison, Fernando et al. 2013) and as such clinicians are at pains to present themselves and their team, department or organisation in a good light and in ways which help them to justify their decisions and actions (Winthereik and Vikkelsø 2005).

From the perspectives of clinicians as information consumers the credibility of recorded information is closely linked to their familiarity with the individuals or groups who are recording it in terms of perceptions of quality and reliability (Berg, Langenberg et al. 1998, Zwaanswijk, Verheij et al. 2011). This raises questions about the implications for clinical practices if there were a loss of trust in recorded information associated with the greater distance and indeterminacy of authorship. Moreover the multiple and unclear authorship of nationally networked EPRs introduces new risks and concerns in relation to where medical liability rests if the information on which a critical decision is made is found to be inaccurate (Zwaanswijk, Verheij et al. 2011).

It may be argued that the implicit objective of the EPR agenda is to 'free' patient data from its local context to make it available and usable by individuals in different care settings (Berg and Goorman 1999, Morrison, Fernando et al. 2013). However, patient data is arguably inherently local and therefore a balance has to be struck between the work required to codify information into a standard and consistent, transportable format and the need to contextualise information in order that it makes sense to others (Berg and Goorman 1999, Halford, Obstfelder et al. 2010).

2.10.4 Redistributions of work

Whilst the potential benefits of EPRs for the quality of healthcare overall are widely accepted, benefits for users who interact directly with patients are more questionable (Berg, Langenberg et al. 1998, Burton, Anderson et al. 2004, Vikkelso 2005). It is suggested in relation to clinical work that EPRs are time-consuming to use (Goorman and Berg 2000, Henwood and Hart 2003, Burton, Anderson et al. 2004, Eason 2007, Stevenson, Nilsson et al. 2010), and this implies inadequate consideration of the needs of clinical users as arguably the crucial user group amongst the constellation of stakeholders as recipients of healthcare.

Where clinical users' needs are neglected secondary users of EPRs may reap the benefits whilst the burden of information management involved with providing the data in the EPR falls on those involved with interacting directly with patients (Berg, Langenberg et al. 1998, Berg and Goorman 1999, Greenhalgh, Potts et al. 2009). This may be problematic in terms of the effective functioning and acceptability of such systems, potentially leading to workarounds, resistance and subversion of intended use (Berg, Langenberg et al. 1998, Eason and Waterson 2013).

This sets up a concern in relation to the NPfIT because there is an implicit expectation that clinicians will enter data at the point of care, during or soon after the clinical interaction (Eason 2007, Sheikh, Cornford et al. 2011). This also establishes data entry as a new aspect of the clinical role which many clinicians see as an administrative or technical task at odds with their professional identity (Vikkelso 2005, Jensen, Kjærgaard et al. 2009, Haland 2012).

Studies which have explored user's issues with EPRs report cumbersome processes to gain access to records (Eason 2007, Stevenson, Nilsson et al. 2010), the time consuming nature of use (Aderibigbe, Brooks et al. 2007, Sheikh, Cornford et al. 2011), and the need to input additional data (Sheikh, Cornford et al. 2011), variable data quality, lack of interoperability with other systems, information overload, difficulties with finding relevant information in the record, poor technical performance of systems and concerns about confidentiality and security of patient information (Zwaanswijk, Verheij et al. 2011). Rather than straightforwardly liberating users from tasks EPRs may create additional work, for example, by making it necessary to print and validate hard copy versions of documents where electronic and paper clinical

processes interface at the boundary of organisational information systems (Vezyridis, Timmons et al. 2011).

2.10.5 Conceptualisations of information

Electronic patient records are far from complete or objective accounts (Berg and Goorman 1999, Halford, Obstfelder et al. 2010), not least because clinicians may leave fields empty or record just enough detail for colleagues to interpret and 'read between the lines' according to a shared local understandings (Berg, Langenberg et al. 1998). Clinical work is information intensive, with much of that information in the form of professional expertise, exchanged in informal ways and not recorded formally (Hardstone, Hartswood et al. 2004, Tjora and Scambler 2009). Furthermore clinical knowledge is often tacit, context-bound and hard to codify and in so far as the EPR embodies an aim to structure and codify information about the patient this entails considerable work, and risks the loss of important detail about the patient (Berg and Goorman 1999). This highlights and problematizes an assumption that by creating the EPR objective data will flow unproblematically between dispersed users and clinical functions.

It is argued that simplistic notions of clinical information which treat it as a mobile commodity are misconceived because they do not acknowledge its fundamentally man-made nature, that it is produced for specific purposes and is entangled with its context of production and use (Berg and Goorman 1999). Clinical information is not necessarily easily broken down into atomic units because information items tend to supplement each other and cannot readily be separated, which can present problems in relation to expectations that information systems will help to 'free' information and make it transportable (Berg and Goorman 1999).

Looking across NHS healthcare organisations, the diverse EPR implementations that exist entail differences in the scope of sharing of records meaning that the geographic and contextual distance which information within the EPR can travel may differ considerably. For example, an EPR may be restricted to a single General Practice and be used by GPs within that practice sharing a common role and healthcare context, or, under EU plans for cross-border sharing of summary-style EPRs, could be visible and editable by healthcare professionals in vastly different roles and settings within quite different healthcare systems (epSOS Consortium

2012). In this respect the more widely documents such as EPRs are shared across different contexts of use, the more explicit the content needs to become in order to make up for the loss of context (Berg, Langenberg et al. 1998, Østerlund 2008), and also to mitigate asymmetric access to knowledge between those interacting with patients and providing information inputs to the EPR, and those consuming that information at a greater or lesser distance (Østerlund 2008).

2.10.6 Professional identities

A number of authors discuss the ways in which technology serves to shape representations of clinical work and thereby patients' and professionals' identities (Henwood and Hart 2003, Halford, Obstfelder et al. 2010, Korica and Molloy 2010). It is suggested that professional identities are relational in that they are defined in part relative to other professional roles within the clinical domain and there is continual maintenance and renegotiation of professional boundaries in relation to other professional groups (Halford, Obstfelder et al. 2010, Haland 2012). The negotiation of this order is influenced by technologies such as EPRs, because they not only create new divisions of labour (Vikkelso 2005) but also unsettle associated hierarchies and power relations between groups (Halford, Obstfelder et al. 2010). EPRs therefore become entangled in and leveraged by the conflicts generated by different professional and institutional values, for example the aspiration to improve the status and professional autonomy of the nursing profession in relation to that of doctors. Halford, Obstfelder et al (2010) suggest that clinical work and the patient record become mutually constitutive such that they become hard to discuss without reference to the other, and this means that there is a need to consider the relationships between work routines and the EPR as a representation and ordering of work.

By changing work practices information systems can bring about shifts in inter-professional power relations and are therefore inherently political. For example EPRs shared by nurses and doctors may undermine doctors' traditional authority over nurses (Berg, Langenberg et al. 1998, Halford, Obstfelder et al. 2010, Haland 2012), and may demand new organisational structures in which previous hierarchies and authority relationships are changed (Checkland, McDonald et al. 2007).

Wider sharing of electronic records means that colleagues may be encouraged to work more collaboratively in the production of accounts within the EPR, for example, with nurses starting to contribute clinical entries to shared records (Haland 2012). This also implies a broader constituency of more or less active clinical collaborators providing direct or indirect contributions to the record, for example in the form of comments on a difficult clinical case. Moreover, as contributors may be geographically distant and potentially off-shore in the case of sourcing specific expertise, drawing that medical expertise from non-local sources will influence conceptions of clinical best practice and will change the body of medical knowledge from which clinicians operate, in effect building a global virtual hospital (Rigby 1999).

The use of technologies such as EPRs changes clinicians' relationships to the bodies of medical knowledge which are the basis for their professional status by helping to define what is legitimate clinical knowledge and practice (Berg and Bowker 1997, Checkland, McDonald et al. 2007, Reich 2012), and they therefore may also alter their relationship to the organisational bureaucracy within which they operate (Reich 2012).

Professional groups may experience and respond to EPRs differently in terms of how they impinge on professional identity (Oborn, Barrett et al. 2011, Haland 2012). Some studies suggest that use of EPRs is perceived by clinicians as exceeding the boundaries of their professional role and as such does not constitute part of clinical work as they define it e.g.(Henwood and Hart 2003, Haland 2012).

It is suggested that healthcare users do not see the use of EPRs as integral to clinical care, but as an additional activity and an administrative burden (Cresswell, Worth et al. 2011).Users report that the attention required in entering patient data into the EPR may take the clinician's focus away from their patient, and may influence the quality of engagement (Makoul, Curry et al. 2001, Haland 2012).Others claim it creates an additional burden of work because clinicians need to type up records after rather than during patient consultations (Henwood and Hart 2003, Stevenson, Nilsson et al. 2010, Sheikh, Cornford et al. 2011).

Clinicians may perceive the task of updating records as lower status work (Henwood and Hart 2003, Sheikh, Cornford et al. 2011). Jensen & Aanestad's (2007) study

reports that surgeons see using a computer as "secretaries' work" and not part of their professional make-up. Similarly other studies report that some nurses (Timmons 2003, Currell, Urquhart et al. 2009), and midwives in particular (Henwood and Hart 2003), believe that using the computer to input patient records takes them away from the 'real' nursing work of spending time with the patient. However it is also argued that documenting care, as a form of coordination work, is a core element of the nursing role, and as such nurses' requirements in this respect need to be adequately supported in the EPR design (Stevenson, Nilsson et al. 2010).

Some authors argue that technologies such as the EPR are implicated in the deprofessionalisation of medicine, and associated with a loss of autonomy and discretion e.g. (Jensen, Kjærgaard et al. 2009, Reich 2012). In nursing the use of standardised care plans within the EPR has raised concerns about the potential for deskilling because nurses no longer need to apply professional judgement in developing individual patient care plans, even though upskilling may be supported by the technology in other aspects of work (Stevenson, Nilsson et al. 2010). This recognises that different professional groups may experience new technologies in different ways in relation to their professional identities (Henwood and Hart 2003, Korica and Molloy 2010). Furthermore new technologies may threaten the basis for certain roles and functions, if not make them redundant (Korica and Molloy 2010, Waterson, Glenn et al. 2011)and as such new roles and professional identities may need to be negotiated (Korica and Molloy 2010).

Technologies are traditionally part of, integral to and highly visible within clinical work practices, and healthcare professionals, especially doctors, have traditionally had a significant degree of control over their use within clinical work (Tjora and Scambler 2009).Early adopters of new technologies within organisations may be celebrated as cutting edge pioneers and 'tech savvy' heroes whereas those who argue against, resist or reject them may conversely be perceived as out of touch, particularly within the medical profession, and surgery especially, where active involvement with new technologies is integral to the role (Korica and Molloy 2010). Where individuals resist the use of EPRs this may be characterised as 'technophobia' by managers promoting a technology-led healthcare agenda (Stevenson, Nilsson et al. 2010), or

as lack of understanding of the technology and failure to appreciate its benefits (Zyglidopoulos and Fleming 2011) .

2.10.7 Surveillance of work

The centralisation of information associated with the EPR generates an accessible record of the work done by front line healthcare professionals and thereby widens scrutiny of their inputs and their work (Rigby 1999, Reich 2012), highlighting the potential for surveillance of work. The durability of digital documents extends the power that managers have to call staff to account in performance management terms, extending this authority across space and time, with the potential for scrutiny of decisions over an extended period (Munro 1999).

Critical IS studies recognise the potential for power to be exercised through the use of organisation-wide information systems e.g. (Myers and Young 1997, Doolin 1998, Kohli and Kettinger 2004, Reich 2012). Through the shared visibility of work activities afforded by information systems, or rather (more or less adequate) representations of those activities, users are encouraged to adapt their behaviour towards a particular set of organisational norms or standards via a process of self-discipline, and the associated expectation that one might be called to justify one's actions if one strays from the norm (Bloomfield and Coombs 1992, Reich 2012). Evidence-based clinical practice is one way in which such norms are being defined in healthcare (Harrison and Dowswell 2002, May 2006). The use of a single EPR across multiple sites and groups of clinicians is seen as a means to standardise work practices to bring them in line with 'best practice' and also with other more subtle organisational drivers such as economic interests, which may or may not derive from clinical concerns (Reich 2012).

Standardising medical activities against a centrally defined notion of 'best practice' may serve as a mechanism of control (Berg 1997, Reich 2012), that may be manifested in protocols, templates or computerised decision support incorporated into EPR functionality (Harrison, Koppel et al. 2007, Khurana, Ogston et al. in press). The ways in which power and politics are inscribed within EPRs is therefore of interest in terms of revealing the reality of users' experiences.

Surveillance of staff also extends to the monitoring of EPR access and other aspects of information security, particularly with respect to the privacy and confidentiality of patient information (Stahl, Doherty et al. 2011), and this is critical to the public acceptability and overall legitimacy of the EPR in the UK NHS (Pouloudi and Whitley 2000). Information governance mechanisms necessitated by electronic patient records imply the threat of sanctions for unauthorised access which may generate fear and resistance to use (Aderibigbe, Brooks et al. 2007, Greenhalgh, Stramer et al. 2010). The disciplinary consequences of information security breaches are conspicuously emphasised and reiterated within organisational communications (Stahl, Doherty et al. 2011).However, despite the cautionary atmosphere around information governance in healthcare, uncertainty about how authorised access might be determined in practice sustains concerns about the privacy and confidentiality of patient information (Zwaanswijk, Verheij et al. 2011).

2.10.8 Accountability and control

The role of clinical documents in organisational accountability within healthcare provision is recognised (Harrison and Dowswell 2002, Winthereik and Vikkelsø 2005). A number of authors highlight the role of information systems in providing the mechanisms for a certain kind of organisational accountability associated with making organisational activities, or rather certain aspects of those activities, both measurable and visible e.g. (Bloomfield 1991, Doolin 2004, Reich 2012). Accountability to the public externally and to healthcare managers internally is a prominent feature of contemporary healthcare organisations, and currently within the new public management vision EPRs are an important part of this landscape.

It has been observed by a number of authors, in particular Power (2000), that in the UK we are in the midst of an 'audit explosion' which has arisen as a result of new forms of public management, manifested in increased demand for organisational accountability and transparency and new models of organisational control associated with discourses of quality assurance (Shore and Wright 2000, Strathern 2000). It is suggested that the use of health information systems in this context has brought with it vocabularies with which to discuss clinical work such that the new discourses are mobilised and reinforced through their enmeshing with practice (Doolin 2003).

However, it is proposed that the ways in which large organisations respond to the contemporary 'ideology of visibility' may actually undermine genuine accountability by making the tracing of activities through the organisational complexities more convoluted (Zyglidopoulos and Fleming 2011). By couching the relevant discourses in ever more technical language they are made *less* accessible to public debate, thereby denying the public the institutional legitimacy with which to question and challenge them (Zyglidopoulos and Fleming 2011). Furthermore because of the conspicuous rhetoric about and appearances of greater transparency, for example through the uses of information technologies which enable greater visibility of (certain aspects of) organisational activities, this may serve to obscure a de facto decrease in transparency (Zyglidopoulos and Fleming 2011).

Through the use of technologies such as EPRs as symbols of transparency their information products are given status as evidence. In this role information as 'evidence' has a critical part to play within contemporary healthcare, for example, in the form of quantitative information about the cost and effectiveness of clinical processes (May 2006).

2.11   Standardisation of recording

Proposed benefits to healthcare from secondary uses of EPR data depend upon the scope of sharing of the EPR in relation to stakeholder groups, NHS organisations and geographic coverage. Stakeholders included within the scope an organisational EPR implementation, and represented in the record, for example through a dedicated section of the record for surgery or midwifery, are rendered visible and comparable, supporting management decision-making

The UK government's vision of EPRs as enablers and foundational infrastructure for other technologies and capabilities whether explicit, aspirational or yet to be defined, relies upon the EPR's ubiquity across all NHS organisations. EPRs are more than simply information containers; they are supporters of care activities by direct or indirect means (Greenhalgh, Potts et al. 2009).

However, aspirations for greater breadth and integration of multiple information sources also entail balancing ambiguity of content with more unequivocal clinical recording, which relates back to the discussion of its questionable and variable

objectivity. As argued above in defence of paper records, ambiguity may be desirable in that it allows for interpretive flexibility so that the same information is usable by individuals in different contexts (Ellingsen and Monteiro 2000, Winthereik and Vikkelsø 2005, Oborn, Barrett et al. 2011) and it also tolerates a degree of uncertainty and provisionality which can serve a useful purpose (Hardstone, Hartswood et al. 2004, Winthereik and Vikkelsø 2005). For example, ambiguity and vagueness in hospital discharge letters allows clinicians to present a coherent narrative of organisational competence, making a case for decisions made and actions taken even when the diagnosis or outcomes are inconclusive or unsuccessful (Winthereik and Vikkelsø 2005).

Clinical decision-making is based not only on explicit knowledge but on tacit and informal knowledge that may come in various forms, and as such requires space for ambiguous diagnoses and outcomes, emphasising the importance of narrative recording for clinicians in so far as it is better able to accommodate uncertainty (Morrison et al 2013). It is argued that the increased standardisation of recording entailed by the development of EPR systems may undermine these modes of documenting care because of an emphasis on organisational accountability over and above clinical usefulness (Winthereik and Vikkelsø 2005).

2.12   Informatization of healthcare

A number of authors highlight the extent to which the production and management of information has become critical to the functioning of the UK health service (May 2006, Moser and Law 2006, Halford, Obstfelder et al. 2009, Stahl, Doherty et al. 2011). Information systems have a central role in providing information to support the NHS' internal market model (Bloomfield 1995) and to evidence a variety of financial and clinical performance measures which support commissioning, administration, policy making and other kinds of 'evidence-based' decision-making (Department of Health 2002, Care Record Development Board 2007).

Social science research has acknowledged the growth and 'spiralling demand' for information as a contemporary macro-social phenomenon (Bloomfield 1995, Winseck 2002, Kallinikos 2006). Webster (2002) characterises the 'informatization of medicine' in terms of the ever increasing demands for precise technical information on which to base clinical decisions. It is suggested that this is being driven by

improvements in medical technologies and public health that have shifted the emphasis in healthcare towards preventative medicine, more probabilistic approaches and earlier care interventions, which entail greater uncertainty about risks versus success in diagnoses and treatments and therefore generate an associated demand for more information as a means to reduce uncertainty (Webster 2002).It is argued that this frames social challenges and situations as technical problems for which information is a solution, rather than problems that require judgement of a moral nature (Webster 2002).

By presenting issues as technical it is difficult to argue against them (Checkland, McDonald et al. 2007). Accounting systems are appealed to by actors when trying to convince others (Lowe 2001), reflecting the fact that quantitative information produced and represented through calculative practices involving computational processes tend to be regarded as more reliable than similar information produced on paper (Greenhalgh, Potts et al. 2009). This, therefore, indicates the potentially powerful position of EPRs in healthcare as mediators of informational activities.

Health information systems are predicated on the gathering, processing and manipulation of information about organisational activities for the purposes of prediction and managerial control (Bloomfield 1991). Making information manipulable implies making it quantifiable, therefore driving a requirement to quantify work activities, privileging representation of activities that are more easily measurable (Bloomfield 1991).

A number of authors have argued for a performative conception of work practices in relation to recording in the EPR, arguing that what is recorded helps to shape the domain of reference, such that the EPR actively produces the clinical reality which it seeks to represent (Berg 1996, Halford, Obstfelder et al. 2010). Barthes and Duisit (1975, p249) argue that "what is noted always tends to be seen as what is worth noting", and in this respect Vikkelso (2005) suggests that EPR implementations bring about shifts in the focus of organisational attention according to what is recorded.

This means that work which is not conducive to quantification may become less visible and this can have implications for the status of particular groups, for example nursing, where much of the work revolves around providing emotional support to

patients (Bowker, Timmermans et al. 1996, Star and Strauss 1999, Darbyshire 2004). In this respect it is argued that the EPR fails to capture many aspects of nursing practice, particularly those which are already easily overlooked and undervalued, such as emotional and psychological support (Stevenson, Nilsson et al. 2010), and as such may serve to make them even less visible through mediating the recording of only the more quantifiable aspects of nursing work (Bowker, Timmermans et al. 1996).

The ways in which EPRs focus attention on particular aspects of clinical work at the expense of others implies that certain activities are explicitly prioritised (Vikkelso 2005) and by implication others are implicitly deemed less important (Halford, Obstfelder et al. 2010). This entails that certain clinical roles or aspects of clinical roles may become less visible, less legitimate, and may be unacknowledged (Star and Strauss 1999, Goorman and Berg 2000). In this way technologies such as electronic patient records are able to redefine what counts as work within any given domain (Star and Strauss 1999, Checkland, McDonald et al. 2007).

2.13   Materiality

The importance of materiality in considerations of how organisational information systems function is apparent because medium matters in practical ways in relation to EPRs, including for example implying access mediated through screens.

The tying of EPRs to computer hardware is indicative of the substantive implications of the materiality of such technologies because hospital staff are now no longer able to carry records with them on ward rounds (Vikkelso 2005, Stevenson, Nilsson et al. 2010); they may present barriers to access because they are slower to read (Berg, Langenberg et al. 1998); documents are more difficult to sort on screen compared with those on paper (Vikkelso 2005), and it may be harder to get an overview of the patient than when using paper records (Stevenson, Nilsson et al. 2010). In hospitals particularly, work is dynamic and unpredictable and this affects access to EPRs, unless suitable mobile devices and interfaces are provided (Tjora and Scambler 2009, Stevenson, Nilsson et al. 2010). Materiality also has implications in terms of the requirement for adequate technical performance, technical support and training in how to use electronic patient records (Stevenson, Nilsson et al. 2010).

In their study of an EPR system in an Emergency Department, Vezyridis et al (2011) note that the positioning of terminals in treatment cubicles conflicted with the way in which nurses usually write reports, which requires time and space for reflection (usually combined with a rare opportunity to sit). Nurses also expressed reluctance to write up notes in front of the patient and were dependent on the availability of colleagues for technical help (Vezyridis, Timmons et al. 2011). When EPRs were introduced, computer availability in the shared nursing workstations became an issue, and other practical challenges emerged, for example around reliance on access to working printers (Vezyridis, Timmons et al. 2011).

Another case study of the use of EPRs in team ward rounds found their use to significantly impact the dynamics of team discussions, decreasing their interactivity, openness and participative nature as compared with using paper records, and this was seen as undermining the trading in information that typically served to underpin group interactions and focus the team's attention (Morrison, Jones et al. 2008). It was also noted that it was more difficult to carry out activities in parallel whilst attending to the main discussion, so that the EPR entailed additional work 'in series' (Morrison, Jones et al. 2008).

2.14   Summary

In summary I argue that there is a need for critical examination of electronic patient records in the context of the unique challenges of implementing information systems in the healthcare environment, and the mixed successes of EPR implementations worldwide. Focussing on the case of EPR development in the NHS' National Programme for IT this begs the question about the rationales for this technology and the gap between the government's vision and the realities of users' experiences. This is particularly so because of the multiple purposes envisioned for EPRs, which imply multiple competing agendas. In this respect the literature highlights the ways in which EPRs can both benefit and disadvantage clinical users and justifies a focus on whether they support clinical work practices.

As a digital object and as an infrastructure that integrates multiple systems, functions and sources of information and which is organisationally global and ubiquitous, investigation of EPR systems is important both because of the challenges of achieving the vision set out for the EPR and also because of the potentially profound

implications of realising it. Furthermore the multiple nature of EPRs as they are being realised creates a case for investigating the status and nature of the technology as a research object.

Considering healthcare more broadly EPRs are already showing signs of becoming a pervasive and inescapable technology as they continue to permeate through healthcare systems, and therefore there is a clear need for their implications to be explored (Haland 2012).

The next chapter explores and justifies my chosen research methodology through examination of the theoretical literature.

CHAPTER 3 – THEORETICAL LITERATURE

This chapter sets out to discuss Actor-Network Theory as my chosen theoretical framework and research methodology, and to justify it as a suitable choice for my research.

Actor-Network Theory literature falls into two distinct categories; theoretically oriented, conceptual studies, or what Gad & Jensen (2010) call 'reflexive' ANT texts, and those which apply Actor-Network Theory to empirical research. These two types of literature constitute different ways of talking about Actor-Network Theory and I will discuss both. This chapter will introduce Actor-Network Theory and its central concepts, initially focussing on theoretical literature in order to situate ANT conceptually, and then shifting focus to position this study in relation to empirical Actor-Network Theory studies of health information systems, including EPRs; discussing how ANT has been applied in practice in this domain.

Doing this will involve acknowledging the compromises to be made in operationalizing Actor-Network Theory in order to make it usable. This includes recognising that I have not attempted to exhaustively explore Actor-Network Theory but have been selective in terms of being pragmatic about what is needed in applying ANT in this research.

Writing this chapter involves acknowledgment of the clashes and overlaps between the functions of this and the Research Methodology chapter that follows because Actor-Network Theory is not applied in a vacuum in so far as it is not possible (particularly with a postmodern approach) to cleanly separate theoretical and methodological concerns. Discussion of ANT as a theory necessarily lays a basis for and ties the researcher to a particular philosophical stance, which, whilst discussed more explicitly in the Research Methodology chapter, is implied by and introduced to some extent in this chapter.

3.1   What is Actor-Network Theory?

In Actor-Network Theory an entity exists as a product of a unique configuration of associations between a constellation of human (or social) and non-human (technical or material) entities (Law version of 25th April 2007). An entity is seen as an effect, or emergent property of its relationships, a concept known as 'relational materiality'

(Law 1992, Law and Mol 1995), so that entities are produced, or rather, performed as network effects through the ordering of relationships between a given set of heterogeneous entities (Law version of 25th April 2007).

The idea that entities are hybrids arises because the social is defined in relation to and presupposes the technical (or material) and vice versa, such that they are inseparable (Doolin 2003). Recognizing something as a particular technology presupposes certain social arrangements within which it makes sense to think of it in this way (Bloomfield and Vurdubakis 1994).

As a theory ANT is concerned with finding out how entities, or actor-networks, are constituted through the interrelationships between the social and the technical (Jones 1998). Therefore ANT can be described as being principally a theory of ontology i.e. a means of describing states of affairs, and how they come to exist and continue existing (however briefly). This means that rather than conceiving of an entity *within* a context as other approaches might do, an entity *is* its context (Miller 1997, McLean and Hassard 2004). In other words Actor-Network Theory considers an act in terms of the factors that influence it (Monteiro 2000), and this means a network provides its own frame of reference in terms of explanation (Latour 1996).

Entities are conceptualised by ANT as 'actors' and they may be people, parts of the natural world, artefacts (such as technologies), institutions, or other kinds of man-made and socially structured things and phenomena such as standards or professional bodies. In ANT everything is seen as an actor-network, including actors themselves (Hanseth, Aanestad et al. 2004).

ANT is distinctive in not only recognising the role of non-human actors in constructing a given state of affairs, but in placing non-human actors on an equal analytical footing to humans (Latour and Woolgar 1979), thereby subtly shifting the nature of analysis. Non-human actors are more than just 'props' in a human world because it is impossible to say where the social (or human) ends and the material (non-human) begins (Law and Moser 1999). This attention to non-humans, including material ones, makes ANT particularly appealing for the analysis of information systems.

Network formation occurs through the processes of enrolment and translation, which establish the relationships between actors that support the actor-network's existence. Enrolment involves actors negotiating to persuade other actors that they share a common interest in the context of a given entity's goals and orientations, such that they create alliances and gain buy-in for any project or cause, that of establishing the actor-network in question (Callon 1986, Doolin and Lowe 2002).

ANT theorists therefore talk of enrolling 'allies', which entails an actor accepting a designated role in the network and inevitably involves some actors having to make compromises (Walsham 1997, Doolin and Lowe 2002). Translation occurs when actors' interests are successfully aligned to the common cause (Callon 1986). Tensions between actors working to exert influence in accordance with their interests therefore bring about a given phenomenon, such as the EPR, as a relational achievement.

Creating an actor-network therefore entails overcoming resistance in the bid to create order (Law 1992, Latour 1996), and that achievement comes at a price (Scott and Wagner 2003) so we may want to question who or what bears the cost of negotiating that order.

3.1.1 Stabilisation and precariousness

When disparate interests are successfully brought to bear to achieve an actor-network it is said to be stabilised. It must be recognised that actors resist, they continually threaten to pull away so that negotiations are necessarily ongoing and actors may or may not cooperate with each other (Underwood 2008). This means that not only is work required to bring any given actor-network into being (Latour 1996), but also that any state of affairs is contingent, incomplete and only temporarily stable (Law 1992).

The maintenance of a phenomenon in an appearance of stability entails the continual performance of translation such that the achievement of order is an ongoing and active process (Doolin 2003, Scott and Wagner 2003). Because of the 'performativity' of actor-networks Law (1992) proposes that (network) ordering should be treated as a verb rather than a noun, as a means to capture the continual

nature of the process and the incompleteness, instability, and impermanence of actor-networks as outcomes.

As actors' interests and their own network configurations shift and change, so this changes the nature of the actor-network in question. This can be used to explain how certain projects and technologies fail or otherwise produce unexpected outcomes, and Latour notably addresses this in his (1996) case study of Aramis, a failed project to implement a mass transit system in Paris. Investigating phenomena from an Actor-Network Theory perspective therefore involves acknowledging that things could have been otherwise. This contingency and precariousness means that even entities that are apparently part of the established order can be questioned and challenged and the foundations of the tenuous status quo revealed through theorising an entity as an actor-network.

A number of studies use ANT as a means to account for how information systems develop and change over time by attending to the interests of the various actors whose influences shape the outcome (Hanseth, Aanestad et al. 2004, Hanseth, Jacucci et al. 2007). This approach is valuable as a means of discussing unanticipated outcomes and the socio-political nature of information systems in organisations e.g.(Hanseth, Jacucci et al. 2007, Cho, Mathiassen et al. 2008), and for investigating the relative stabilisation (or otherwise) of an actor-network in terms of accounting for 'successful' and enduring assemblages (Neyland 2006, Underwood 2008, Guah, Hackney et al. 2009).

This research, rather than using ANT to examine the development trajectories and stabilisation of technological arrangements over time, intends to focus on the constitution of the actor-network, exploiting Actor-Network Theory's ontological principles as explanation for the existing state of affairs with respect to EPRs.

Rose & Truex (2000) argue that ANT's viewpoint is affected by the methodological approach taken because a cross-sectional, snapshot view tends to encourage the conceptualisation of the technology as a source of agency, whereas a developmental, longitudinal research strategy tends to reveal the human actors who are behind the decisions which make the technology 'act' in the way it does. It is suggested that for a more accurate picture researchers need to have both stories in

mind (Rose and Truex III 2000). Therefore, although my research design tends towards a snapshot rather than a longitudinal view of EPRs, it will attend to the changing political and organisational context within which EPRs are being implemented and used, and in this way aims to produce a more integrated account.

3.1.2 What is an actor?

This idea that things could have turned out differently casts actors as agents i.e. entities with the capacity to act; to influence states of affairs. An actor is "something which acts or to which activity is granted by others" (Latour 1996 , p7) and an entity, whether human or non-human, that can make its presence individually felt (Law 1986). This draws on a notion of actors not as inert nodes but as mediators with the capacity to shape the networks of which they are a part (Latour 2005), highlighting the need to avoid conflating the communications network idea of 'network' with that of an 'actor-network' (Latour 1999, Czarniawska 2004).

"Things do not happen unless other actors make them happen, each actor takes the project further and may take it in a different direction than that intended by the previous actor" (Mitev 2009, p18). This means therefore that all actors, even those that are sidelined or that would be obscured in other types of account have an influence within the actor-network. All actors leave traces, otherwise they would not be actors, even those which may be considered 'invisible workers' (Latour 2004a). Through the acknowledgment of 'invisible' actors ANT can make claims to being critical through its potential to make visible and give voice to those whose roles in establishing a state of affairs may not otherwise be recognised (Star 1991, Latour 2004b).

3.1.3 Black boxes

If relatively stabilised an actor-network may become considered a 'black box', when its identity is established, its role, function and presence no longer questioned and it has a commonly agreed set of meanings (Latour 1987, Monteiro 2000, Bonner and Chiasson 2005). The process, known as 'punctualization', results in an actor-network being conceptualised as a singular entity, and this is a necessary act of simplification which makes it possible to live alongside complexity (Law 1992). Black-boxing is also therefore the process by which issues become analytically closed in such a way

as to create the perceptions of asymmetries which we experience, including the illusion of a separation between the social and technical (Ormrod 1995).

In terms of its research agenda Actor-Network Theory is therefore also interested in studying how artefacts such as technologies come to stabilize (Brey 1997) through the closure of black-boxes. Investigating the make-up of an actor-network as a means of describing and explaining how an entity or state of affairs comes about can be approached through selectively opening and 'unpacking' black boxes (Cordella and Shaikh 2006).In this way constitutive influences and interests are revealed, and given that network formation involves negotiation to convince actors that enrolment is compatible with their interests this means that the process is fundamentally political and that there are power relations at work (Tatnall and Gilding 1999, McLean and Hassard 2004).

This makes it clear that power too is an effect of the network that emerges from a particular configuration of relations between entities, instead of an absolute, or zero-sum conception of power as a cause or something that is possessed by individuals or groups over others (Law 1992). ANT applies a fundamentally Foucauldian notion of power as manifested everywhere; embodied in discourses and 'regimes of truth' (Foucault 1977). This is a performative conception of power, recognising that it does not exist as something 'out there', but is continually produced and reproduced through acts taking place within a larger context. In this respect inscription, discussed below, provides a conceptual hook for actor-network accounts of power and politics.

3.1.4 Inscription

Inscription, a concept central to ANT, is the translation of interests into material form (Callon 1991) through the design and configuration of material artefacts. The 'social shaping of technology' perspective from which ANT inherits holds that the design of an artefact, such as a technology, reflects certain assumptions about its use, normative values in relation to how it should or should not be used, and desires and intentions in relation to how designers (or those who influence the design) expect it to be used, in turn reflecting a particular vision for technologically-enabled organisational change (Williams and Edge 1996).

Through the concept of inscription, therefore, ANT acknowledges that artefacts are political and that design is contingent on the interests of particular stakeholders and not only on the rational optimisation of functionalities, and also that those interests may serve to shape and constrain the behaviours of others in relation to the use of a given artefact (Winner 1980, Dawson, Clausen et al. 2000, Spicer 2005, Ramiller 2007). Discussion of inscriptions therefore enables Actor-Network Theory researchers to engage in debates about power and politics and to critique the prevailing situation.

3.1.5 Generalized Symmetry

Like other dichotomies Actor-Network Theory rejects the macro-micro dichotomy in relation to the phenomenon being researched (Hanseth, Aanestad et al. 2004). ANT holds that all things are fundamentally local by virtue of allowing micro and macro (and meso) actors to co-exist at the same level of analysis, producing 'local universality' (Timmermans and Berg 1997) rather than treating them differently by applying distinct analytical approaches (Monteiro 2000, Nicolini 2009).This gives ANT a 'flat ontology' (McGrath 2002) that is the source of the flexibility and granularity in analysis which ANT affords (Monteiro 2000).

Through agnosticism about size, or scale, ANT avoids imposing a priori distinctions on the object of study and entails that no actor is privileged over another; all actors are treated equally regardless of type, status or position (Callon 1986). This can also be framed as a question of conceptual distance or scale by which we perceive some actors or entities as 'bigger' or more important than others. Impartiality means that within this study a hospital and a senior NHS manager will be treated (analytically) in the same way as a medical receptionist or paper case notes.

This has invited the criticism that ANT is too local because by treating everything as composed of micro level entities it denies explanatory macro-social structures as shapers of action at local level (Knights and Murray 1994, Reed 1997). Latour counters by arguing that large scale phenomena are 'made of the same stuff' as micro phenomena (Latour 1991) and the perception of larger size is an effect of actor-networks which remain fundamentally local (Latour 1996).

3.2   Operationalizing Actor-Network Theory

In defining which aspects of Actor-Network Theory will be employed for this study I acknowledge that researchers inevitably have to apply constraints in order to make ANT 'do-able' in practice, because its open-ended nature as an approach means that the research could be unbounded and potentially unmanageable.

In making the research practically feasible I have therefore elected to make use of the aspects of Actor-Network Theory which best fit my needs. I discuss these, and in doing so justify the choice of Actor-Network Theory on the basis of my research question and motivations, the characteristics of the research object and how and where it might be researched. I start by discussing the operationalization of ANT in terms of the ways in which applying ANT implies a particular type of research account. This discussion also serves to justify why I have included and excluded particular concepts from Actor-Network Theory.

Callon (1986) theorises the mechanism by which actors have an influence within the actor-network in terms of the steps which culminate in the translation of an actor's interests, equated with their interests being aligned with that of the ordering endeavour and their integration into the network. These stages are problematization, through which a network-building endeavour is presented to an actor as a solution to their problems; interessement; enrolment and mobilisation.

Whilst Callon's (1986) theorisation of the mechanics of translation through which actors become part of the actor-network is a core part of Actor-Network Theory's armoury, these four 'moments of translation' are not applied in this thesis. These concepts, which theorise the mechanism that culminates in the translation of an actor's interests and their integration within the actor-network, are used to analyse the alignment of interests to the actor-network and are therefore appropriate to investigation at the level of individual actors' influences on the network and the representation of their particular interests in inscriptions, e.g. (Lee and Oh 2006).

In taking a meso level approach that aims to capture both the distinctiveness of unique EPR use contexts and an inter-organisational view that accounts for the data sharing vision for EPRs, actors and sets of interests are multiplied making it unfeasible to apply the concepts of problematization, interessement, enrolment and

mobilisation on this scale. Moreover, in setting a research agenda that seeks to identify actors and their interests within an actor-network as a means to map the actor-network for the EPR, the research starts from a different position to studies that seek to analyse the agency of a known actor or actors within the network or to scrutinise the workings of a particular translation, therefore I take these concepts as given within the notion of the translation of actors' interests.

Likewise the notion of the 'obligatory passage point' (Callon 1986, Callon and Law 1992) whilst characteristic to ANT, is not used in this study. An obligatory passage point is an actor that mediates the transactions of other actors in the network, controlling and regulating activity by acting as a 'gatekeeper', for example, in the way that peer reviewed publications are obligatory passage points for academic research (Star and Griesemer 1989). Again the breadth of the actor-network at meso level entails a trade-off between discovery of the actor-network and the scope to analyse individual actors more closely, which might otherwise include identification of obligatory passage points.

3.3.1 Actor-Network Theory Accounts

In using ANT there is a risk that the convenient aspects of the theory may be taken up whilst deeper or more subtle ones are neglected (Hanseth, Aanestad et al. 2004). Commodification of intellectual approaches is an issue raised by Suchman (2007) in relation to the co-opting of the anthropology discipline into new domains, and in relation to Actor-Network Theory Law (1999) argues that as it becomes fixed and defined, respectable and legitimized so it may also become sanitised and lose the tension which is the source of its value. This highlights a concern that Actor-Network Theory may be used superficially and that such an instrumental approach may treat it as a black box in ways that are inconsistent with its underlying sensibilities.

Applying Actor-Network Theory therefore involves striking a balance between the extremes of unfettered postmodernism and radical relativism at one end of the spectrum and superficial, functionalist approaches at the other. There is a risk in this respect of being unable to produce any contribution to knowledge beyond the local context, or conversely that using a 'toolkit' approach achieves a simpler research process but one which is inevitably more reductionist.

Using Actor-Network Theory authentically therefore means avoiding simplistic accounts of the research. Woolgar, Coopmans et al. (2009) make a distinction between 'smooth' and 'rough' accounts in research, with conventional 'smooth' accounts being flat, singular, disengaged and therefore unproblematic, reminiscent of the detached objective observer outside of and separate to the object of research, which leads unsurprisingly to greater certainty courtesy of that distance and detachment. Conversely rough accounts acknowledge the entanglement of the author with the object of research and do not offer concrete answers but instead exploration of multiple arguments and positions (Woolgar, Coopmans et al. 2009). This research aims for just such a rough account.

Producing rough accounts also implies reflexivity about the role of the researcher within the actor-network being researched. Reflexivity is a characteristic consequence of ANT's ontology, recognising that the researcher contributes to the creation of the reality they are researching. Therefore there are ethical and political responsibilities placed on researchers who could easily reinforce and recreate the dominant realities (Law 2004). This does not mean that we as researchers can discover any 'truth' we want to, or that there is nothing that could be considered concrete reality, but that the enacted nature of things does not make them less real, because they are both material and social (Law 2004).

As a theory of ontology Actor-Network Theory has been criticised as being merely descriptive in documenting phenomena without explaining them (Law 1999, Kaghan and Bowker 2001). However, Latour claims there is no difference between explaining and describing something with the ANT view of the world since by accounting for or explicating a network you also explain it (Latour 1996). The idea of Actor-Network Theory allowing us as researchers to demystify things (i.e. unpack black boxes) and see relational achievements for what they are is part of the claim for the inherent criticality of ANT (Doolin and Lowe 2002). This also goes to the heart of the truth claims for ANT in terms of how well equipped it is to yield a coherent story which is sensitive to the complexity and fluidity that underpins ANT's epistemological value.

Actor-Network Theory recognises the irreducible complexity and ambiguity of reality and therefore denies the possibility of certainty (López and Potter 2001) in keeping with its and basis in Science and Technology Studies. This means I am explicitly

choosing to take an approach that will not produce complete or certain answers. However the trade-off is that ANT claims to be able to comprehend complexity better than other approaches exactly because it avoids realism's reductionist strategy (Law, Ruppert et al. 2011, Law version of 19th January 2006). Producing ANT accounts therefore presents something of a challenge in terms of creating a sense of order whilst rejecting a priori ordering.

I aim to achieve a balance that will offset a necessarily focussed use of ANT against producing a rich account that is able to do justice to the complexities of the phenomenon being researched.

3.3.2 Empirical Actor-Network Theory

Identifying Actor-Network Theory studies amongst the literature on health information systems was challenging for reasons that are telling about the nature of Actor-Network Theory. A number of studies use Actor-Network Theory without explicitly stating a theoretical allegiance, and these have been identified instead from their use of distinctively ANT concepts and/or prominent use of seminal ANT texts and authors.

It is indicative of the flexibility of Actor-Network Theory that it is used within studies where the researcher does not necessarily align themselves with Actor-Network Theory, because they are able to make use of the versatility of its concepts without making their research *about* Actor-Network Theory. It also highlights a tendency for ANT to be hybridised in that elements may be used in a somewhat piecemeal manner, and sometimes in combination with other theories e.g. (Mitev 2009, Greenhalgh and Stones 2010, Cresswell, Worth et al. 2011), so that uses of ANT may be partial (McLean and Hassard 2004).

In the following sections I discuss the ways in which the characteristics of the research as I have chosen to frame it can be addressed through an Actor-Network Theory approach.

3.3   Information systems and heterogeneity

I have argued for a conception of information systems as socio-technical systems that need to be understood in the context of situated use. Information Systems as a discipline is interested in the interface between technical systems and the social

world and therefore it is proposed that Actor-Network Theory can contribute because of its conceptual basis in the socio-material nature of reality (Hanseth, Aanestad et al. 2004). By recognising the social and the technical as a co-constitutive whole Actor-Network Theory avoids treating technology either as part of the context or background, or as independent of human affairs (Doolin 2003).

As a theoretical approach ANT is explicit in its consideration of entities as heterogeneous. Actor-Network Theory sees IS phenomena as outcomes of the interactions of humans and technologies (Rose, Jones et al. 2005), thereby providing a relational understanding of digital technologies that involves recognition of the interrelationships of multiple socio-technical arrangements (Savage, Ruppert et al. 2010). As an approach to researching manifestly socio-material phenomena where the contributions of both human and non-human actors are equally important Actor-Network Theory is arguably a good fit (Tatnall and Burgess 2002, Bruni 2005).With this in mind there is now something of a tradition of applying Actor-Network Theory within Information Systems research.

A number of authors have suggested that the materiality of information systems is under-theorised and that the technology artefact is neglected by social constructivist perspectives on technology in organisations e.g. (Rose, Jones et al. 2005, Leonardi and Barley 2008, Østerlund and Bjørn 2011). Such approaches, by focusing on the context surrounding the technology, may treat the technology itself as a proxy or discuss it only as a presence or absence (Sawyer and Chen 2002). This means that the specifics of the technology itself may not be addressed in terms of the concrete physicality of mundane objects, such as cables, monitors and servers, which make up the technologies being theorised (Star 1999).

Not only does Actor-Network Theory hold that entities are both social and technical, but these elements are also treated equally under the principle of 'generalised symmetry' so that humans are not privileged over non-humans and both are granted agency i.e. the ability to act (Rose and Truex III 2000). It is proposed that that it is exactly this symmetry through which Actor-Network Theory aims to take technology seriously within IS (Monteiro and Hanseth 1996, Rose, Jones et al. 2005, Savage, Ruppert et al. 2010). By rejecting the distinction between the technical and the social theorists argue that there should be no a priori distinction drawn between them and

therefore no need to change register and treat them differently in analysis (Callon 1986).

The heterogeneity of EPRs is evident in terms of the 'baggage' needed to make them both practically feasible and acceptable to stakeholders, including information governance processes, NHS smartcards and audit software for example. Moreover the entities which constitute this baggage are inextricably linked with the very possibility of there being an EPR, reflecting a fit with ANT's conceptualisation of technological phenomena as products of their actor-networks.

As a software application and information infrastructure the EPR is both material and virtual. It is suggested that the virtuality of the EPR as a software artefact lacking in physicality means its presence and operation within an actor-network has to be inferred from physical traces in other objects (Bruni 2005). Therefore Actor-Network Theory may be of value in investigating EPRs for its attention to materiality and because it enables the tracing of connections between different actors.

Unlike other non-human actors involved with clinical practices the virtual nature of the EPR makes it independent of use context whilst being 'in' various different settings at the same time, and this requires the researcher to attend to other objects in order to infer the presence of the EPR, which entails mapping its network of associations (Bruni 2005). Bruni's (2005) ethnographic study of a recently implemented hospital EPR system found that despite being part of everyday hospital processes the EPR's presence was not always apparent, therefore the research focus was reoriented to following the EPR software itself. This meant the software rather than the people was 'shadowed', enabling connections to be traced between actors and processes throughout the organisation (Bruni 2005).

3.4   Investigating mess

The scale and complexity of contemporary information systems in terms of their reach and interdependencies is a contemporary context that demands a suitable theoretical and methodological response (Hanseth, Aanestad et al. 2004, Law and Singleton 2005, Alvesson and Deetz 2006), for example, in relation to the potential for emergent properties and effects to arise within complex systems as a result of unanticipated connections and interactions (Hanseth, Aanestad et al. 2004). In this

respect the unintended consequences of information systems have provided ample material for case studies of information systems failures which have been the bread and butter of IS research e.g. (Myers 1994, Drummond 1996, McGrath 2002). The complex socio-material nature of EPRs demands an approach that acknowledges the heterogeneity of the phenomenon without consigning the inconvenient or 'messy' parts to the background. Moreover in recognition of the contested definitions and varied manifestations of EPR systems, there is a requirement for a theoretical approach that is also able to tolerate and give an account of multiple phenomena.

A number of authors have highlighted a need for research methods which are better equipped for researching contemporary phenomena e.g. (Adam, Beck et al. 2000) such as digital technologies (Kallinikos, Aaltonen et al. 2010, Savage, Ruppert et al. 2010) and infrastructures (Monteiro and Hanseth 1996, Cordella 2010), particularly in relation to their characteristic complexities.

Kallinikos, Aaltonen et al. (2010) suggest that the attributes of digital objects make their identities elusive. This makes them challenging to investigate because research methods tend to assume a stable and singular object of study (Jensen 2004, Law and Singleton 2005). Law and Singleton (2005) report in their study of Alcoholic Liver Disease that it was difficult to pin down their research object, finding it behaving like a moving target, often mistaken for and overlapping with other medical conditions in various ways. Rather than attribute the methodological difficulties to 'technical' (process-related) or managerial issues they use this insight as a basis for arguing that social science research methods are poorly equipped for investigating complex, 'messy' phenomena.

They suggest that social science research methods tend to treat such messy objects as problematic, and as a consequence they are sidestepped and relegated to the 'unknowable' pile, which presents an epistemological challenge (Law and Singleton 2005). This creates an argument for research methods that can be used to investigate messy phenomena without aiming to 'purify' them.

Taking another perspective on 'mess', Jensen's (2004) study of the development of EPRs within the Danish healthcare system uses Latour's (2000) concept of a

'partially existing object' to discuss the EPR's hard to define nature in relation to its various purposes and differing levels of maturity. The study finds that in practice the EPR differs between each context of use due to shifting frames of reference and therefore becomes multiple, and sometimes conflicting versions, demonstrating a 'variable ontology' (Jensen 2004).

EPRs, and other technology projects are not well-defined, stable, singular research objects but multiple, and definable only in relation to certain times, places and purposes (Jensen 2004). He argues that understanding multiplicity is important to offering new ways of researching objects like EPRs, and whilst this presents methodological challenges, by not defining the object of study a priori there is the potential to produce more sophisticated analyses that are more sensitive to real work practices (Jensen 2004).

Moreover, acknowledging the entangled nature of research about technologies and organisations, and respecting that entanglement rather than trying to 'fix' or avoid it is arguably a more valuable approach to researching them than opting for narrow and simplistic notions of success and failure (McGrath 2002).

3.5   Meso level perspective

The networked nature of electronic patient records is of particular interest, because, as previously discussed, the ambition for the scope of sharing to be national or even supra-national will have wide reaching ramifications not only within the contexts of healthcare delivery, but also in terms of more subtle and pervasive macro-social implications, including shifts in understandings of healthcare and of privacy. This implies a need for a theoretical approach that can facilitate an understanding of the EPR as a networked technology.

In order to appreciate the implications of the EPR's networked-ness, in conjunction with its multiple manifestations, it is necessary to take a meso level view that goes beyond a single organisation and/or use context to investigate how the ubiquity of EPRs influences use. Therefore in terms of understanding whether EPRs benefit users through mapping the EPR actor-network, there is a need to be able to trace the connections between actors across organisational boundaries.

For the purposes of this study I define the micro context as an organisation-level EPR implementation. Recognising that in the context of Foundation Trusts and Primary Care Trusts (PCTs) a Trust may comprise a single or multiple organisations and healthcare settings, secondary care Trusts, which have or aim to develop a single EPR system potentially across multiple settings under the umbrella of a single Foundation Trust are considered micro level contexts. Conversely each General Practice, part of a bigger PCT, has its own local EPR system and on that basis is treated as a micro-organisational EPR implementation context.

The macro context is taken to comprise government policy and strategy for EPRs. Therefore in saying that I intend to approach the study of EPRs at meso level I am emphasising the role or envisioned role of EPRs as inter-organisational artefacts and the extent to which they connect secondary care organisations and GPs with each other and with central NHS and Department of Health and associated bodies as an aspect of the healthcare ecosystem.

Investigating how a technology is constituted across multiple instances and settings therefore makes it necessary to be able to theorise the technology both in an abstract and a concrete sense, and also to be able to identify and follow the actors beyond organisational boundaries.

Nicolini's (2009) study focuses on the tracing of connections within organisational practices around a telemedicine service in order to explore how trans-local phenomena are produced as a result of local activities. Organisational practices are theorised, using ANT, as accomplishments of a network of associations and tracing the connections from micro to macro practices is used as a means of understanding how practices are sustained through ongoing and active translations (Nicolini 2009).

By allowing the researcher to switch between the macro-social context and local, micro level processes Actor-Network Theory can support analysis of the dynamics of IS projects. Hanseth, Jaccuci et al (2007) investigate how a hospital EPR system ultimately failed to meet its implementation objectives, due in part to interests shaping the software at national, regional and international level, which came to influence product development at the micro level in unforeseen ways.

My objective in choosing to use Actor-Network Theory is to be able to attend to local processes whilst maintaining a view of the whole. It is impossible to keep the whole actor-network in view or to understand a phenomenon in its entirety, therefore it is necessary to be guided by research questions with respect to which aspects to focus in on (Law 1999).

3.6   Criticality, IS research and Actor-Network Theory

Actor-Network Theory's strategy of revealing interests underlying a state of affairs by unpacking its constitutive relationships enables it to be used to uncover power and politics at work, and this feeds into the critical and questioning motivations for this research.

In terms of revealing what is usually hidden in relation to what are variously characterised as 'the missing masses' (Latour 1992), 'invisible work' (Star 1991) and 'quiet politics' (Bowker, Timmermans et al. 1996) Actor-Network Theory claims to be able to be honest and revealing about who and what do the work of constituting any phenomenon or entity as the object of research. In this way ANT can be said to be critical because 'to reveal is to critique' (Doolin and Lowe 2002) and it presents opportunities to represent such marginalised or invisible actors in order to produce a more realistic story.

Actor Network Theory is often critiqued for failing to account for power and thereby for being uncritical because its ontological realism denies the independent existence of power structures (Whittle and Spicer 2008). Moreover, due to its concern with investigating how order is achieved, it necessarily highlights the victors and the heroes because their interests win out over those of others in accomplishing stabilisation of a network, and they are therefore are influential in shaping a particular order or reality (Star 1991, Lee and Brown 1994).

However, Law (1991) argues that although we should not only follow the heroes it is inevitable that they are the actors most likely to produce our picture of the network for us because they have greater influence on the shape of that network. And furthermore to treat them differently to other actors because they are the heroes plays to the very idea that they are different or special (Law 1991).

EPRs in their various forms cut across organisational boundaries and link processes and work practices within one setting with those in another, and through integration connect previously unconnected technical components, applications and processes (Bygstad and Hanseth 2011) and can be therefore argued to have attributes that make them infrastructure-like (Ellingsen and Monteiro 2000). This has implications in terms of approaching them as objects of research because it is suggested infrastructures are characteristically difficult to investigate and to understand, not least because they become 'part of the furniture' (Star 1991). Their taken for granted nature also therefore justifies exploring their politics.

Information infrastructures have politics embedded in less visible and accessible ways than other artefacts (Bowker, Timmermans et al. 1996), making those politics less open to debate and therefore potentially more concerning. By tracing an actor-network through opening black boxes to reveal the influences which establish and maintain a particular status quo one can potentially reveal such politics and the unacknowledged 'invisible work' being done by otherwise unrecognised actors, which are nevertheless essential to the existence and operation of the network as a relational achievement (Bowker and Star 1991).

The political nature of infrastructure is researched in a study of the development of a classification system for nursing work which investigated how it was constructed by a discrete group of nurses, thereby inscribing their view of what nursing work is and what it should be (Bowker, Timmermans et al. 1996). By making nurses' work visible the classification scheme was intended to enhance their professional status, conferring legitimacy on their activities, whilst by bringing their work into the realms of quantification, surveillance and control, also entailing the risk of greater management of those activities (Bowker, Timmermans et al. 1996).

Conversely work considered unclassifiable became invisible within the system, and implied loss of legitimacy and status for certain activities and roles, forming the basis for the stratification of work and making them doubly invisible in relation to the agenda to make nurses' work explicit (Bowker, Timmermans et al. 1996).

Establishing infrastructures not only entails aligning the interests of multiple groups of users and in ANT terms, heterogeneous actors (Hanseth and Monteiro 1997), but

in aiming for universality it is necessary for infrastructures to discipline work practices in the local contexts of deployment (Bowker, Timmermans et al. 1996, Hanseth and Monteiro 1997). Actor-Network Theory allows for the investigation of the inherently political processes of alignment in such standardisation by revealing and attending to the interests of different actors involved.

Whitley & Pouloudi use Actor-Network Theory in their (2001) case study of the introduction of NHSNet, the NHS network infrastructure for electronic data exchange, to analyse the ethical debate around the risks implied for the confidentiality of patient data. By conceptualising both stakeholders and aspects of the technology itself as actors in an actor-network for NHSNet ANT allows recognition of the interests of all entities that influence the debate. They also acknowledge those stakeholders excluded from the debate whose interests are represented by others, and inevitably translated by their representatives' agendas (Whitley and Pouloudi 2001).

3.7   Actor-Network Theory and empirical studies of EPRs

The literature discussed below is used as a means to position this study as an Actor-Network Theory study of EPRs in relation to how studies of EPRs and health information systems more broadly have applied ANT.

3.7.1 Power-related health information systems studies

A number of authors use ANT to discuss the ways in which power operates through the use of health information systems, such as EPRs. Exercises of power through EPR systems come to the forefront particularly in relation to their use as mechanisms of clinical accountability, a theme which emerged strongly in the literature e.g.(Winthereik, Van Der Ploeg et al. 2007, Reich 2012).

Health information systems may be used with an intention to shape the behaviours of their users and thereby exert power through the increased and wider visibility of certain activities captured and recorded in the system (Bloomfield 1991, Bloomfield 1995, Doolin 1999). It is suggested that hospital casemix information systems, which capture information about patients' treatment, are used to exercise power over clinicians by inscribing a management objective to increase control over clinician behaviour in relation to managing the costs of treatment and making them more conscious of resource usage (Bloomfield 1991, Bloomfield 1995, Doolin 1999).

Through use of such systems the concept of medical practice is renegotiated in line with the strategic aim of increasing management control over clinicians' resource usage (Bloomfield 1991, Reich 2012).

ANT enables the casemix system to be theorised as an embodiment of managerial intentions to shift from a professionally-based to a market-based rationality as part of the establishment of internal markets within their respective healthcare systems (Bloomfield 1995, Doolin 1999).

The concepts of durability and delegation are used to conceptualise the ways in which human values, rules and intentions are ceded to technologies, in durable, material form, thereby allowing them to stand in for humans, but also therefore making those technologies inherently political tools (Bloomfield 1995).

Bloomfield (1991) and Lowe (2001) use the concept of inscription to argue for the potency of representations of work within and through information systems. Users' engagement with clinical accounting systems and their use of inscriptions, such as reports, to represent their work practices, serve to strengthen their legitimacy and help to achieve the black boxing of those systems (Lowe 2001).

Bloomfield's (1991) study of information systems associated with the NHS' Resource Management Initiative proposes that the mobility of inscriptions within information systems in conjunction with the primacy given to quantitative information and calculative practices have a powerful effect in constituting expertise. Therefore in terms of their use in management decision-making this form of evidence-based rationality is not neutral. Furthermore it is argued that the pervasiveness, scale and complexity of such systems makes it hard to challenge, resist or unpick the assumptions underlying their representations of reality produced (Lowe 2001).

Berg (1997) critically examines the abstract models of clinical work embedded within EPRs in relation to their role as 'formal tools', contrasting the complex reality they claim to represent with how they work for users in practice .In this respect recording activities within an information system produces a representation rather than an objective document of reality, and implies the presence of political interests in decisions about what should be recorded, which may or may not favour users whose

work practices are being measured and scrutinised using those representations (Checkland, McDonald et al. 2007).

Actor-Network Theory is useful not only in revealing the interests that shape a given manifestation of an information system through inscriptions, but also in showing how power as an effect emerges from a particular set of relationships, so that phenomena such as accountability are constructed through multiple interactions (Doolin 1999, Doolin 2004, Winthereik, Van Der Ploeg et al. 2007). The concept of enrolment is used to discuss how a casemix system came to be established in a New Zealand hospital and how clinician buy-in was achieved, partially through the use of inscriptions in the form of reports and other information made available to users, the use of which served to stabilise the system and engender legitimacy and acceptance by users (Doolin 1999).

A later study of the same casemix system shifts the emphasis to investigate the interaction of the information system and the sets of interests within the organisation in terms of how power is constituted through the competing interests of managers and clinicians. The system is used to reinforce dominant management discourses around the control of clinical resources by making their use more visible and clinicians therefore more accountable (Doolin 2004). However, it also engenders resistance amongst users, some of whom co-opt the system to their own ends, using it to argue for more resources, and their resistance ultimately changes the meaning of the system, consigning it to a less prominent role (Doolin 2004).

Winthereik, Van Der Ploeg et al. (2007) use Actor-Network Theory to explore the ways in which GP autonomy is realised in relation to the use of EPRs as a tool of organisational accountability. They argue that accountability as a representational activity has an extensive influence on actors involved, and rather than producing direct and faithful representations of work practices it is an outcome of translations associated with the various sets of interests involved (Winthereik, Van Der Ploeg et al. 2007). GP autonomy as an actor-network is found to be defined relative to mechanisms of accountability, is constructed not through individual action but from the GP's position within their network of relationships with human and non-human actors (Winthereik, Van Der Ploeg et al. 2007).

Because actors are active agents they have to be enrolled, and in doing so they too help to shape and define a system. Ramiller (2007) uses ANT to account for way in which actor's interests shape a new information system used for documenting safety-related practices within a behavioural healthcare service organisation. In particular it discusses the agency of the technical artefact in directing and constraining staff behaviours in relation to their responses to incidents with patients (Ramiller 2007).

Through its use in documenting staff actions the system demonstrated agency in drawing attention to a poor record for safety and misuse of restraint procedures on patients, thereby threatening organisational legitimacy. As a result actors' interests brought to bear on the system design reshaped it, inscribing a reduced set of options for representing reality in relation to how staff were dealing with such incidents and preventing them from recording the use of unsanctioned restraint (Ramiller 2007). In this way the reconfigured system, by limiting the options for representing reality allowed for misrepresentation and ambiguity in accounts by making documented accounts more opaque (Ramiller 2007).

The ways in which power emerges are therefore far from straightforward or one-sided, and because of its attention to relationality ANT is therefore arguably well placed to theorise more subtle and realistic conceptualisation of power and politics that is essential to overall understanding of technological phenomena.

3.7.2 EPR implementation studies

The political nature of EPR implementations is approached from a project perspective by a number of studies that use Actor-Network Theory to investigate how interests are translated in the information system, and how they are implicated in the continuous evolution of the technology outcome. Many of the ANT studies on health information systems use it to research and evaluate processes around adoption and diffusion of information systems, allowing researchers to theorise how a particular outcome was achieved.

With an emphasis on how IT-enabled organisational change programmes in the healthcare sector can be researched and understood, it is argued that Actor-Network Theory can help with evaluation of IS success in terms of enabling more subtle

understanding of the dynamics of IS adoption and diffusion which is not narrowly technical, through revealing interests and thereby highlighting which groups are included in and excluded from negotiations (Guah, Hackney et al. 2009).

Rather than seeing them in a static 'before and after' way ANT is of value in theorising the dynamic, changing nature of technological innovations and also how they continue to evolve beyond the official end of the implementation process e.g. (Hanseth, Jacucci et al. 2007, Ramiller 2007, Takian, Sheikh et al. 2012).

Focussing on the NHS' National Programme for IT, Guah, Hackney et al. (2009) investigate the interplay of information systems with the institutional structures of healthcare through explicit discussion of both human and non-human actors. They argue that ANT supports analysis of the interests of the broad range of stakeholders in a highly heterogeneous institutional environment (Guah, Hackney et al. 2009).

Cresswell, Worth et al. (2010) propose the use of Actor-Network Theory for the evaluation of large-scale health information systems programmes, specifically EPRs implemented in secondary care as part of the NPfIT. They argue that ANT may be useful in accounting for the complexity of technology-human interactions and contend that it is the fluidity, as well as overall complexity of such systems which demands a research methodology that can cope with evolving situations in a way that linear approaches cannot, and moreover they argue that ANT is able to provide the nuanced understanding of those dynamics (Cresswell, Worth et al. 2010). It is also proposed that from a methodological standpoint ANT can help to guide the selection of research participants by identifying stakeholders in the technology project (Cresswell, Worth et al. 2010).

Greenhalgh & Stones (2010) propose combining the use of ANT with strong structuration theory (SST) for the study of large-scale IT programmes, again investigating the National Programme for IT. The attention to the relational aspects of phenomena afforded by ANT and its recognition of non-linear change and unintended consequences are argued to be valuable for the study of complex socio-technical phenomena. However they suggest that SST can be used to counter the perceived shortcomings of ANT in dealing with the issue of agency and structure in

which ANT is argued to neglect the influence of organisational structures on IT implementations (Greenhalgh and Stones 2010).

Social theory has traditionally appealed to an agency/structure dualism whereby social structures are posited in order to explain commonalities in how individuals act within a given context (Reed 1997). Actor-Network Theory is said to have a strong orientation towards processes (such as technical implementations) because it can tell a good story about how situations are created and maintained. However this is also a source of critique because with the focus on process it is suggested that ANT does not position phenomena in a wider context or recognise the role of social structures in shaping social interactions (Mutch 2002). For this reason some studies argue for the use of ANT in combination with other theories, particularly strong structuration theory (SST), because SST acknowledges the causality of social structures e.g. (Cresswell, Worth et al. 2010, Greenhalgh and Stones 2010).

In response to this criticism it is argued that Actor-Network Theory bypasses the issue by rejecting the agency/structure dualism, claiming instead that these positions are in fact aspects of the same action (Latour 1991). This again embodies the ANT principle of not imposing a priori order as a researcher advancing on a field of study, including inferring the existence of social structures (Latour 1996).

In addition to project-focussed studies Actor-Network Theory is also used by IS researchers at the level of examining micro level use practices, particularly in terms of users' information needs and conceptualisations of information, and how these are associated with particular organisational views of reality. A number of studies, discussed below, use ANT to argue against rationalistic conceptions of information and information systems in relation to the models of work which systems present.

3.7.3 Studies on conceptualisations of information

In relation to the complex information needs of a hospital it is suggested that ambitions for EPRs to become a unified source of organisational information are unrealistic (Ellingsen and Monteiro 2000). The wide variations in practices between different medical settings across departments of the same hospital are reflective of the way in which EPRs are expected to behave as boundary objects in supplying

information in an abstracted form to be used in different ways and for different purposes across the organisation (Ellingsen and Monteiro 2000).

Others critique what they argue are flawed conceptualisations of clinical information on which such 'Utopian' EPR development programmes are based (Moser and Law 2006) and challenge the problematization of more 'organic' and fragmented information ecosystems within healthcare (Ellingsen and Monteiro 2000).

This study has drawn heavily on the work of Marc Berg who has researched EPRs extensively from a socio-technical systems perspective using concepts from ANT. Berg, Langenberg et al (1998), for example, analyse the interplay and mutual shaping between electronic patient records and local level work practices in hospital settings, examining how their use diverges from the model of healthcare work they embody.

Developing these themes in relation to the conceptualisations of information, Moser & Law (2006) apply a version of ANT they call 'after ANT', which it is argued better theorises complexity, in order to argue for a conceptualisation of information and clinical decision-making which can better inform design and use of ICTs in healthcare, particularly in relation to the information flows which underpin EPRs. They argue that the assumptions about clinical decision-making and about the nature of information on which ICT implementations are based are unrealistic. It is also suggested that what counts as information may shift according to context from being clear and codified to being tacit and context-sensitive (Moser and Law 2006).

In this way Moser & Law propose a performative conception of information, suggesting that it should be considered a 'mutable mobile' (adapting the ANT concept of immutable mobiles), which not only flows through an organisation but is also fluid because it changes shape according to context (Moser and Law 2006). IT programmes must therefore take into account the multiple forms information may take (whether material or virtual) and be open to its imperfect, incomplete and uncertain nature (Moser and Law 2006).

The prevailing rationalistic, standardising agenda in relation to EPRs has generated a number of studies about how EPRs are used and experienced by users in practice, in contrast with the organisation's stated objectives for the technology.

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3.8   Summary

This chapter has outlined the principle characteristics of Actor-Network Theory and related them to the features of my research. By reviewing the literature which applies ANT to studies of health information systems I have also sought to indicate where my own study sits in relation to their various applications of ANT to aspects of this topic. The following chapter builds on this theoretical discussion by bringing Actor-Network Theory into consideration of the research philosophy and research strategy which inform my fieldwork.

CHAPTER 4 – RESEARCH METHODOLOGY

This chapter sets out to describe the research methodology for this study, beginning by reiterating my philosophical and theoretical stance. I will go on to discuss how this informs and constrains my research design and to what extent it provides a structure for the methodology in relation to practical decisions about data collection and analysis. I also discuss the challenges specific to using Actor-Network Theory as a methodological approach.

Having discussed the theoretical Actor-Network Theory literature and ANT studies of health information systems, including EPRs, in the previous chapter, I will briefly position Actor-Network Theory as a research methodology, before discussing the research strategy and protocol for this study.

4.1   Situating the research paradigm

Actor-Network Theory recognises both the materiality of technology and its inherently social nature, so that the technical and the social cannot be separated (Callon 1986). In choosing to use Actor-Network Theory I align myself paradigmatically with interpretivism, which as an epistemological perspective derives from a social constructivist worldview that considers reality to be socially constructed and therefore subjective, in opposition to positivist perspectives which hold that there is an objective external reality (Walsham 1993). Interpretivism holds that reality is not a 'given' i.e. does not exist independently, but is a product of humans and their (social) actions and interactions (Mitev 2005). Whilst positivism seeks to discover laws and make causal inferences, it is not suited to studying indeterminate relationships (Orlikowski and Baroudi 1989) and therefore interpretivist approaches are more suited to the study of complex phenomena because of their acceptance of contingency and attention to context (Walsham 1993).

An interpretivist stance entails taking a qualitative approach because the emphasis is on understanding of phenomena within their contexts (Golafshani 2003). I am seeking to illuminate a context and understand it in-depth, and one might say that as actor-networks are intimately concerned with context (Miller 1997) this is a good paradigmatic fit. Qualitative methods are often applied to studying social phenomena because they give primacy to the social context and the viewpoints of human

participants (Myers 1997). They suppose an aim to produce 'thick' descriptions (Geertz 1994) and in this respect the objective of qualitative research is not to predict but to explore and to improve understanding (Orlikowski and Baroudi 1989). This has implications for generalizability that will be discussed below.

The classification of academic research into positivist, interpretive and critical paradigms (Myers 1997) is widely used and accepted as a basis for positioning studies. Nevertheless interpretive and critical research are generally assumed to be closer in their ontology with respect to recognition of subjectivities and emphasis on social context. Moreover a number of authors consider that interpretive research may also be critical e.g. (Walsham 1995, Doolin and McLeod 2005, Cecez-Kecmanovic 2011). In particular it is recognised that Actor-Network Theory, whilst often associated with interpretivism, can also be used critically (Doolin and Lowe 2002, Hedström 2004, Mitev 2005, Alcadipani and Hassard 2010).

4.2   Why ANT?

The multiplicity of stakeholders and agendas that impinge upon the EPR might be approached using interpretivism's notion of interpretive flexibility, and I might therefore have used an interpretive framework. However Actor-Network Theory, whilst paradigmatically interpretive (in relation to being non-positivist) has characteristics that distinguish it from interpretivism which are pertinent to my interests and motivations in researching EPRs.

Actor-Network Theory sets itself apart from other methodological approaches in a number of ways that mean that it does not fit neatly into the interpretive paradigm. Cordella & Shaikh (2006) argue that there is a subtle but distinct difference in ontology whereby interpretivism emphasises the subjective construction of reality by the researcher whereas Actor-Network Theory emphasises the construction of reality through the interplay of actors.

This highlights the chosen focus for this research whereby Actor-Network Theory's intrinsic concern with interaction and relationships is central to my critical motivations to reveal the actors and interests at work in constituting the technology as it is being manifested multiply in use.

Interpretivism, whilst recognising multiple interpretations of the research phenomenon, nevertheless still seeks to discover a 'real' underlying object (Law and Singleton 2005), whereas using ANT to allow for not only multiple interpretations but multiple realities implies a subtle and important shift of emphasis in the approach from an epistemological to an ontological one.

In terms of both the networkedness of EPRs as a prospective information infrastructure and the influences of multiple sets of stakeholders and purposes that may to differing extents shape the outcomes of EPR developments, my interest in the EPR is in the relational aspects of its nature. For this reason I have chosen to use Actor-Network Theory both for its attention to relationality and for its corresponding revelatory agenda with respect to the emergence of power as an outcome of the confluence of interests.

While interpretivism is criticised for changing register according to whether it is investigating macro or micro phenomena, Actor-Network Theory treats all actors the same regardless of their 'size' (Monteiro 2000). As a networked and infrastructural technology, investigating EPRs demands a theoretical and methodological approach that is able to take a meso level view in order to trace connections across organisational boundaries, and furthermore, one which can give an account of a complex and multiple research object. In this respect the ability to treat actors at all scales and of all types in the same way has value for my aim to take a meso approach because it enables the researcher to discuss relationships between heterogeneous actors.

Actor-Network Theory's principle of 'generalised symmetry' is criticised on ethical grounds by those who argue that it demonstrates moral relativism, making ANT uncritical about the social implications of technologies in failing to take a moral or political stance (Winner 1993, Ormrod 1995, Munro 1999). This derives from the viewpoint that only humans have agency, understood in terms of moral capacity and intentionality. However it is argued the principle has been misunderstood and that humans' status as moral agents is not being threatened, rather this principle is used as an analytical tool and does not detract from what makes us as humans distinctive (Law 1992, Latour 1996).

4.3   ANT, qualitative research and generalizability

Interpretivist studies are criticised for lacking validity, reliability and generalizability in relation to findings (Kelliher 2005). Whilst interpretivists argue that the criteria their studies are judged against are essentially positivist and therefore set up to fail, nevertheless there is an expectation that interpretivist researchers ought to acknowledge these criticisms and mitigate or justify the perceived weaknesses of their position.

Interpretive research (as judged by positivist epistemological criteria) is criticised for its lack of generalizability because it does not allow the researcher to extrapolate from a sample to make causal inferences about a wider population (Orlikowski and Baroudi 1989). However, in spite of this bias towards a statistical definition of generalizability there are other conceptions of generalizability that may be applied (Lee and Baskerville 2003). It is argued that interpretive research should be judged by its own epistemological standards and therefore generalizability can be considered in relation to the ability to make inferences from a micro research setting to the wider social context (Orlikowski and Baroudi 1989) and it can be used to generalize to a theory, rather than to a population (Yin 2003).

Walsham (1995) proposes that for interpretive research the development of second-order concepts, the generation of theory, the contribution of rich insights and the drawing of specific implications may be considered types of generalization which are applicable. While I have made a distinction between ANT and interpretivism on an ontological level, nevertheless Walsham's arguments may be considered to apply to non-positivist research more broadly, including approaches which use Actor-Network Theory.

The reliability of research findings rests on the extent to which the research method can be consistently applied over time to produce similar results, which also relates to generalizability (Lee and Baskerville 2003). In the context of qualitative research this can be achieved through gathering multiple perspectives on the same phenomenon (Lee and Baskerville 2003). This study sets out explicitly to capture multiple perspectives on EPRs in terms of individuals, Trusts and healthcare settings.

Reliability and validity as criteria for judging the quality of research may also be addressed through a robust account of the research process, which documents and justifies decisions made and actions taken throughout the process as a means to build credibility and enhance trustworthiness (Golafshani 2003). This will be supported by the reflexive stance of Actor-Network Theory in relation to the researcher giving a credible account of the research.

The positioning of my study as interpretivist and critical has certain implications for how the research will be conducted in terms of data collection and analysis, and I will outline my research strategy and the associated challenges below.

4.4 Using Actor-Network Theory as a research methodology

Whilst numerous studies use Actor-Network Theory as an analytical tool, fewer use it as a methodology (Walsham 1997, Hanseth, Aanestad et al. 2004). Setting out to use ANT unapologetically and wholeheartedly as a methodology rather than just as an analytical technique presents both methodological challenges as well as opportunities for contribution to knowledge. For this reason I sought out Actor-Network Theory literature and theoretically related studies that document the research methodology in order to get a sense of how an ANT study could be 'done'.

My original aim was to discover a set of guidelines for conducting ANT studies, however, I found that few studies include much discussion of methodological practicalities and that there is no such template to follow. It is noted that there is a tendency to neglect discussion of how research is carried out (Walsham 2006). I believe this is true in terms of the general neglect of research methods as a topic of academic discussion and also in terms of a perception that research methodology is a low status pursuit and a means to an end. Law, Ruppert et al. suggest that artificial boundaries tend to be put up around things related to technique (i.e. research methods) and things related to theory, such that they are seen as separate (Law, Ruppert et al. 2011) and this feeds into the perception of a neglect of methodology. This justifies my attention to research methodology by treating it as on a par and intertwined with the investigation of the research phenomenon.

It is recognised that there are broad differences in approaches to data collection and analysis employed by ANT researchers (McLean and Hassard 2004). This reflects

the scarcity of models for ANT research, and could be said to be a consequence of the characteristic openness of ANT with respect to its own boundaries in the sense that there is flexibility in how it is applied as a research strategy (Lee and Hassard 1999, Mitev 2009). This resistance to being defined is also therefore the source of a number of challenges for researchers who want to practice Actor-Network Theory, which I aim to give an account of here.

It is acknowledged by a number of authors that using Actor-Network Theory is not unproblematic because it cannot be considered a stable framework or body of knowledge that can be readily applied by researchers (Walsham 2001). If it is to be true to its own principles Actor-Network Theory must reject the notion of applying boundaries to itself in terms of what belongs and what does not. This means that in the context of research methods Actor-Network Theory does not prescribe or preclude the use of any particular approach to data collection. However the fact that ANT forgoes construction of boundaries for itself, whilst problematic for the researcher in practical terms may also be seen as the source of its success (Lee and Hassard 1999). Theory tends to be characterised by a fixity which carries a cost in terms of understanding complexity, however, it is argued that ANT embodies a productive tension that, by leaving some things unclear and undefined may help to retain rather than strip out those complexities (Law 1999).

If ANT is not an unchanging and reliable fixed point within the research then this means that in conducting my research I not only need to reflect on the meanings of my empirical data but also to be reflexive about the research process itself and the ways in which I am using Actor-Network Theory, whether and how they work and what challenges have arisen.

The usual way of approaching social science research methods as a set of tools for studying the world tends not to take into account that because they too are part of the social world, and that the use of such tools in itself has consequences which are often unanticipated (Law, Ruppert et al. 2011). It also means acknowledging that we are driven to research what is interesting and relevant at the time and according to our own agendas (Law, Ruppert et al. 2011). This implies that as a researcher I should not ignore my own role as an actor within the actor-network and I therefore

need to avoid taking an instrumentalist approach that sets me apart from the subject of my study.

Acknowledgement of my role as an actor in the network means recognising the ways in which my actions have influenced the course of the research and how I am implicated in the production of my outputs. This does not mean that the researcher can simply enact the findings that they want or expect, because relations take effort to produce due to actors' resistance (Law 2004). It is the overcoming of that resistance that is achieved in the enrolment of actors in the network.

Thinking in this way about the field therefore changes what it means to experience difficulties with access and resistance (Winthereik, de Bont et al. 2000).For this reason I will discuss the methodological challenges presented by my decision to use Actor-Network Theory.

I have argued that my aim to find out whether EPRs benefit users is driven by a critical agenda, particularly in relation to the EPR's networked nature and the implications of this. I have therefore justified my choice of Actor-Network Theory as just such an approach in relation to these research aims and motivations.

The following chapter will describe how the research will be conducted.

4.5   Methodological challenges of using Actor-Network Theory

That Actor-Network Theory presents methodological challenges for the researcher has been recognised by numerous authors e.g. (Miller 1997, McLean and Hassard 2004, Bonner, Chiasson et al. 2009). As a part of my contribution is intended to be methodological, discussion of these challenges needs to be recognised as also feeding into preliminary findings.

4.5.1 When and where does the research start?

The starting point for research is problematic because the research process is not a neatly structured and linear process; this is an institutionalised fiction. Whilst this is not news, at least with non-positivist research approaches, it is particularly problematic in terms of trying to force an Actor-Network Theory approach into a positivist-driven conception of how research should be done. In a broader sense Calas & Smirchich (1999) highlight the paradox in trying to write about postmodern

ideas through a modernist form, and I suggest the standard model of research is just one such modernist form. This indicates that researchers must go through a process of 'reinterpreting' and repackaging their work to fit institutionalised expectations.

This comes to the fore within this study particularly in relation to the processes involved in gaining research permissions from NHS Trusts, whose rules and procedures for research and ethical approvals engender an expectation that research will fit (or be made to appear to fit) within just such a standard model, which I discuss in greater detail later in relation to gaining access.

The failure to fit within neat boundaries also relates to the process of writing. For the literature review I read not only academic articles but also, as an aspect of defining my research topic, government and NHS documents. In doing so I acknowledge that the boundary between documents as research data in their own right and documents as literature and background context is blurred.

Trauth (1997) recognises that qualitative research does not begin with the first formal interview, but with the researcher's initial exploration of themes. The process of acquiring contextual information about the status of EPRs within the NHS, key stakeholder groups and how to go about gaining access to participants, necessary to determine the feasibility of my research project, is an activity that constitutes beginning to identify actors in the actor-network.

4.5.2 Delineating the boundary of the actor-network

Actors inevitably have membership of multiple networks such that for any given actor-network it is interconnected with multiple others belonging to the actors from which it is constituted (Star 1991, Singleton and Michael 1993). Recognising this, an actor-network can therefore potentially be unbounded. This creates a situation where exhaustively mapping an actor-network would, even if feasible, produce something fractal-like and too complex to research (Williams-Jones and Graham 2003). This is not desirable or useful for analysis and so the challenge for a researcher becomes one of isolating foreground from background (Williams-Jones and Graham 2003).

Therefore a perennial challenge within ANT is how to draw the boundary of the network for the purposes of an empirical study (Miller 1997, Monteiro 2000, McLean and Hassard 2004) to determine what is brought to the fore and what remains in the

background (Monteiro 2000, Williams-Jones and Graham 2003, Nicolini 2009). Van Loon (2006) suggests that networks by nature do not have clear-cut boundaries even if they must be finite, and that the boundary may only become apparent in terms of what is included and excluded when one tries to gain access to the network. If this is the case then the boundary of the EPR actor-network should become progressively more apparent through the process of discovering the network.

In practice many empirical studies that use Actor-Network Theory are contained within a single organisation that conveniently serves as an intuitive and practical limit to the process of explicating the network, even whilst they must acknowledge the possibility of continuing to follow actors beyond those boundaries (Tatnall and Gilding 1999). However a clear organisational boundary does not apply to this study as the actor-network not only includes stakeholders from multiple NHS Trusts, but also includes non-clinical organisational bodies within the NHS, and a number of bodies which sit outside the NHS, for example 'arm's length' government bodies such as the National Institute for Clinical Excellence.

By setting out to provide a meso-level view of electronic patient records I am negating the possibility of making use of a natural organisational boundary (albeit to the extent that most organisations are now to some extent distributed and virtual one could argue that the idea that there can be a natural organisational boundary is illusory). My objective will be to reduce the arbitrariness of my boundary as far as possible by justifying it in terms of my research questions.

Each actor is in itself also an actor-network which can be 'unpacked' to reveal another therefore it is a matter of the researcher's judgement, again, how far to unpack, and this can only be determined as the investigation unfolds (Tatnall and Gilding 1999). This, as an aspect of the boundary dilemma, has implications for determining the number of participants required and identifying target participants in advance, because identification of actors within the network will be at least partly achieved through investigations of other actors. Therefore I have targeted a minimum set of 3 interviewees from each type of healthcare setting among known groups of EPR users and have designated an arbitrary practical upper limit of 50 interviewees.

4.5.3 Actors' knowledge of the network

The challenge of determining an actor-network from interviews is that where an actor-network crosses the bounds of multiple organisations actors may be unaware of the other actors involved (Underwood 2008).

The process of punctualization in Actor-Network Theory is one through which actor-networks are simplified into black boxes and means that we experience an assemblage as a unified thing such that the component entities are masked until and unless breakdown, failure or controversy arises (Law 1992). This is especially the case with the most reliable and widely shared actor-networks which are performed the most, and which are therefore taken for granted in such a way that they are considered predictable and routine (Law 1992).This would apply, for example, to entities such as information infrastructures for which ubiquity and reliability are defining characteristics. Moreover, where any process or issue is taken for granted and no longer an active point of negotiation, (i.e. black boxed), interviewees may be less inclined to discuss it, thinking of it as a 'done deal' (Scott and Wagner 2003). For any actor followed, entities which are not relevant or do not matter to them may therefore become invisible (Law 1991).

It is also argued that within accounts of phenomena significant events and actors may only be recognised as such retrospectively when narratives are constructed and as such it may be difficult for actors to give an account of the *start* of something when talking about how a phenomenon came into being because it does not gain significance as a phenomenon until later (Czarniawska 2004). Events are not inherently important or unimportant but they are only made as such within accounts (Law 1994). This potentially means that interviewees may not discuss matters that are significant within the actor-network. The tracing of connections is, then, a means to gain access to these entities.

Punctualization which makes it possible to trace connections between different 'levels' of analysis and actors of different 'sizes' because it enables abstraction by collapsing actors collapsed into actor-networks that are then obscured to all intents and purposes by the impression that the network is a single actor (Law 1992, Wickramasinghe, Tatnall et al. 2012). It is for this reason that only in the event of

breakdown is the make-up of the actor-network unmasked, and this therefore lends assistance to the researcher aiming to unpack black boxes (Law 1992).

It is also suggested that controversy is important in helping to identify actors because they are more visible at these points (Bonner, Chiasson et al. 2009, Mitev 2009). In a similar vein failures of technology to translate are revealing of the actor-network and of the values, norms and interests which are embedded in it (Williams-Jones and Graham 2003).

Networks form by aligning the interests of actors and this work, where successful, reshapes the world into one where the actor-network is taken as self-evident and unquestioned because actors' interests have become predisposed towards its existence (Bowker and Star 1996). This 'convergence' also creates a difficulty for understanding the composition of the actor-network by getting actors to talk about it, because they cannot step outside the network (Bowker and Star 1996).

In this respect as an outsider researcher I may have an advantageous perspective, because although I too shape the phenomenon that I am seeking to investigate, as an outsider to the NHS I may be able to perceive aspects of the actor-network and ask questions about it, which would not be apparent to my participants.

4.5.4 Representing non-human actors

Representing non-human actors is problematic in that they cannot speak for themselves; instead they have to be represented by others (Bloomfield and Vurdubakis 1994, Pouloudi and Whitley 2000). However it is acknowledged that this issue is not unique to non-humans because human actors who are excluded from direct involvement in negotiations also need to have representatives, and every stakeholder group which claims to represent an actor, whether human or non-human, has their own agenda and may accordingly advance different (and even contrasting) views of those they represent (Pouloudi and Whitley 2000).

In seeking to understand what it means to investigate a non-human actor it is necessary to appreciate what investigating an actor means. Vidgen & McMaster (1996) suggest that it involves talking about an actor's interests and goals in the context of its relationship with the object of study (in this case the electronic patient record), and therefore how it influences the nature of that object's actor-network.

Investigating non-human actors entails interviewing human actors who are able to speak for non-humans as well as examining sources such as documents, which relate to those actors, to find out about their interests. In doing so I must acknowledge that any so-called representative will have their own agenda and interests which will colour their representations of non-human actors' interests (Pouloudi and Whitley 2000).

As a researcher representing participants I also have an agenda which influences the actor-network being researched, because by engaging with it I become part of the network, and this is an unavoidable aspect of conducting research.

4.5.5 Research ethics and Actor-Network Theory

I set out to follow the accepted model of ethical research data management by anonymising participant interviewees and their organisations. However individuals could remain identifiable within their department or organisation because Actor-Network Theory recognises that an entity is defined by its position within the actor-network, through its relationships with other entities (Sismondo 2004) and therefore it is not unexpected that this presents an ethical dilemma.

For single organisation case studies and project-based studies applying Actor-Network Theory the ethics of participant confidentiality is arguably less problematic. In such studies the very accomplishment of access entails tacit (if not explicit) consent for disclosure of their participation on the basis that a significant number of people from the same organisation, unit or department are involved with the study and know of each other's involvement in the study so there is no privacy to uphold in terms of participation per se.

In relation to what counts as data, actors willing to talk to me informally about their work but who did not consent to participate in the research nevertheless added to my understanding and knowledge of the actor-network, and I would not 'un-know' what they had told me. This is also the case with informal conversations I had before starting formal data collection which helped to build background knowledge and test the feasibility of my chosen topic. Whilst there may be a blurring of the participant consent issue with all qualitative research for these same reasons this may be brought more to the fore with Actor-Network Theory exactly because background

context, which might be considered 'unofficial' data for the purposes of other kinds of study, is part of the primary research data for my purposes and therefore part of the actor-network.

4.5.6 Following the actors

Bowden (1995) observes that there are two notions of 'method' employed in academic literature, suggesting that whilst methods of *explaining* collected data are well furnished in the form of data analysis techniques, methods of *collecting* data are not. Because the researcher's explanatory framework influences the data that they set out to collect "choices about the method of explanation take analytical precedence over the details of data collection" (Bowden 1995 p66). In relation to data collection I aimed to adhere to the principle to 'follow the actors'.

An actor is "something which acts or to which activity is granted by others" (Doolin and Lowe 2002 p.72). Actors can be thought of as mediators because they transmit effects according to their particular interests. Actors in an actor-network are not passive links within a chain (Underwood 2008), rather they mediate and influence what they touch, involving the notion of transformations between nodes of the network (Latour 1999). That is to say actors do work and in so doing modify the network (Latour 1996).

There must be rules for deciding which entities to include and exclude in an investigation otherwise any actor-network will open to all humans and non-humans (Whitley 1999). Moreover following all of the threads from each participant would result in an explosion of actor-networks (Bonner, Chiasson et al. 2009). This replays the issue of boundary definition discussed above.

In practical terms this demands criteria for deciding which actors to follow so that I can be selective rather than attempting to exhaustively investigate all actors. I will therefore explain the criteria I have used as part of a wider discussion of the practicalities of the research protocol.

4.6   Research Approach

Having no pre-existing links with the NHS precluded the opportunity to exploit pre-existing connections with the NHS as 'ins' or make use of the tacit knowledge of a research community in relation to researching the NHS.

A number of studies of health information systems advocate an ethnographic case study approach e.g. (Henwood and Hart 2003, Bruni 2005, Swinglehurst, Greenhalgh et al. 2010, Greenhalgh and Swinglehurst 2011). It was apparent that observational research would not be a realistic option, because insider status and internal sponsors would have been needed in each participant organisation. Moreover by explicitly rejecting a micro level approach, which would focus on a single organisation or site, I have also declined to take an ethnographic approach, which would involve detailed exploration of a specific organisational context.

My research does not fall neatly within the definition of a case study because I chose not to focus on a specific NHS organisation. Because associations between actors in a meso level actor-network will inevitably escape the bounds of any single organisation, the study was not restricted to any single NHS organisational unit such as a Trust, hospital, ward, specialist unit or General Practice. The study focus on the NHS in England is incidental and a means to an end; my research is not about the NHS or English healthcare per se. Rather the object of research is the electronic patient record as a class of technology and the NHS in England presents a practical context within which to investigate it.

In order to investigate EPRs I focused my study at the meso level as a means to gain an understanding of the technology as experienced from different user perspectives in relation to various roles, Trusts and healthcare settings. I started by investigating the human actors who are users of EPRs to find out how EPRs mediate their interactions within their work practices in supporting and delivering healthcare to patients. I did this by tracing the associations between actors (both human and non-human) within any participants' actor-network for the EPR.

4.6.1 Accessing the NHS as a research site

Recognising my own role within the study actor-network I aim to acknowledge and document the ongoing struggle to negotiate access to participants in the NHS as an 'outsider', and as someone conducting research which is viewed by some NHS Research & Development (R&D) managers with some confusion, and even suspicion.

My experience of successes and failures in gaining access to research participants within the NHS is revealing about the actor-network which I am engaged with investigating. My disciplinary background being Information Systems rather than health, I lack the benefit of regular contact with people who understand the NHS context and how to navigate the research permissions process, nor do I have access through my academic community to contacts within the NHS who would be able to facilitate such processes or provide information and insights about how it works.

The role of this kind of insider knowledge in facilitating access should not be underestimated. Law (1994) gives an account of an ethnographic study he conducted, including how he gained access to the organisation via a letter of introduction from his supervisor. Whilst it is a brief acknowledgement of access as a potential issue and although it did not apparently present any challenges in his case, it is interesting in so far as he makes what most would exclude as an irrelevant issue explicit and part of the overall narrative. Such details are conspicuously absent from most accounts of research other than PhD theses.

My starting point in terms of the research was therefore from further 'behind the line' than insider-led studies, because understanding how the research permissions process works within the NHS, and how best to engage participants in various different roles has become part of the research itself. Nevertheless, far from merely reworking what is already known by insiders, I suggest that there are useful insights to be had not only from an outsider's experience of the NHS, but also from the breadth of viewpoint I am able to take across multiple Trusts which may have little knowledge or experience of each other.

The research permissions process involved contacting R&D managers for each Trust where I identified a willing participant. In practice this has involved securing informal agreement from potential participants in advance of seeking R&D permissions. Each R&D manager may bear responsibility for a number of Trusts in a given geographic area, which has facilitated gaining permissions in some cases because once my application was accepted for one Trust it was straightforward to secure permissions for additional Trusts within that manager's remit. However the experience of approaching different R&D managers has varied widely, underlining the point made about the NHS operating in practice as separate organisations. Each

R&D manager has demanded different documentation and evidence in relation to my proposed research and each separate approach has involved more or less protracted negotiations.

The forms which I was asked to complete indicate that my research does not fit the usual model of research carried out within the NHS, accepting as they are of qualitative approaches. Moreover, the norm is for the researcher to secure an internal sponsor and NHS sanctioning for a study by going through the NHS National Research Ethics Service (NRES) process. As I did not intend to interact with patients or their data my research has been classed as a 'service evaluation' by those Trusts which granted approval.

Whilst I initially approached R&D managers seeking advice on how to engage with the permissions process, many expected me to have answers to questions which I could only gain from asking their advice. The process is therefore heavily skewed towards researchers who already know the system so that it is challenging to break in to the system to start a permissions process without the insider knowledge of it. I also observe that funded research studies that involve multiple researchers tend to include researchers who work within the NHS, or who work both within the NHS and academia, making organisational access issues potentially less complex.

I suggest that had my research been eligible for the NRES process, whilst anecdotally neither a quick nor trivial undertaking (to achieve a successful outcome), the process nevertheless has a sustaining momentum which would have benefited both the perceived legitimacy of my research and the timely achievement of research permissions. Once a researcher is caught up in the mechanism they are carried along with it because there are fixed tasks and processes for NHS research managers and others involved to complete within particular timescales.

My awareness of the NHS' sensitivity about the confidentiality of patient data was heightened by early experiences with Trusts' research permissions processes, and in recruiting interviewees and gaining Trust level research permissions it was therefore necessary to emphasise that the research would not involve interviewing patients or viewing patient records. This aspect of the research process would

otherwise have been less notable had access been invisibly facilitated by institutional structures and tacit knowledge of the domain.

4.6.2 Research Protocol

The research protocol set out below describes the iterative and overlapping processes of identifying participant organisations, participant interviewees, and of gaining research permissions from organisations. It describes and justifies approach to data collection. It also documents the outcomes in relation to the numbers and roles of participants interviewed, and the range of participant organisations, in terms of number and type of healthcare setting.

I also drew on official documents as both primary data about the research question and related themes, and also as a means to confirm identifications of actors from interview data. I investigated formal documentation such as government documents, Trust websites and the websites of healthcare related bodies, relating to:

- The prescribed and intended uses of the electronic patient record.
- The vision and objectives of electronic patient record implementation programmes in the NHS in England.
- Other documents relevant to investigating actors identified from interviews.

Government policy and strategy documents can be seen as inscriptions because they present idealised versions of reality associated with particular actors (Nimmo 2011) and once inscribed with actors' interests they have agency by imposing those inscriptions on other actors (Troshani and Wickramasinghe 2014). Because Actor Network Theory treats documents, amongst other artefacts, as actors this avoids a tendency within research methods to treat documents as a supplementary data source rather than as agents in their own right (Prior 2008). Documents were used to provide a comparison between the stated objectives of EPRs and users' actual practices and experiences, and to support identification of key actors in the network. I set out to collect data both from interviews and from documentary sources about the following broad themes below, informed both by the literature and by the motivations outlined in the introduction.

4.6.2.1 Benefits and disbenefits

I stated an explicit objective to investigate benefits to users on the basis of a fundamentally critical motivation to question the technology because the literature on EPRs highlights the potential for additional burdens on clinicians in relation to provision of information, which, if driven primarily by secondary uses, may or may not be offset by benefits to their clinical work e.g. (Berg and Goorman 1999). Discussion of benefits is a means to reveal the multiple roles and purposes which the EPR fulfils for users and feeds into understanding the nature of EPRs as a technology.

4.6.2.2 Information governance

It was apparent from preliminary research that information governance (IG) is an area of active controversy in relation to public and professional debate about the privacy concerns surrounding EPRs, in terms of the security of data within the NHS network (Pouloudi 1997) the aim to increase centralisation of records (Kierkegaard 2011) the competing tensions around the desire to be able to use and share clinical information more widely to improve care (Miller and Tucker 2009, Caldicott 2013), and more comprehensive plans for the exploitation of patient data (Caldicott 2013). Information governance is therefore a major shaper and constraint for EPR systems and because of this, discussion of IG is a valuable means of revealing significant aspects of the actor-network.

4.6.2.3 Networkedness

I set out to find out about the scope of sharing, or 'networkedness' of EPRs in their various forms because their usefulness, and indeed the government vision for EPRs is based on this characteristic with respect to the organisational scope of the information system and its corresponding information flows. Discussion of scope therefore provides a means to compare the original vision with the reality and to question the gap between them. It also supports the development of an understanding of what the EPR *is* as a technology in the NHS in England.

4.6.2.4 Secondary uses

The literature highlights a tension between primary and secondary uses of EPR data in terms of the benefits versus disadvantages to those who are the providers of data. The existence of a secondary uses agenda for EPRs was already apparent, and I

therefore asked participants about secondary uses of EPR data as a means of understanding the key non-clinical drivers for EPR use and development, and in order to identify significant non-human actors. I also aimed to find out how and whether secondary uses impinge on clinical users in terms of the benefits they experience and whether those are offset by new risks and responsibilities as the primary providers of patient data in EPRs.

4.6.3 Interview protocol

Interviews were semi-structured and where possible were audio-recorded. All were transcribed in a timely manner following the interviews, or notes typed up where no audio recording was available.

Through the interviews my overall aim was to find out who and what constitute the actor-network for the electronic patient record from the points of view of my interviewees. I set out to ask interviewees about how their roles relate to the use of EPRs, what are their experiences of the record in terms of support for and benefits to their roles and conversely whether it brings about new risks and responsibilities. Interview questions addressed the following:

- How does your role relate to use of EPRs?
- What is your experience of EPRs?
- What are the benefits to you?
- What are the concerns and/or challenges?

The openness of the interview questions and the emphasis on letting participants talk freely about their uses and experiences of EPRs had advantages and disadvantages. Whilst greater focus may otherwise have elicited more detail from interviewees about particular aspects of EPR use, the aim of allowing actors to define their own actor-networks in relation to the EPR from their particular role, setting and organisation-based perspective necessitated a less structured format.

As interviews would be semi-structured, additional questions were asked depending on participants' responses in order to probe further about the research themes and in acknowledgment of the wide variations in participants' clinical or non-clinical roles. Furthermore for solely non-clinical users of EPRs the wording of questions was

adapted to acknowledge the understanding that their uses are for non-clinical purposes. The flexibility required justifies my use of a semi-structured interview approach.

Through interviews I sought to explore participants' relationships with the other actors that constitute the network in relation to their use of EPRs. These actor-networks are inevitably be unique to participants as individuals, although they will be coloured by their roles and organisational settings, for example, as a hospital consultant, community nurse or GP. Participants speak on behalf of the EPR as a non-human actor from their own perspectives and influenced by their own interests and worldviews.

4.6.4 Participant selection and recruitment

As a qualitative study that does not aim for statistical generalization my selection of participants does not constitute sampling per se. I employed a set of criteria for participant selection that aligns with my research aims and objectives. Figure 5 below shows the layers of criteria and constraints involved in identifying and recruiting research participants.

Investigation of entities & their relationships within an actor-network.

Research question

Limited time and access and meso view rule out observational and longitudinal data collection methods.

Qualitative research approach

Documents   **Interviews**

Trusts selected on the basis of use of an EPR system in conjunction with informal recruitment of participants.

Where?   **Who?**

EPR user

Trust has an EPR

Breadth and richness of participant's actor-network

Typical healthcare setting and clinical role categories and a single category for non-clinical users.

Diversity

Interviewee role type:
- **Doctor**
- **Nurse**
- **AHP**
- **Non-clinical**

Healthcare setting type:
- **GP**
- **Hospital**
- **Community**
- **Other**

Multiple instances of each role and healthcare setting.

Reliability

Understanding develops and feeds iteratively into targeting of participants.

Understanding of the actor-network

Informal participant consent and Trust research permissions.

Access

Informal participant consent   **Formal Trust Research permissions**

Figure 4. Criteria for selection and recruitment of Trusts and interviewees.

Having previously discussed my choice of research paradigm and data collection strategy in the context of my research question I will outline the rationales and processes of site and participant recruitment in greater detail.

During the scoping of the research informal conversations identified specific individuals, departments and Trusts where EPRs are used. I initially narrowed down the range of Trusts to approach by establishing which organisations had relatively mature EPR systems in place. Knowing that General Practices have been computerized for some time and that the majority would have mature EPR systems, this preliminary research was directed principally at secondary care organisations such as hospitals and community healthcare providers. I exploited informal conversations, Trusts' websites and well regarded health informatics resources for healthcare professionals such as e-Health Insider (E-Health Insider 2014) to understand where EPRs had been implemented and how recently.

Participant-interviewees were initially selected from amongst stakeholders identified from preliminary research as interacting directly with EPRs for clinical or non-clinical purposes as part of healthcare delivery. By defining my target participants in this way I elected to exclude certain stakeholders in EPRs such as software suppliers, including Local Service Provider contractors involved with the NPfIT, and pharmaceutical companies. Whilst acknowledging these actors I did not intend to investigate them but to restrict myself to organisations within the public sector domain that are involved with the EPR as an aspect of the provision of healthcare.

As previously discussed, the literature recognises that the distant interests of managers and others who are not 'hands on' users of health information systems influence their design and use in ways which may disadvantage clinicians e.g. (Bloomfield and Coombs 1992, Berg and Goorman 1999, Doolin 2004, Halford, Lotherington et al. 2010, Reich 2012). This influenced my original aim to capture just such distant interests; however after starting to collect data I recognised that tracing their connections to EPRs would be a lengthy process.

Without extended time and resources it would be impossible to trace all of the connections from, for example, a hospital consultant's actor-network for the EPR, to the informatics strategy for the NHS. In this respect Actor-Network Theory can only

be done slowly, by tracing connections from the micro level (Latour 2005). Therefore I have, in this study, tried to stay true to this methodological injunction by starting off and staying close to the 'action' in focussing my attention on direct clinical users of EPRs and leaving indirect EPR users out of scope.

I originally set out to investigate both clinical and non-clinical users' experiences of EPR use, with an ambition to appreciate the multiple sets of interests being brought to bear on the EPR. This was with an assumption that I could, by gaining a comprehensive view of users and their interests (albeit within a subset of the NHS as a snapshot), fully understand the actor-network.

In exploring multiple viewpoints I aimed to get a sense of the EPR as used in a diverse range of roles and healthcare settings. For this reason I included non-clinical users of EPRs in roles where they consume the information outputs of the EPR and who may therefore, in ANT terms both shape and be shaped by the EPR.

However the escalation in complexity in accounting for and representing the interests of non-clinical roles proved to make full exploration of non-clinical uses of EPRs via non-clinical users unfeasible. In contrast with clinical roles that are associated with distinct professional identities, non-clinical roles are more numerous and harder to categorise distinctly and as such it would not be possible to make any claims to have accounted for a complete range of non-clinical perspectives. Non-clinical users nevertheless provided valuable information about the constitution of the actor-network in relation to non-clinical interests and importantly from different perspectives to those of clinical users.

This makes explicit my assumption that clinical users are more significant within this study. To qualify this I propose that whilst clinicians are not more important in terms of professional status or influence on the actor-network for the EPR, nevertheless in being at the 'coalface' of healthcare and in fulfilling the core business of the NHS these stakeholders are key actors in a study about a technology which is intended to support healthcare. This relates back to the study rationales set out in my introduction and literature review. Other non-clinical roles and functions, whilst important in their own right, exist to serve the machinery of delivering healthcare,

and therefore my ongoing decisions about participant recruitment were led by the need to retain an emphasis on clinicians.

With the spectrum of unique user perspectives on EPRs potentially indefinite, I recognised that it would not be feasible to comprehensively gather data on and account for all of them. Moreover by trying to account for all users I would be in danger of trying to map an organisational structure for the current NHS rather than mapping an actor-network for the EPR. An aim to map all of the relevant interests in the network would also have placed me in a position outside the network, which is antithetical to Actor-Network Theory. Therefore decisions about which participants to target were guided by an aim to account for the key (direct) clinical user roles and organisational perspectives within the NHS.

In the targeting of specific clinical role types I do not seek to claim that clinical roles are not internally heterogeneous, as it is clear that a hospital nurse is likely to have a different role and experience of EPR use to a community-based nurse, for example. However, these labels are nevertheless associated with a distinct professional bodies and role functions and are useful constructs with which to structure a piece of research. This would enable me to gain an understanding of the aspects of EPRs as they relate to distinct types of role and NHS healthcare contexts and settings and the significance of these characteristics as indicators of actors' positions within the overall actor-network. For this reason participant recruitment involved both active targeting of particular types of role and organisation to acquire data across a spread of roles and organisations and to recruit multiple participants from each specified user category and organisational setting.

Recruitment of participants was iterative and done by means of direct referral from another participant and/or by identifying an individual as a suitable participant through personal contacts or by researching the Trust and its staff using websites and publicly available documentation. Where not possible to identify participants through direct referral, identification of actor roles from interviews enabled me to identify potential subsequent participants. This process ranged along the spectrum from being more opportunistic to being more targeted and became successively refined as a result of my evolving understanding of the actor-network.

This meant that my target participants were not known at the start of the data collection but were identified on an ongoing basis. I have been opportunistic, through necessity, about recruiting participants because of the difficulties of both gaining formal research permissions from each Trust and finding willing participants. I sought advice from the R&D manager for each Trust about gaining research permissions. Non-clinical users of EPRs were harder to gain access to than clinical users, possibly because of increased workloads during a period of change for all Trusts that involves a significant informatics focus, and also possibly because unlike clinical staff who come from a research-active context and of whom many are likely to have been involved with research, non-clinical users are not as closely associated with a research community and therefore potentially less disposed to engagement with research.

It follows from my decision to approach the research object at meso level that my interviewees are significant not as individuals in their roles within any given NHS organisation but as types, or classes of actor. In terms of identifying a set of criteria for which actors I follow I have therefore begun to analyse the data about which types of actors there are.

4.6.5 Analysis and mapping the actor-network

I reviewed interview transcripts and made initial identifications of potential actors within the actor-network for each participant, in combination with the use of documentary sources. In this respect data collection and analysis are intertwined as identification of a potential actor within the network influenced the selection and recruitment of subsequent research participants, and as such there was continual refining of my understanding of the actor-network.

The iterative nature of data collection and analysis in interpretive research is acknowledged (Walsham 1995, Walsham 2006), and arises as a result of the tendency towards openness rather than prescriptive-ness in terms of the researcher's assumptions about the data (Walsham 1995). This is particularly the case with Actor-Network Theory because it rejects the notion of a priori ordering which imposes the researcher's assumptions and therefore influences data collection (Latour 1996).

It became clear that I could not simply 'follow the data' in order to follow the actors, which would, in essence, have been akin to tracing my way through a kind of information architecture or NHS organogram. Furthermore my ability to follow data across organisational boundaries was restricted to my ability to achieve research permissions in other organisations. Whilst Bruni (2005) talks about 'shadowing the software' as a means to understand an EPR implementation, his study took place within a single hospital and was approached ethnographically, enabling the tracing of indicators of the EPR's presence through the hospital. Rather my following of actors evolved from interviews with user-actors.

In mapping the actor-network I followed actors that have a role as influencers of the EPR at meso level. In aiming to escape a solely micro level view I sought actors that exemplify a meso level perspective on EPRs by operating beyond the immediate local network, acting as bridges between different local networks.

In section 2.2. I defined the EPR as a technology designed for multiple stakeholders for a range of purposes, both clinical and non-clinical, and for this reason I have chosen to follow actors that are providers and/or consumers of information in the EPR; that is they can be considered users in a formal sense, whose roles in using the technology would be taken into account within design and development of EPR systems.

These actors include those in clinical roles caring for patients as part of different clinical functions and healthcare settings, who are the principle providers of the information content of the EPR. It also includes those who consume EPR data within non-clinical roles whose consumption of the information products of the EPR may also influence design.

It does not include those, such as secretaries and document scanners, who use the EPR to input information on behalf of others but who do not significantly influence, take ownership of or make use of the content. They are not true producers or consumers of EPR data in this respect and I have elected to exclude them from the field of potential participants.

I started formal data analysis by drawing out the themes pursued in the interviews and noting additional themes which emerged. I categorised responses from

interviews across the themes outlined above in section 4.6.2, namely benefits to users, scope of EPRs, information governance and secondary uses. I organised these responses into tables and made a second iteration of categorising the responses within each theme into sub-themes.

I reviewed interview transcripts immediately and made initial identifications from interview transcripts of actors that are influential to users' core role-related informational activities involving the EPR. This was carried out on an ongoing basis as and when interviews were transcribed. The spokesperson roles of participant-actors in identifying other actors in the actor-network was supported by cross-referencing with documentary sources such as policies on information governance that allowed me to develop a better understanding of the significant actors and their relationships with EPR use. Once interviews reached a stage where novel perspectives and aspects of user experience were becoming scarcer in terms of the themes set out, at 'theoretical saturation' (Morse 1995), I stopped recruiting further participants.

Instances of actors tentatively identified from interview transcripts were used to filter the categories in the tables and to provide reciprocal confirmation or disconfirmation of those entities as actors. This enabled more confident identification and labelling of actors from amongst the sub-themes. I referred back to the operational definitions of 'actor' throughout this process, as entities with influence, or 'agency' within the network.

4.6.6 Caveats

I employ notions of clinical and non-clinical interests and recognise that these are not straightforward and that clinicians' work is not solely clinical. For this reason and for the purposes of this study I define clinical interests as those related directly to the care of specific individual patients and/or patient cohorts, while I consider non-clinical interests to be those associated with the management and administration of the health service. I recognise that the boundary may be blurred in so far as government or otherwise centrally-led and centrally-driven activities undoubtedly influence clinical agendas, such as care quality improvement initiatives. However, the difference is one both of directness to the care relationship with specific patients, and whether they are centrally-imposed and mandated.

My uses of the terms 'data', 'information' and 'knowledge' is not without an awareness of the differences in definitions or their contested nature. Whilst I have aimed to maintain general consistency I have, in places, used these terms loosely and interchangeably as I have judged best suits the flow of writing. Were the study to place greater emphasis on the concepts themselves I recognise I would have had to be more precise in my use of language.

4.6   From plan to execution

This chapter has presented a philosophical justification and basis for the research strategy. My decision to use Actor-Network Theory as a defining approach rather than as an 'off the shelf' analytical tool has made it necessary to embed its philosophy firmly in the practical decisions about how to research this topic, and therefore this chapter is more heavily theoretical than might otherwise be expected.

I have systematically stepped through a logic based on Actor-Network Theory's defining principles to produce a description and justification for the mechanics of the research in terms of the research protocol, data collection and analysis strategies.

This chapter has incorporated reflections on the process of defining the methodology, because my epistemological position curtails the extent to which one can pre-know the research context as a means of making decisions about the most appropriate research approach. As a consequence the methodology was necessarily iterative rather than pre-given, and reflection is therefore crucial to justifying its trajectory.

These reflections have introduced a tension into the chapter between the pre-fieldwork planning phase and the findings of the research. The tension arises particularly because reflections on the evolving methodology during the planning and conduct of the fieldwork become early findings in themselves that relate to my stated objectives around evaluating and operationalizing Actor-Network Theory as a methodology.

It is fitting that this narrative tension should arise at the point in the thesis where it transitions from pre to post fieldwork phases. That this tension may be starker than intended is a consequence of the need to adhere to a conventional structure for

presenting academic research, within which the iterative and exploratory approach implied by the use of Actor-Network Theory is ill-matched.

The findings section begins as a relatively conventional reporting back about data collection from interviews using vignettes for each to present the flavour of the concerns of participants as a known actors in the EPR actor-network in relation to their roles, healthcare settings and experiences of EPRs. These vignettes are intended to present in narrative form, and (to avoid reproducing interview transcripts) a brief overview of each participant's actor-network for the EPR or EPRs that they use.

CHAPTER 5 - FINDINGS

Data were collected from participants in 8 NHS Trusts and 1 non-Trust body. The table below summarises participant interviewees and their organisations, listed in chronological order of interview with non-clinical roles shaded in grey:

Role	Participant	Organisation	Organisational EPR system
GP	P01	General Practice A	INPS Vision
Consultant Diabetologist	P02	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise
IM&T Manager	P03	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise
Business Change Manager	P04	PCT A	N/A
Diabetes Nurse	P05	Community A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise
GP	P06	General Practice D	INPS Vision
Nurse	P07	General Practice D	INPS Vision
Data Manager	P08	Data Management Integration Centre	N/A
Clinical Coding Manager	P09	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise

Consultant rheumatologist	P10	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise
GP	P11	General Practice C	EMIS
Occupational Therapy Team Manager	P12	Community B	Lorenzo (iSoft) soon to be replaced by Civica's Paris
GP	P13	General Practice B	INPS Vision
Assistant Practice Manager	P14	General Practice B	INPS Vision
Nurse - critical care ward	P15	Hospital B	Graphnet
Consultant anaesthetist	P16	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise
Consultant oncologist	P17	Hospital C	System C (Medway Sigma)
Consultant surgeon	P18	Hospital A	Lorenzo (iSoft) soon to be replaced by Allscripts Sunrise

Table 1. Participants, organisations and organisational EPR systems.

In documenting the interviews conducted I do not seek to replicate the interview transcripts but to outline the relevant characteristics of each participant's role and setting, and the aspects of EPR use which capture the particular issues and concerns relating to them. In addition I have identified specific aspects of the interviews that have directed me to certain actors, or otherwise triggered further attention to and investigation of potential actors. The following thumbnail sketches of interviews therefore do not seek to be comprehensive accounts of all actors and potential actors drawn out of each interview. Rather this section engages practically in the process of 'following the actors'.

The findings are categorised by clinical and non-clinical users and then within each section organised in chronological order as interviews were conducted.

5.1   Clinical users

P01	GP	General Practice A

P01's practice uses the INPS Vision EPR and has had it for at least 10 years. She has access to patient information from the local hospital's EPR via the composite Integrated EPR that also includes extracts from local GPs' and clinics' EPRs. This shared access for GPs to the local hospital EPR involves using a separate log in which takes time that GPs can little afford given the 10 minute consultation allowance per patient, so it is not used much.

Whilst shared access to the hospital record was potentially useful, content was restricted, and P01 would have liked, for example, to have access to ECGs, which she does not. The GPs can cut and paste some content from the hospital record into their practice EPR, which they often want to do, but this again only works for certain content, and not all. They also may want to print and scan certain pieces of content, such as blood results as another means to add them into their own EPR. However this is a forbidden operation, apparently intended to prevent pieces of paper 'floating around' and possibly getting separated from the patient's record, lost, or risking breaches in confidentiality.

P01 expressed concerns about the future implications of the increased visibility and shareability of EPRs, particularly for patient-accessible records, because of a perception this would increase pressure on GPs to censor and/or heavily edit their recording with an awareness of the potentially wider audience. She also raised concerns in this respect about the ability to manage patient confidentiality, particularly for patients with mental health or social care needs where details of other individuals such as family members, who are significant to their care may be recorded in the patient's EPR without that individual's explicit consent.

P02	Consultant Diabetologist	Hospital A

P02 has a long history of using the hospital EPR system, iSoft's Lorenzo, having been instrumental in its original development going back to the 1990s, in which respect the organisation is considered a trailblazer and ahead of other hospitals in England. His engagement was and continues to be strongly influenced by his specialism, diabetes, which is the source of a number of drivers for being able to share patient data more effectively between separate healthcare organisations which treat the same set of diabetic patients on a regular and long term basis.   For diabetes the management of large volumes of patient information makes the EPR indispensable and it supports identification of patterns in that data over time. Because care is geographically distributed they have established an EPR that integrates contributions from the hospital and general practice that all of them have access to.

The long term nature of care for chronic conditions was highlighted as a creating demand for more convenient, electronically mediated communications between clinicians and patients, and for patients to be able to access and in future contribute to their own clinical data. Clinical audit was clearly noted as being a key driver for EPR development as the EPR fields can be structured to support monitoring of care quality against the clinical guidelines for a disease, so clinicians can easily check whether certain clinical activities have or have not been done. In a similar way the EPR can support coordination between functions in the hospital when a patient is admitted and act as a checklist of care activities from admission through to discharge.

Provision of tests and results from pathology and radiology systems, and later, letter viewing functionality for patient-related correspondence from clinicians outside the Trust were the first elements of the enterprise-wide EPR to be developed as these types of clinical information are particularly in-demand across clinical roles and specialisms in the hospital. The reliable availability of these sets of information is the fundamental source of benefits for clinicians. In particular, for any patients admitted to hospital in an emergency it would be impossible to access paper case notes quickly, whereas the EPR provides instant access.

P05	Diabetes Nurse	Community A

P05 is a specialist diabetes nurse based in a community diabetes team, which supports diabetic patients to self-manage their condition and helps to reduce demand for hospital admissions and to prevent unscheduled hospital admissions. They have a need to share information with local GPs in the area and the local hospital diabetes team who serve the same constituency of diabetic patients and in this respect the care plans from their EPR feed into an inter-organisational diabetes-specific section of the hospital's iSoft Lorenzo EPR.

However, although shared access to the EPR makes possible the clinical governance 'box ticking' around activities within any given specialist silo, generating a lot of entries for each specialism, trying to review the detail for what different clinicians have done is hard because it involves opening a lot of separate files, whereas a chronological journal would be of greater value.

The team have relatively recently been brought under a Foundation Trust associated with the local hospital and there are still some areas where systems, such as the Patient Administration System are not shared, such as an outpost clinic for the children and young people's service. A problem arises because the community team have no clerical support to verify the biographic details of patients coming into the clinic in the evenings. This means that patient biographic details on the national patient database cannot be reconciled with the community team's EPR to keep them up to date on both the national and local systems.

P05 highlighted the ability to graph and visualise results of various kinds for patients as supporting the patient consultation in making negotiations about progress and targets more persuasive, and also in challenging patients with the evidence from the record where accounts of diabetes management vary, such as where patients may not be following their medication regime properly.

The team anticipate new functionality will become available with a new EPR implementation within the Trust, which will help them to audit their service to measure effectiveness against various KPIs.

P06	GP	General Practice D

P06 is a GP who currently works part-time at a local hospice, having just retired from working at general practice D. The hospice does not have EPRs as it sits outside the NHS, but the general practice is using INPS Vision. P06's practice are known in the area for good management of diabetes however she is nevertheless disappointed, having tried another Trust's diabetes-specific EPR that something of similar standard was not implemented in her Trust.

The Quality Outcomes Framework (QoF) is noted as having been a major driver of EPR development in general practice since being introduced because it involves paying GPs to prove that they have done certain things in terms of patient care, and payment is tied to achievement of those activities. P06 believes it has without doubt improved diabetic care, particularly in terms of monitoring medication and checking whether patients have been taking their medication as prescribed.

P06 notes anecdotally a dramatic shift in the patient outcomes for such conditions as a result of QoF and using EPRs. Managing care with paper records and handwritten prescriptions meant that it was impossible to consistently and accurately record or monitor prescribing, and EPRs also support graphing of patients' results.

QoF regularly updates the list of conditions that GPs must target for care quality improvement so for example, osteoporosis has been added this year for which the practice has to comply by reporting on the activities by the end of the financial year. However conditions like diabetes seem to be a perennial target.

Documenting thought processes within the EPR serves as a justification and rationale for diagnosis and treatment decisions, which can be important from an accountability perspective, particularly medico-legal accountability. However P06 notes that the abundance of information in the EPR can be an issue in that patients may need help with interpreting it, and it is also an issue for other clinicians who do not want to wade through large volumes of information to find what they want. She is also wary about patients allowing insurance companies to have a copy of their record without fully understanding the content or the implications of sharing it.

P06 sees coding in records as weak point because they do not get coded correctly, even though quality of coding is also now incentivised via QoF so it is in the practice's interests to get it right. However, setting up QoF-able condition templates within the EPR helps with both coding and making sure the right information is recorded as evidence for QoF.

Pathology results can be accessed by P06 on a system which allows read-only access but they are not currently transferred into the practice's EPR system and have to be entered manually. They also still arrive as a paper copy. The GP EPR system is also not visible to hospital consultants and this can lead to duplication of tests as recent tests and results cannot be seen by them.

The practice can get GP2GP transfers of EPRs for incoming patients from practices with compatible systems, and whilst this is a vast improvement on waiting for the paper case notes which can take several weeks, but there is still considerable work to do (by trained note summarisers) to clean up records when they arrive, as not all the information transfers properly.

She notes that not everything can be adequately captured in the EPR and it can be like 'painting by numbers', neglecting to represent softer and more caring-oriented activities such as comforting a patient when they are crying. She argues that doctors need to maintain the bigger picture and use clinical common sense to make sure that they are not being over-reliant on the record for how they work.

P07	Nurse	General Practice D

P07 works part time at a general practice that has the INPS Vision EPR. Although the practice is, in theory, paperless, patients who come in from other practices come with paper case notes. In the 20 years P07 has worked at the practice she notes that the amount that is recorded on records has increased vastly. Now the issue is data quality and the skill of recording enough relevant information without making it hard to wade through. She believes that clinicians' skills in recording are improving to catch up and that younger colleagues are more proficient because they are already familiar with technology. It is important to record what you have done for medico-

legal accountability and to inform colleagues about what the problem was, what has been done and the outcome so they can make decisions about next steps.

Recording is crucial for chronic disease management, which is increasingly being managed in primary care to avoid hospital admissions. A lot of this work involves educating patients and empowering them to manage their own condition. The practice has a lot of diabetic patients because it has developed a good reputation for treating them. The EPR is invaluable for this because the practice uses a template to cover all aspects of care for all conditions that are targeted by QoF, which includes chronic conditions like diabetes.

The EPR supports graphing and other visualisation of results, particularly useful for diabetes where you might want to show trends in blood sugar levels over a period of weeks, blood pressure, cholesterol and weight, for example. It is useful when there is a language barrier with patients, for educating them about where on the graph they should be aiming for, and generally to show them what is happening with their condition.

In terms of sharing of EPR data between organisations, pathology results are accessible electronically so P07 can check up on outcomes of tests patients have had in hospital. Moreover, anonymised patient data is being extracted from the EPRs for a smoking cessation initiative to evaluate the success for the Primary Care Trust, and this is done with patients' explicit consent.

P07 acknowledges a risk with structured recording that the consultation could become too target-oriented and about 'ticking boxes', and neglect the softer aspects of the patient interaction and attending to the patient's individual needs. The templates for capturing essential details about the condition are also only valuable if they are used in conjunction with a patient consultation, which aims to change their behaviours and takes into account their individual experiences, such as mood and lifestyle.

It takes some skill to be able to maintain the flow of the patient interaction and the conversation whilst using the record to read notes and update the EPR, although explaining the need to use the EPR to the patient helps. It is important to try to do it contemporaneously otherwise details are forgotten.

Accurate coding within EPRs is important for the practice in order that they receive the target-driven financial incentives on offer because Read code data facilitates reporting on the meeting of targets. However P07 suggests she finds them difficult to do sometimes when she cannot find the correct code. Slowness of the system can also be an issue when updating the templates, which P07 believes is an ongoing technical issue.

P10	Consultant Rheumatologist	Hospital A

P10 is a clinician-academic consultant rheumatologist who works in a hospital and also does clinical teaching and research at a university; therefore he has an interest in both clinical care and research aspects of EPRs. The hospital Trust uses iSoft's Lorenzo EPR but is soon migrating to Allscripts Sunrise.

EPRs are potentially extremely valuable for research, and P10 sees this as feeding directly into clinical work by helping to create a learning environment around care, which would be informed by research. He currently uses EPR data from primary care for his research but not secondary care because it is so far behind in the uptake of EPRs. He uses a number of databases that take anonymised extracts from primary care EPRs, though only a small subset of general practices currently contribute. GPs may not be aware that this data is being extracted once the agreement has been set up because it is done automatically.

The lack of access to secondary care EPR data is a problem for P10's research so he moved to a hospital Trust which has an EPR, although he notes that the data is still not structured in a way which allows him to get the information he needs and so he is involved with longer term work to try to change the structure of records and recording practice in his specialism to capture more useful data.

P10 recognises the clinical usefulness of EPRs and that this agenda has dominated their development and believes there EPRs should be used for more than just clinical care because there are other potential benefits and uses which need to be considered in terms of ongoing and future design and development, including research, audit and revalidation, quality improvement and policy development.

Getting other uses onto the agenda with IM&T departments is a challenge in a context where there are a lot of stakeholders whose needs have to be considered.

P10 believes that patients should be able to contribute updates about their condition into the EPR, so they have to attend fewer clinics if their condition is regarded as 'well-managed'. This is particularly relevant for useful clinical information that only a patient can report on, such as disease severity, or tender joint count for rheumatology.

P10 is aware that asking clinicians to record more information must have a payoff and provide benefits that are relevant to them so then do not feel overburdened. For example, they might make it easier for doctors to get statistics to show what work they have done that they can use for their appraisals. Structured and coded information is seen as particularly important, and should be collected not only from clinicians but also from allied healthcare professionals and patients themselves.

Unfortunately the ways in which data in EPRs (where they have them) is structured varies from one hospital to another so any ambitions have to start locally; the idea of getting national EPR extracts from across the NHS is ambitious and has great potential but is also a long way off. Even if the data were available in the same format the 'plumbing' does not currently exist to extract it because data flows are restricted for governance reasons.

The Summary Care Record is not currently useful to P10 because it does not contain the volume or type of information content necessary for research. The Integrated EPR, which is also available at P10's hospital Trust (which incorporates extracts from local GPs and the hospital which they can all access on a read-only basis) may be useful for research purposes and P10 has requested access but has found the governance processes around gaining access were not straightforward.

The main benefits of the EPR 'as is' are quick access to test results and being able to get all the patient information you want. He acknowledges some frustrations with having to open and close a lot of different interfaces and having to open up scanned documents and notes to find out certain things because some information is buried within documents and not easy to get at. Orders and requests for treatments and tests are another area of frustration because the categories P10 wants to use are not

always available and he wastes time looking for them or trying to adjust to categories offered and this introduces potential for error, whereas with paper he could have written down what he wanted. P10 currently writes notes on paper during his outpatient clinics then dictates a clinical note for entry into the EPR, though the paper still gets scanned and kept for legal accountability reasons. The clinical note in the EPR doubles as the letter to the GP, and reduces work in that way.

P10 recognises there is the potential for loss of quality of patient interaction if clinicians look at the screen too much and this is something that clinicians have to find the best way to manage.

P11	GP	General Practice C

P11 works at a practice which uses the EMIS LV EPR and which also offers patients electronic access to their own records. They have to register and are given a PIN to access their record online via a link on the practice website. The record is identical to the one held by the practice and is known as a 'tethered' record, and P11 is at pains to make the distinction between this and what are known as Personal Health Records (PHRs) which involve patients recording various clinically relevant information for themselves. This, he argues, is only useful for an extremely niche group of patients, such as those with very rare conditions where they have no choice but to self-manage it and they have greater expertise than their doctor, however it would be useful nevertheless for tethered EPRs like his practices uses to incorporate an overlay of patients' own comments, which would help provide context. The main advantage of tethered records for patients is to provide an accessible reminder of salient points from a consultation.

It is important that patients get explanation and guidance from the GP with interpreting information in the EPR, and the relationship of trust with the GP is essential to that. P11 stressed the role of the GP in this, and that their data management skills are often overlooked with respect to summarising and recording notes in the record in analysing and interpreting the data and also keeping it clean.

P11 notes that EPRs were originally a GP-led development to support prescribing, which is why they are so useful to GPs, particularly in terms of having well-structured

and legible information that allows GPs to quickly find and check details from the medical history, letters, medications, the latest summary and notes from other healthcare professionals.

The EPR forces a certain way of handling patient consultations based on one problem at a time, whereas in hospital P11 often used to use mind maps to capture multiple, often interacting, patient problems. He has to work around this by recording the main problem in the 'problem title' field and then document others in the free text, however he notes that it can be challenging to deal with multiple issues within the 10 minute consultation and the EPR is set up to reflect that model.

The Quality Outcomes Framework (QoF) changed the nature of EPRs significantly because they became no longer optional in that they had to start carrying out and recording certain clinical activities for certain conditions. However P11 suggests this skewed recording as GPs try to avoid recording diagnoses like depression because it is associated with a number of targets, and he thinks that targets like this are a poor way to performance manage GPs. He thinks it also skews clinical activity because those with QoF-able conditions, and 'super patients' with multiple QoF-able conditions get a lot of time and attention whilst others get neglected. This applies for other incentive schemes as well, such as flu vaccinations.

P12	Occupational Therapy Manager	Community B

P12 is a team leader for the occupational therapy (OT) service within a community healthcare unit, comprising 13 people in all including the OT coordinator above P12. The community services of which the OT team are a part were recently brought under an ex-mental health Trust that now has Foundation status. They still use different EPR systems, with the community services using iSoft's Lorenzo, and expect an imminent roll out of a new system, Paris, to the whole Trust. The new information system is seen as important also for bringing the new organisational structure together so they can communicate more effectively with colleagues at other sites who currently use different EPR software.

The occupational therapists use Lorenzo to record high level details of their contacts with patients but have no facility to input clinical notes about the content of their consultations, which continue to be recorded in paper records. P12 anticipates that the roll out of the new EPR system will eventually allow them to do this and is keen for the team to be able to record all OT work online.

The EPR incorporates a diarying and appointment system which is used by a separate team, the 'Booking Management Centre' to book initial patient appointments with the OTs based on timeslots made available. OTs are expected to take a minimum number of new cases each week, and the diary system produces an overview of caseload for the OT team which is useful to P12 as the manager for performance management.

This is seen as supporting a drive to reduce the waiting list for OT services and enable the team to meet their 6 week target period for treating patients. The NHS imposes an 18 week limit for treatment, which, if breached, the Trust gets fined for. The control over individual clinicians' caseload was entirely with the OT in the past, however P12 perceives that this meant OTs were treating patients for too long, sometimes extending their role because they have built a good rapport with the patient. There is now emphasis, supported by use of the EPR on OTs limiting their work with the patient and sticking more strictly within treatment guidelines. The waiting list for OT treatment has now reduced from 12 weeks to 10 days.

The performance lead for the Trust uses the EPR data to produce the 'contract report' which P12 and her team receive each month. It provides an overview of referrals received, treatment times, patient contacts, cancellations and what percentage of patients were seen within the 18 week waiting time target. This is used for performance management of the team, along with the weekly statistics, which P12 is able to produce herself.

Team members can get an overview of patient referrals for the whole team and for the other community services. However they would not be able to see the details of other clinicians' appointments because they are confidential. P12 can only see a patient contact on the EPR if they have been referred to her.

OTs use the EPR system to record all of their contacts with patients, whether face to face, by phone or letter, including discharge letters. It is important that these get recorded because the income for the Trust relates to number of contacts per patient, with a target set by the Trust. At the end of each day OTs need to 'outcome' the contacts within the EPR system to show what has been done, for example if they will have a follow up appointment or be discharged. OTs spend most of their time out on home visits and would have to come back to the office at the end of the day to do this unless they have mobile EPR access.

There was a trial of 'toughbook' laptops with mobile broadband at one time which OTs could take out on home visits and access Lorenzo from the car or while with the patient, although P12 believes it is difficult to 'do your statistics' when the patient because of a perceived loss of rapport and connection with them. There were also problems in some geographic areas with getting an adequate broadband signal, meaning they could not access the system at all or records were slow to load and use.

P12 uses the system to look at her team's 'statistics', and these are important for proving the value of the service because they now have to operate as a business and could lose out to a private provider if they do not meet the targets and prove they are 'worth the money'.

P12 finds the Lorenzo system slow but is familiar with using it, having come from another Trust that uses the same software, whereas she believes some colleagues find it difficult and will be resistant to the new system because of the change it will involve.

As a lot of work is still paper based the team have to write out patient referrals and fax them off to other services, and P12 would also like this to be electronic. She also believes having access to fuller EPR functionality would support sharing of information with other bodies such as Social Services who they tend to work quite closely with. They often need to share information, for example, about patients at risk of domestic abuse or who are drug users. P12 is aware that patients' record content cannot be shared but suggests that indicators could be visible to external users on the patient's record to help safeguard both patients and also staff going into patients'

houses. They currently have markers for MRSA positive patients but P12 believes these are not prominent enough.

P13	GP	General Practice C

Easy and quick access to clinical notes on the 'problem screen' when first going into the patient record helps P13 to attend to particular things in her assessment of the patient, and this is especially needed as there are only 10 minutes allocated for each consultation, so the GP does not have to 'start from scratch' and sift through the large amounts of information in the EPR. Easy access to clinical notes about the patient also equips P13 to challenge a patient's version of events, for example whether they have been taking their medication.

There is a vast difference in the legibility and therefore usability of hospital discharge letters sent electronically (which accounts for a minority) and those received from hospitals handwritten on carbon copy paper or as a photocopy and then scanned into the practice's electronic document management system. Receiving paper discharge letters can also be slow, taking up to a month, so electronic versions are also more timely.

Ordering tests from pathology services (which are commissioned from a hospital in the region) and receiving the results directly into the EPR is a well-used functionality. However a recent change of provider to a different hospital has introduced some issues with delays and receiving duplicate results, and because of the medico-legal status of things documented within the EPR duplicates create extra work as each has to be checked to see whether it is new and has to be seen to have been actioned to justify ignoring it.

Read coding of diagnoses and treatments within the EPR feeds into QoF, which is one of the main income streams for GPs in terms of rewarding them for recording certain information, for example, details on asthmatics are entered into the practice disease register for asthma. This and other incentive schemes such as the Local Enhanced Service, National Enhanced Service and Direct Enhanced Service operate to ensure GPs provide a certain level of service and quality of care and

EPRs support these by being structured so as to make sure the relevant content is recorded in the right ways.

P15	Nurse Critical Care ward	Hospital B

P15 works on an acute medical ward of a local general hospital, which uses the Graphnet EPR system. The hospital Trust has recently been incorporated into a Foundation Trust with another local hospital that does not currently have an EPR system.

Nurses have access to pathology results such as blood tests via the EPR system. However, they continue to use a variety of paper documents alongside the EPR, including the drug kardex, food, fluid balance and weight charts. They use the EPR for reference and input mainly the patient care plans, but these often also get printed out to go with the paperwork at the end of the patient's bed so there is duplication, and P15 perceives that this creates problems with too much information being in too many different places. He believes there are too many demands for information and that it needs to be streamlined and made easier for nurses. He would prefer for more of the clinical information to be recorded only in the EPR as it would reduce the workload involved in accessing information and documenting care and would get rid of issues with legibility and losing paper notes.

P15 perceives a lot of the recording as being driven by the demand for accountability in terms of proof that he has been doing his job in case there is a need to go to coroner's court.

Doctors on the ward use Computers on Wheels (COWs) to access and input into EPRs whilst at the bedside, although the hardware is too big and cumbersome to use properly on the ward and a lot of EPR use happens off the ward. In this respect there tends to be a shortage of computers available when clinicians want to use them and nurses usually have to defer to doctors and allow them to use the computer if they need to. Ward clerks tend to do a lot of the inputting on behalf of doctors, and older doctors are often reluctant to use EPRs, asking nursing staff to get information for them which they could access for themselves via the EPR.

P15 perceives ongoing challenges with protecting patient confidentiality both with paper records and EPRs because visitors sometimes start reading the paper notes at the end of the patient's bed, although they can potentially also read over the shoulder of the doctor using the EPR on the COW. To protect patient confidentiality access to EPRs is not possible from the computers on the ward as these are more public spaces, but they are available at the nurses' station and the manager's office. However there are also issues with some people leaving themselves logged in to EPRs and leaving their Smartcards in the machine so other users could use their access rights.

There are sometimes technical usability issues with the EPR application freezing and staff may be left unable to use it for hours at a time. Finding the time (as well as the hardware) to update the EPR is difficult and nurses as a general rule end up working an extra half an hour each day to do all their administrative work, some of which involves inputting into the EPR. The unpredictable nature of work on the acute ward makes it especially hard to find time to do these things, and there are currently heavy workloads due to shortages of nursing staff that exacerbate this.

P16	Consultant Anaesthetist	Hospital A

P16 is a consultant anaesthetist and pain specialist, creating two elements to his role, one tied to surgery and the other, which involves outpatients (and occasional inpatients) suffering from chronic pain. The hospital has very recently moved from iSoft's Lorenzo to Allscripts' Sunrise EPR, which is currently being implemented throughout the Trust. P16 does not have an electronic anaesthetics record, although a nearby hospital Trust does have one. He uses the hospital-wide EPR as part of which he can access blood results and letters.

Currently for the anaesthetics element of his job there is a pre-operative assessment for the patient which is done on a paper document but which should mostly become electronic with the new Sunrise EPR system, and this will enable him to do the assessment more flexibly rather than doing it in a rush a few minutes before the operation. This is made possible by having operating lists also available in advance from the TheatreMan system, which is currently separate to the EPR.

Patients' pre-operative consent is the only aspect that is challenging to incorporate into EPRs because they have to provide a signature and be given a copy of the signed consent form, and therefore paper is still used. The anaesthetics related monitoring of the patient during surgery generates large quantities of quantitative physiological data including blood pressures and drug concentrations, which are measured at regular intervals, and this currently has to be recorded on paper charts although it would be ideal to capture electronically.

P16 believes that developing an electronic document for the pre-op assessment should change users' behaviours, for example in carrying out the review before they go onto the ward. This might also help address a bottleneck because patients all need to be assessed at the same time and there is not enough hardware to support this, whereas people could access EPRs for their reviews anytime and anywhere in the hospital or potentially from home.

P16 dictates clinical notes for entry into the EPR, which his secretary types up, though the use of EPRs means there is an increased demand for secretarial time. However he can re-use clinical notes for GP letters if necessary by cutting and pasting content, and this saves time. Junior doctors do not have secretarial support and have to type up their own clinical entries.

Prescribing of post-operative pain relief benefits from being electronic because it has been protocolized so that there are standard sets of pain relief which you can select for each of a number of patient 'types'. This encourages the use of the standard medication sets by making it easier for doctors than individually selecting drugs.

The specialist team are able to make use of the information within the EPR system to review their work and to prove what they are doing, particularly in the form of audit data that they have to publish. The ability to aggregate and manipulate data from procedures also enables the team to monitor the quality and safety of work, for example in reviewing complications from epidurals. There are currently no Dr Foster league tables for P16's pain work; the anaesthetics work comes partially under surgery and is hard to untangle from it, and P16 believes it is not well captured. They can also use EPR data for their own clinical appraisals to provide evidence of their clinical practice.

Scanned documents, which are mainly historical documents, are seen as a major inconvenience because they do not open quickly and are slower to read than paper, and can be difficult to find, whereas with paper records you could look for a section of paper of a particular thickness. Thumbnailing helps with findability but the only resolution would be to dispense with paper completely. Another flaw in the system is that results which have come back are not flagged up as new to indicate that they need to be reviewed or actioned, instead the secretaries receive a spreadsheet of results and flag new results to the consultants.

Despite the drawbacks, using EPRs is an improvement on paper records because they do not get lost and multiple people can access them at the same time from different sites across the hospital.

P17	Consultant Oncologist	Hospital C

The hospital Trust provides specialist services within the region, meaning that they care for patients who would otherwise primarily be cared for by GPs across a number of PCTs and general hospitals within the region. This creates a unique set of needs for sharing clinical information about patients between these different organisations, for which the Trust have developed a web portal which allows GPs and other hospitals' consultants in the same specialism to access their EPRs on a read-only basis if they are treating the same patient. However they have found that despite a stated demand for this, mainly from GPs, access audits show that the main users are consultants in other hospitals.

The Trust currently uses the Medway EPR but is in the process of developing a new EPR system. This is being done in-house as a result of disappointment with suppliers' inability to meet the Trust's basic functional requirements for an EPR system.

Support for clinical communications between consultants and services such as radiology that are integral to the Trust's function are a priority for any EPR system. The Trust requests services from a number of sites within the Trust and patient records need to be transferred between consultants and these providers, documenting what needs to be done for the patient and then the results and

outcomes communicated back to the consultant, and EPRs are indispensable in this respect.

The main issue for consultants in the Trust revolves around lack of access to their 'home' EPR system when holding peripheral clinics on other hospital sites (belonging to 12 other Trusts across the region). As a response a link has been set up which allows access through the Trust's firewalls for at least one of P17's peripheral clinics. However shortage of hardware can still pose problems for getting access to EPRs in peripheral clinics and at home Trust sites.

Tackling the backlog of paper, both legacy case notes and paper correspondence which continues to come into the Trust from outside is seen as one of the main barriers to becoming paperless. The management of paper will rely on scanning paper documents into an electronic document management system that will be integrated with the EPR.

EPRs support the monitoring of treatment for individual patients against the nationally imposed target times. They are also used for clinical audit for the Trust internally to monitor patient outcomes for different disease groups. This has been made possible by the introduction of disease-specific templates within the EPR, which are highly structured and ensure that specific information relevant to the specialism is consistently captured, to enable subsequent aggregation and analysis by the Trust. It was noted that the use of these templates was not seen as a burden by clinicians because they had been designed by them and tailored to their needs. The data they can now produce on the basis of these templates is also invaluable for submissions to the relevant national disease registry, and figures produced are more accurate now they can be produced in-house from EPRs than when this was being done by an external body on their behalf using the paper case notes.

P18	Consultant Surgeon	Hospital A

P18 is a consultant surgeon who uses the EPR system (now the Allscripts' Sunrise EPR) for all her patient contacts, both inpatient and outpatients and it is also used for letters to GPs. All clinical entries are dictated and secretaries then either audio-type them, or they can now use voice recognition software to create entries, which they

need to then check for errors. A lot of the discharge summaries, written on her behalf by junior doctors, and which go to GPs are now created within the EPR, or alternatively are dictated by P18 and input by secretaries using MediSec and sent electronically, if the GP system is set up to receive them.

The main problem with using EPRs is that although the Trust is paper light they still get a lot of incoming correspondence on paper, which has to be scanned. Scanned documents are noticeably slow to open and with duplicates and irrelevant information it can be hard to find what you need, although you can bookmark documents making them easier to find again. The tight timescales for consultants when they see patients in the clinics, where a new patient gets allocated a 20 minute time slot means that this slowness when opening documents can be a problem, although P18 believes this will improve in the future. P18 comments on the need to use filters to manage the larger volumes of information in order to access what is relevant within an EPR that integrates the contributions of many different clinical groups.

Consultants with tertiary referral practices tend to experience the most problems with scanned records as they get a lot of them, and they are not necessarily aware that new correspondence has come in so they would not know that they need to look for it. P18 has a tertiary referral practice but as she is the only person dealing with her sub-specialism she is always aware of what correspondence has come in, whereas for others there may be multiple consultants and it is not always clear who has seen and dealt with what information.

P18 would review a patient's notes in the EPR every time she has contact with them and then submits entries after every ward round by dictating notes. There is a problem with a lack of hardware for accessing the EPRs with demands from a lot of other clinical staff, and the consultants can and do pull rank to get access to a computer if there is a shortage, but for others finding a free computer can waste time.

She notes that nursing staff at the hospital now use handheld tablets to access patients' charts, though they are reported to be unsuitable for making clinical entries and reviewing records. The other downside of the hardware shortage is that

clinicians can end up taking paper notes on the ward round and then typing them up later, which duplicates work and gets away from the objective of real-time entry at the bedside. It also means that they tend to provide less detail.

Currently pre-operative consent is still paper-based because it involves the patient having to be sign the document and being shown it while on the operating table, before the operation can go ahead. P18 states that there is a plan for electronic signing to be introduced in future.

P18 believes that a lot of the issues currently experienced with EPRs may be due to users' lack of familiarity and if clinicians invested time in familiarising themselves and doing the self-training modules they would find things easier. She also recognises her own role in cascading information about developments and in acting as an advocate for clinicians' interests in future EPR development, though this is demanding in terms of time and requires her to be selective about what she chooses to focus on. P18 would like to be able to pull data off the EPR system for audit and quality review purposes but currently would have to request reports from the IT team as she does not have the permissions to do this for herself.

P18 is aware of possible perceptions of poor patient interaction when clinicians are looking at the EPR a lot during a consultation, and this is exacerbated by patients hearing that hospitals are understaffed, so it can give the impression that clinicians are wasting time and not caring for patients. She believes that patients need to be educated that clinicians are looking at the computer because they have to use it to access the patient information needed to care for them.

5.2   Non-clinical users

P03	IM&T Manager	Hospital A

As a project manager for development of the existing iSoft Lorenzo EPR and for the imminent implementation of a new Allscripts EPR system P03 has an overview of benefits and challenges, cutting across the hospital and the Trust. The hospital Trust has become a Foundation Trust and recently incorporated local community healthcare services. The hospital has a well-established EPR relative to other

hospitals in the NHS, and for this reason they are considered exemplars. P03 argues that work practices in the hospital could not function now without the EPR as using it has become part of their processes. P03 reports that clinicians universally accept that there is no going back to the days of using paper records. This means, however, that if the system goes down it has a huge impact, so extracts from the system are backed up on a separate server on a daily basis as a contingency. There is ongoing work to scan historic paper case notes to add them into the EPR so that eventually they will not have any paper notes.

P03 highlights issues for the EPR team to do with meeting the needs of diverse settings and diverse specialisms, suggesting that some, like diabetes, have lead the way in driving EPR development, whilst others, like A&E and surgery do not necessarily perceive a need for an EPR.

The EPR is multi-disciplinary in so far as all healthcare professionals and specialisms are represented within the record so that the information is now shared and nursing staff in particular say they feel more involved in decisions.

There are continual demands for the IM&T team to add new documents or ways of manipulating and visualising patient data in the EPR, many arising from new care quality initiatives, whether local or national, such as 'intentional rounding' on the wards (checking patient comfort hourly) and VTE assessments for risk of pulmonary embolism, which create a demand for activities to be documented. For national initiatives having an EPR makes it easier to provide the data for compliance with reporting demands as compared with hospitals which do not yet have an EPR and have to record on spreadsheets. Some nationally imposed activity and performance targets are associated with payments so it is important for the Trust to be able to report back on them.

P03 believes that expectations of what the EPR should do have increased significantly, partly because people are used to using devices such as iPads, whereas in contrast some of the interfaces and hardware in the hospital are dated, 'like a Fisher Price computer'. Some of the hardware is also unsuited to the context; for example, nurses ought to be able to use an EPR at the bedside with the patient rather than having to go to the nurses' station.

The Trust also uses an Integrated EPR, which combines EPR extracts from the hospital's EPR system and local GPs' EPR systems into an electronic record that can be accessed by both on a read-only basis. The Trust's EPR is also able to provide electronic discharge letters within 24 hours directly into local GP EPR systems, dispensing with paper discharge letters. This also ramps up expectations that more processes should become electronic through the EPR.

Taking on community services has meant that the new EPR needs to be more mobile, and it also needs to cater better for functions like A&E. The current EPR has some decision-support functionality embedded which triggers or creates alerts for certain activities and there is a plan to expand on this. NICE guidelines more within the care pathways so that certain activities are done as standard and, for example, there will be safety alerts so that you aren't prescribed contraindicated medication, and the EPR will automatically trigger ordering of tests and procedures. However, P03 is mindful that users might get alert fatigue if this is taken too far.

The other significant part of the vision for the new EPR is to be able to give patients access to their own records. The Trust already does this on a smaller scale with a national system called RenalPatient View, which allows renal patients to access their own results electronically, and to have email consultations, as one consultant at the Trust already does. There are some concerns, however, that this might create a burden for consultants if patients email unnecessarily.

P09	Clinical Coding Manager	Hospital A

P09 works as the Head of Clinical Coding and Data Quality for the Trust. P09 manages the team of 23 who deal with coding of patient records and manage the quality of that coding.

They use two coding schemes; ICD10, which is a worldwide classification scheme developed by the WHO, and OPCS. ICD10 captures diagnostic information including what the patient was admitted for as well as details of existing conditions and clinically relevant health and social care issues, whilst OPCS captures procedures and interventions. Coding does not capture everything well, in particular severity of

disease is hard to capture, and it is something that has an influence on the length of stay.

Use of coding enables the Trust to use the EPR data for all manner of secondary purposes including research, epidemiology, mortality rates and looking at the 'casemix' of patients and treatments for future planning purposes with regard to resource needs. They are able to examine costs at patient level and use the EPR to justify why a particular patient had a longer length of stay. Care quality initiatives known as CQUINs are also supported by coding because care outcomes can be quantified and analysed against CQUIN targets.

Coding is critical to the Trust getting paid for patient care. For this reason the team audit the quality of documentation and the quality of coding internally. There is also an external Payment by Results (PbR) audit to check coding is accurate in relation to the income received. Since PbR was introduced in 2003-04 the coding team have become more visible within the Trust because of their role in bringing in income and the increased focus on the quality of data in records. There are also audits for records access with respect to confidentiality.

The team cover coding for both inpatients and outpatients and start as soon as the patient is discharged. Having an EPR is a major advantage to P09 and her team because it was difficult and time consuming in the past to track down and keep hold of the paper case notes for coding when other people wanted to use them, and the delays impacted timescales for reporting. The Trust now has a target to code the record for every patient within 10 days of discharge. The EPR allows them to code more quickly and more accurately and in-depth about the treatment that the Trust has provided, however there is more information content than in paper case notes and therefore more work for the coders. The other benefit is legibility compared with paper records and concurrent accessibility of EPRs, which helps when the coders have to contact consultants to check things and they can both look at the record at the same time.

The team code all aspects of the record and look at everything from an episode of care from when a patient gets admitted through to the discharge summary. Once the Patient is registered on the Patient Administration System (PAS) this then feeds the

EPR with the patient's details. Having the correct demographic details is important, particularly the GP details because they are needed for reimbursement of treatment costs and for sending out discharge letters. Demographics are checked against the national database, which also helps identify overseas visitors, duplicate records and patients who have died.

P14	Assistant Practice Manager	General Practice A

P14 supports the Practice Manager at the practice, and is involved with the claims for reimbursement the practice makes for treatments they offer over and above the basic GP service, such as minor surgery and contraceptive implants. She also deals with new patient registrations and when their records come in, often electronically via GP2GP, P14 summarises the record in their EPR system. This process is much quicker with GP2GP, which helps the practice meet the target set by QoF to have notes summarised within about 6 to 8 weeks. Using the Smartcard to access the Spine enables patient's core details to be updated on the national patient database.

P14 uses EPRs also in answering external queries about patient medication or for checking history, and this would be much more difficult if they had to go and find paper case notes. Letters are now received electronically from the local hospital (although they still get paper letters from other hospitals) which has also reduced the use of paper.

The practice have also been receiving pathology results electronically into the EPR for 5 months and can order blood tests and other tests such as X Rays, cytology and baby scans electronically, with types of results available directly via the EPR continually expanding. These are downloaded directly into the EPR at several points throughout the day. However there can be some confusion because results are not added to the EPR system on the day the test was done so the date shown can be misleading. Practice staff have visibility of tests and results from the hospital but not to the hospital EPR.

Although the surgery is aiming to be paper light P14 believes it contradictory that when a patient leaves the surgery all of their electronic record has to be printed off to send to the receiving practice, whereas she would like to be able to send a CD or

encrypted memory stick instead. P14 reports that there are district nurses who are based with the practice in the same building but who do not have access to the EPR system. They therefore have to use paper referral forms to request district nursing services and district nurses have to ask directly for additional information on the patient if they need it.

P14 does a lot of searches and reports using the EPR to make claims, for example, she would search for how many patients had received contraceptive implants during a given period, or she might be asked to carry out an ad hoc search for patients who had been prescribed particular medications if there had been a safety warning issued about contraindications.

For activities which are compulsory for the practice and which they get targeted on, such as flu vaccinations, having an EPR now makes it a lot easier to report on how many have been done. Read codes are important for doing searches for reporting purposes, however it can be problematic if doctors code things in different ways, even though the consistency was improving. The EPR includes guidelines for activities that need to be carried out for certain conditions, such as asthma, and this also supports the consistent and accurate use of Read codes. Without the guidelines there to act as a checklist of activities may be omitted and patients have to be recalled because these activities are important for meeting QoF targets. P14 believes that data is extracted automatically from the EPR system for QoF on a weekly basis.

All reporting for reimbursement must be done for 31st March each year in order for the practice to be reimbursed. There are a number of incentive schemes they might be reporting for, including the Direct Enhanced Services and the Gold Standards Framework for end of life care. The targets which practices are given tend to change each year so that a new set of indicators might be added, for example, and they are set in October so that practices may have to start recording certain things if they had not already been getting recorded, and may have to backtrack to add information for the previous 6 months.

P08	Data Manager	Data Management Integration Centre

P08 works as a data manager in a Data Management Integration Centre, one of 9 new types of NHS organisation across the country whose function is to acquire and process the NHS data taken from primary and secondary care in the region for a variety of management and other secondary uses purposes. The Health and Social Care Information Centre was expected to fulfil the function of managing NHS data but in practice does not seem to respond well to local data needs.

P08's role involves acquiring data from hospitals, and NPfIT has forced them to start providing it, however getting information from GPs is much more difficult because they are self-employed businesses. Only a small amount of data is currently being acquired from GPs in comparison with secondary care, although changes in the NHS (which happened in April 2013 with the NHS restructure) are expected to be able to force GPs to provide more data.

The QoF is one way in which the NHS is able to get data from GPs; however P08 does not trust the data because it suggests performance levels that are unrealistically high. He believes the self-governed nature of the reporting undermines its reliability and suggests the audit process is also questionable. P08 explains that GPs argue against providing patient data on confidentiality and data security grounds, particularly where patients have chosen to opt out of sharing their records via the Summary Care Record. There is an argument that the NHS number, which was intended as a means to transfer patient data confidentially because it enables record data to be pseudonymised, has come to be labelled as 'person identifiable' data itself because so many systems are using it now.

The GP Extraction Service extracts some patient data from GP-held EPRs for particular conditions, in order to provide aggregated data on prevalence of diabetes in an area, for example. Patient data also currently 'flows' beyond individual NHS organisations via the Patient Demographic Service, which maintains a national index of all patients, with basic demographic details and their GP, which is needed to support the economic model where the 'owning' GP has to pay for their care. This

index is used to cross-check and update patients' details when they are admitted to hospital.

Added to the challenges of persuading GPs to provide information, patient record data may not be shared or might be incomplete if they contain sensitive data such as HIV status, and similarly abortions would be considered sensitive data.

If P08 wants to acquire particular information from GPs he can ask for a particular set of Read code data to be added to the GP extract which is automatically downloaded, however the process to do this takes a long time and the need for the data might well be out of date before he received it. Overall this creates a problem for P08's role because the data is not able to flow beyond the GP organisation without explicit agreement. Where GPs share EPR data beyond their organisation, for example in the Integrated EPR (where extracts are taken from local GPs and the local hospital EPR system and are made visible to both on a read-only basis), not all GPs in the area participate so this too is partial.

In relation to the agenda for sharing of data more widely with other public services, P08 is similarly sceptical about this being possible because of the legal barriers to sharing confidential data. Patients have to explicitly consent to all specific uses of their data, so that for a risk stratification project that he is working on the GPs involved had to contact all of their patients by letter to request consent for participation, and as expected only a subset of these patients are reached and subsequently give consent, therefore the population being represented is only a small sample.

P04	Business Change Manager	PCT A

P04 works as a Business Change manager for primary care IT and clinical systems within a Primary Care Trust. This role involves managing data quality for primary care EPRs for 100+ general practices within the Trust. It also involves managing the 'referral gateway' system that enables them to do electronic referrals to hospital, the roll out of Summary Care Records within the Trust, and also upgrading a number of practices from the EMIS EPR system to EMIS Web. The team also collect data from

the practices within the Trust for various submissions, for example, national returns such as flu vaccinations.

They support practices to configure their EPR systems to make data entry easier, for example by setting up templates and forms. All of the practices within the Trust have an EPR system and would only use paper case notes as a fall back now, although these retain some legal status and cannot be destroyed without permission.

The Summary Care Record works on the basis of implied informed consent and will contain core, high level clinical information and will link to GP systems so that it is updated from them when GPs use their Smartcards to connect to the Spine. Users also have to be on an N3 site to gain access, i.e. a site with access to the NHS network infrastructure. The Trust is not 'switched on' yet for Summary Care Records because 50-60% of the patient population need to have had records created to make it sustainable to use.

The data for the SCR comes from GPs because patient information within the NHS flows back to them by default, except for patient data from sexual health clinics or prisons. Some PCTs have set up their own local versions of Summary Care Records which take extracts from GPs within a particular Trust so that it is available to out of hours GP services. This is being done by some Trusts in addition to the SCR, which is national in scope.

Improving the data quality of Read coding in EPRs is part of P04's teams function. Read codes turn data from a patient's record (diagnoses, procedures, operations test results and also demographic information and whether you are a smoker etc.) into alphanumeric codes, and information in Read code form is extracted from GP systems to determine payments to them. P04's team are involved with training GPs how to code properly and with monitoring the quality of coding, for example by checking how many pregnant men they have registered. There have in the past been data quality projects, such as the IM&T Direct Enhance Service where GPs received financial incentives to improve the quality of their coding. Now P04's team tend to act in more of an advisory role as practices manage data quality better for themselves.

Read coding is fairly effortless for GPs because their EPRs contain templates for conditions where codes can be predicted for the most common things. Templates themselves act as an aide memoire and make sure the patient data is entered in a particular way.

Now the Quality Outcome Framework (QoF) is incentivises data quality and drives recording practice. Whereas GPs used to get a fixed sum of money, now they are paid to meet certain quality targets which include doing and recording certain clinical activities for a list of chronic diseases, and this is led by the NICE guidelines. The team also do counter-fraud audits to ensure practices are not submitting false or inaccurate data.

Data for QoF is extracted from GP systems in non-patient identifiable form. There are systems and bodies in place to ensure that data collections follow certain rules, including ethics and confidentiality related ones. There is a Caldicott Guardian for each practice and a committee for the PCT called the General Practice Information Group, which scrutinises all applications for extraction of data from GP systems to ensure it meets the NHS guarantee.

Practices are also incentivised for other 'soft' quality related activities which relate indirectly to information governance, such as note summarising policy, data related skills training, data security and confidentiality measures and business continuity policy to ensure there are data back-ups for example, if there was a system failure.

There are some local incentive schemes for GPs, such as smoking cessation for P04's PCT, where practices would be paid for every smoker who quits, and that information has to be collected from them from their patient records, run through a central database, and then they get paid.

Chronic disease management is difficult to do without computerised patient records and it used to rely on disease registers, but this was time consuming to manage and more challenging if patients have co-morbidities. Child immunisations, age-related health checks and prescribing are also difficult to manage without EPRs. Computerisation of primary care was initially free from IT suppliers in exchange for them sharing their patient data, however now the PCT are responsible for all hardware and clinical systems.

5.3   Summary

This findings chapter has provided an outline of the data collected from interviews with participants, capturing the nature of their experiences of EPR use in relation to the actors and relationships which are relevant to their particular roles, healthcare settings and concerns.

The following chapter provides analysis of the findings from both interviews and documentary sources.

CHAPTER 6 – ANALYSIS

This chapter analyses the findings from participant interviews and documentary sources in relation to the themes outlined in the Research Methodology chapter.

This analysis involves identifying from the data the actors that influence and give rise to the electronic patient record. These actors include human users of EPRs, instances of the EPR in participant Trusts, material actors, and abstract (non-human) actors. In addition to identifying actors the analysis attends to the relationships between actors as a means of understanding how actors influence the actor-network for the EPR. Overlaid on the actor-network analysis I explore the networkedness of EPRs encountered as a characteristic that is significant to their function and to their role as envisaged within the UK government's strategy for the NHS.

The research examines users' experiences of EPRs in relation to both primary and secondary care, noting significant differences in experiences and actor-networks across these two contexts due to differences between care settings and modes of EPR use. These differences reflect the historic evolution of information systems within the NHS, and represent a disconnect within the findings between primary and secondary care, highlighting the challenge with respect to EPRs' proposed contribution to the strategy of 'seamless' care across patient care pathways (NHS Institute for Innovation and Improvement 2006-2013, Cresswell and Sheikh 2009).

The majority of interviewees (13 out of 18) are clinical users of EPRs, and as such their experiences in terms of benefits and disbenefits dominate. The experiences of non-clinical users were also sought, and although I narrowed my focus to emphasise clinical users, interviews with non-clinical users nevertheless served to indicate the scope of non-clinical interests, and to underscore the importance of EPRs to a range of administrative and management purposes, in doing so revealing a number of non-human actors in the network.

6.1   The EPR as a networked object

In relation to the status and scope of EPRs since the demise of NPfIT, the implementation of EPRs has defaulted back to being Trust-led and also therefore implies challenges for funding such development. In this context whereas most GPs already have local EPR systems secondary care has experienced slow uptake of

EPRs (Khurana, Ogston et al. in press). Furthermore local, regional and national clinical databases and information systems have grown up within various healthcare settings and clinical specialties which pre-date organisation-wide EPR systems, and whose functions may or may not be adequately met by those organisation-wide EPR implementations, particularly in secondary care where there are multiple clinical roles, functions and specialisms.

The status of EPRs at 'meso' level (in 2013) is that systems are largely local to an organisation, or Trust (where organisation and Trust boundaries are the same), with little or no integration of EPR systems between different Trusts, and with none of the participant Trusts having fully interoperable EPR systems with other organisations.

Nevertheless there is inter-organisational sharing of electronic patient records (or partial records) of a different nature, including one participating Trust which has enabled read-only visibility of their EPRs via a web portal for external users. Where there is sharing of patient data across organisational boundaries, and particularly between different organisational settings, such as primary and secondary care, this is in the form of subsets of the electronic record rather than whole EPRs. In the case of one participant Trust their Integrated EPR, an example of the most significant degree of sharing between primary and secondary care, is comprised of extracts of the electronic patient records from the majority of GPs in the Trust area and from the hospital EPR system, visible via a web portal to participating GPs on a read-only basis.

At national level the strategic NHS-wide roll out of the Summary Care Record is progressively creating records for the patient population in England, drawing its (currently limited) data extracts from GP systems, where the practice has been enrolled and patient consent obtained. This, when complete, will provide an electronic patient record which is visible to those with legitimate access, across the whole of the NHS in England. However the SCR cannot at present be considered a 'whole' EPR in relation to the vision of a nationally networked EPR for each patient because it contains only biographic and core clinical information, rather than providing a full longitudinal medical history.

In the case of Summary Care Records a number of participants were unsure as to whether the SCR programme as a strategic NHS-wide roll out was still running, and it is apparent that they are not on the radar for the majority of users interviewed. Moreover, clinical participants who have some knowledge of SCRs are not using them in any meaningful way, even whilst they acknowledge their potential usefulness is a general, abstract sense. Figure 5 below shows examples of known flows of EPR data between Trusts.

Figure 5. EPR networkedness and character of sharing

General Practice

Diabetes EPR

GP2GP

Hospital letters

Summary Care Record extract

Tests and results

General Practice

GP2GP

Hospital letters

Summary Care Record extract

Tests and results

Patient

Tethered EPR

Renal PatientView

Summary Care Record

Community Services

Diabetes EPR

Summary Care Record extract

Pathology Radiology X-Ray

Discharge letter

Summary Care Record extract

Diabetes EPR

Renal PatientView

Hospital

Specialist Hospital

Summary Care Record extract

Pathology Radiology X-Ray

Discharge letter

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Whilst not comprehensive (relying on necessarily incomplete knowledge of the actor-network derived from the primary research) Figure 5 is nevertheless indicative of the inter-organisational sharing of whole or partial EPRs.

Improved access to clinical information as the primary driver and raison d'etre for EPR systems implies a particular conceptualisation of information as a resource. Considering EPRs from a knowledge management perspective operates on both a content level in terms of the accessibility of clinical information *within* EPRs, and also on a functional level in terms of accessibility of the records themselves (as compared with paper records).

6.2   Relationships between users and EPRs

Analysing the relationships between user-actors and EPR system actors provides insights into the larger actor-network. Participant Trusts are using various different EPR applications, as shown in Table 1, and there are also differences in the levels of maturity of EPR systems, more so in the case of secondary care. Users' relationships to EPR systems may be experienced as information providers, consumers or both. All clinical users have a strong relationship with their local organisational EPR systems in terms of use being integrated with work practices and their general perception of them as beneficial to and supporting work.

You know every time you switched it on it was just there. …it was there and people immediately began to think ooh this is a step forward. (Consultant P02, Hospital A)

There are also strong relationships for users with EPR data sharing for clinical communications purposes, where services such as blood tests and X-rays are provided by one healthcare organisation or department to another. Furthermore 'GP2GP' exchange of GP-held EPRs, where technical compatibility exists between practice systems, is well used and involves the transfer of EPRs from one General Practice to another when a patient moves.

Users have weak or non-existent relationships with the national level Summary Care Records, apparent in non-use and generally low levels of awareness of them, with clinicians being largely unaware of whether their organisation has enrolled in or uses them. Only a few participants were able to speak on behalf of SCRs, one of whom is in a (non-clinical) role directly involved with implementing them.

Yeah I don't have access to it; I know you're supposed to. I know I can ask to have access to it and it is a thing at the top but the Trust hasn't really sort of forced it on us. Well it's on a slight agenda but it hasn't really been made a key topic for us so I know it exists and I know that it sort of gives you some access and I know that people in this Trust do have access to it and, like I say it was a tab on the top of the EPR but I haven't really integrated into it. (Consultant P16, Hospital A)

A relationship also exists between users and EPRs where there is inter-organisational sharing that enables users to electronically access non-local patient records as consumers of patient information originating from or 'belonging' to another organisation. Interviewees who mentioned accessing other organisations' EPRs indicated that this is on an irregular basis, if at all. Access is also restricted by 'legitimate need' as defined by the user's role and organisation.

There is variation amongst users in the extent to which they use their local organisational EPR system, depending on role, setting and the functionality available to them. A community-based user reports having access to their Trust's EPR, but only to narrow and highly structured forms for recording the core information about a patient appointment, and with no information about the content or nature of the consultation, for which clinical notes continue to be recorded in paper records. At the other end of the spectrum one hospital consultant uses an EPR which has a customised area for the diabetes specialism which combines inputs from the diabetes team in the hospital, local GPs and the local community diabetes team, who are able to access and contribute to the shared specialism-specific record.

The strengths of the relationships between user roles and types of EPR could be considered an indicator of the degree of stabilisation of the respective actor-networks. Whereas organisational EPR systems in primary care and secondary care (where implemented) can be considered relatively stabilised, at the other end of the spectrum the Summary Care Record is arguably not. Table 2 below shows the levels of sharing of whole EPRs that have emerged from the findings; reflecting the degree of networkedness of EPRs along a spectrum from national NHS-wide visibility of an electronic record at one end of the spectrum to locally-restricted visibility of an organisational level electronic record at the other.

Type of record	Purpose
Local organisational EPR	Detailed clinical patient data centred on care within that setting and/or organisation. May include specialism-specific forms.
Inter-organisational EPR	Organisation allows access to its EPR to clinicians outside the Trust on a legitimate need basis.
	Multiple organisations provide elements of a shared EPR that they can all access.
National EPR	Summary Care Records containing the patient's biographic information and a core set of clinical information extracted from primary care EPR systems.

Table 2. Types of EPR by level of sharing

In spite of the potentially distant audiences for patient information, much is for all intents and purposes recorded for the use of a limited group of people; a GP surgery or specialism, and centred on a particular function, and the usefulness of this information is primarily to those recording it rather than to external organisations or other clinical roles.

In the case of a specialist hospital Trust, which by definition would not be the usual healthcare provider for its patients, their EPR can be accessed and treatment information viewed by the patient's GP and specialists at local general hospitals, however the findings suggest lower levels of use than anticipated (P17). Except for the diabetes-specific record findings suggest that inter-organisational sharing of EPRs is exploited little in practice, with clinicians accessing the specialist hospital EPR and the Integrated EPR only on an ad hoc basis. The knowledge management role envisaged for EPRs appears therefore to be of low clinical relevance in an inter-organisational respect, and for most clinicians the value of the EPR is largely local.

Contrary to the impression of some participants that the development of Summary Care Records had been abandoned along with the NPfIT objectives for EPRs, they are continuing to be implemented. However, 50-60% of any practice's population need to have had an SCR created before it is a sustainable option to 'switch on'

access to them, offering a possible explanation for the overall impression of a stalled programme.

In relation to the proposed informational advantages of nationally networked EPRs Greenhalgh, Stramer et al (2010) noted in their evaluation of the Summary Care Record that expectations that it would benefit unscheduled care (particularly Accident and Emergency and out of hours GP services) were not borne out, with instances of use low. In this sense it could be said that Summary Care Records have failed to translate clinical interests.

Inter-organisational sharing of EPR data that is universally agreed to be valuable and heavily used is in the form of clinical communications with other healthcare organisations and clinical functions, replacing other communication mechanisms, usually fax or phone, for requesting and receiving results of various tests and procedures for patients. This kind of sharing is also in evidence where hospitals are able to provide an electronic discharge summary to the patient's GP. Electronic discharge letters can be viewed in the EPR by some general practices where an interface has been set up locally between the hospital and GPs' EPR systems, and a data sharing agreement has been established.

6.3   Interoperability, networkedness & organisational boundaries

Largely autonomous systems development in separate NHS Trusts has resulted in an array of disparate clinical systems in use in different organisations, which generates technical interoperability-related barriers to EPR sharing that need to be overcome. As such there is a view amongst users that achieving interoperability is a distant objective which is difficult to achieve and unlikely to be in the near future (P10, P12).

Interoperability in different forms (e.g. technical, content and format) and at different levels (e.g. intra or inter-organisational) is a defining aspect of EPRs in relation to their role as a mechanism for the wider sharing of clinical information beyond the individual clinician, team, organisation or Trust. The degree of interoperability defines and constrains the scope of the EPR and is determined not only by technical interoperability but also largely by organisational boundaries, which are in turn defined within the NHS organisational structure. Instances where organisational

boundaries are bridged enabling inter-organisational EPR sharing have been noted above.

Within the findings from participant organisations, apart from GP2GP instances of whole EPRs shared between organisations are restricted by geography and also by the types of organisation they serve within that area. A GP with access to an inter-organisational EPR that gives her visibility of EPR excerpts from the local hospital records for her patients, for example, states that this two-way EPR sharing includes GPs within the area but not walk-in centres or other clinics. The table below offers an analysis of the networked-ness of various types of EPR that emerged from the findings in relation to participant Trusts in this study.

TYPE AND SCOPE OF EPR SHARING							
Local *intra*-organisational			*Inter*-organisational + geographically constrained		*Inter*-organisational + national		
EPR Type	**GP EPR**	**Hospital EPR**	**Community EPR**	**Integrated EPR**	**Pathology results**	**Specialist Hospital EPR**	**GP to GP**	**Summary Care Record**

EPR Type	**GP EPR**	**Hospital EPR**	**Community EPR**	**Integrated EPR**	**Pathology results**	**Specialist Hospital EPR**	**GP to GP**	**Summary Care Record**
Scope	Intra-organisational EPR with organisation-wide scope.	Intra-organisational EPR with organisation-wide scope.	Intra-organisational EPR with organisation-wide scope.	EPR shared on a read/write basis between a hospital, community diabetes team and local GPs.	Requests for tests and treatments and receipt of results between GPs and hospital pathology, X-ray and other service providers.	EPR shared via web portal on a read-only basis with GPs and specialist consultants at general hospitals in the region.	Inter-organisational exchange of GP-held EPRs between GPs with compatible (but not necessarily the same) EPR software.	EPR shared between primary and secondary care based on extracts from the GP-held EPR and updateable by all organisations accessing it. Partial national roll out to date (April 2014).
Content	Whole longitudinal patient record for clinical care delivered by that organisation.	Whole longitudinal patient record for clinical care delivered by that organisation.	Whole longitudinal patient record for clinical care delivered by that organisation.	Diabetes section of the EPR only, which is based on the hospital EPR. Read-write access for all users.	Test requests and results only.	Record focused on the specialism and is not a whole clinical record. Read-only access for 'consumers'.	Whole longitudinal GP-held record. Transfers are not 'clean' and work is needed to realign data fields and check and amend the rendering of content.	Core biographic and clinical information only. NPfIT aim was to gradually enrich the record with greater clinical detail.

Table 3. EPR instances and scope of sharing

This analysis indicates that the extent to which EPRs and patient data within them are shared varies with type of EPR and that any organisation may have access to multiple types of EPR; therefore users' experiences may cut across any or all of

these. Sharing of whole longitudinal EPRs on a read-write basis is happening only at local (i.e. intra-) organisational level.

There's issues with sharing information, you know, when there's a safeguarding issue, when there's a child protection issue, that sort of information has been quite relevant in the news where things have *not* been shared because people don't talk to each other, the communication systems don't talk to each other and this is a way that we need to get the communication systems to talk to each other. (Occupational Therapy Team Manager P12, Community B)

Since 2004 Trusts have been able to apply for Foundation Trust status, which allows for devolved financial management independent from the Department of Health (Robinson 2002), and this has been associated in many cases with the expansion of Trusts' boundaries to absorb other NHS healthcare providers in the locality. The changing organisational boundaries of Trusts involve shifts in the scope of EPR sharing within a local geographic area, for example, a participant hospital Trust expanded to incorporate community health services and a participating community healthcare team has been brought under a former mental health Trust, entailing a need for EPR systems to accommodate user groups with particular functional needs and at different sites.

This also presents challenges for developing EPR systems that accommodate different ways of working and take account of different roles and healthcare settings, such as community-based roles, which need EPRs that are able to support mobile working and the associated information security considerations (P12).

The organisational boundary determines the scope of EPR sharing by defining an arbitrary limit.

An issue with the Integrated EPR project that [deleted name of individual] works on is that it only helps if patients go to hospital A, when in fact they may easily go to MRI or another hospital (because of the choice they have now). Additionally there are other places they can be sent for care within the [deleted name of area] area which would not come under the ICR programme, such as the now-defunct Darzi centres which were 8 til 8 walk-in centres intended to reduce A&E attendances, or the Care UK centre on [deleted road name], which is private but contracted by the

Crossing organisational boundaries requires formal data sharing agreements to be established due to the legal requirements of data protection. Data sharing on any level also therefore sets up a requirement for EPR access to be audited to ensure that only those with a legitimate need to access records do so.

Organisational boundaries also come into play with respect to healthcare organisations that fall outside the control of the NHS, including hospices and nursing homes, which do not share access to NHS information systems, even if they are part of certain care pathways.

Within the NHS there are also boundaries set up around certain services that affect the scope of EPR systems. Although patient information flows back to the GP by default, certain organisational information systems (and patient records) remain local to prevent the flow of patient data because of its sensitivity, including records held by sexual health clinics.

Even within the same physical site organisational boundaries are apparent, as different groups who work together may not share access to the same electronic patient records. For example district nurses located in a participating GP surgery do not sit within the same organisation as the GPs, and have no visibility of their records (P14). Similarly, hospital consultants who hold peripheral clinics outside their own Trust may not have access to the systems of their host Trust even though they may be treating their patients (P17).

6.4 Clinical coding [ACTOR #1]

Coding is a critical actor in relation to both primary and secondary care, providing a means of translating patient information into a context-free format that makes it more transportable and mobile, thereby providing content interoperability between NHS organisations. It involves translating information about diagnoses and treatments into alphanumeric codes using one of two main hierarchical schema, Read codes, used in primary care, and ICD10 (and on a smaller scale OPCS codes) used in hospitals. Unsurprisingly widespread and comprehensive use of coding is only made fully practicable by the existence of EPRs, which facilitate the finding and selection of appropriate codes and enable easy filtering and reporting on the basis of these codes across aggregate bodies of patient records. Coding is mandatory as an aspect of recording, in primary care where it is done by GPs when updating patients' records, and by professional coders in hospitals.

The use of coding does not meet direct clinical needs for primary users but supports administrative requirements, largely determined by external demands from the centre for various forms of reporting about patients and the quantity and quality of care. It also enables pro-active use of EPRs within the organisation for searches and reports based on clinical records, for example to identify resource needs and trends within local patient populations in support of care initiatives. Moreover, central reporting demands internalised by healthcare organisations have generated internal organisational requirements for administrative and clinical information through such reports.

Yeah, you can probably search, like I say I could probably learn a lot more on search and reports. You can search for anything as long as it's on the records and you've got the right Read codes. (Practice Manager P14, General Practice B)

The coding of patient diagnoses and procedures supports calculation of the costs of treatments and services and determines reimbursement to Trusts for services they provide to each other within the internal market of the NHS. Documenting care activities in the EPR affords quicker, more accurate and more granular clinical coding compared with paper records, and EPRs in turn enable more accurate claims for reimbursement (P09). In this way the association between EPRs and coding

serves to support the stabilisation of EPRs by enrolling allies in the form of non-clinical processes and activities that are supported by their use.

Whilst Read and ICD10 coding are used as standard across the NHS other forms of structuring of EPR content are locally-defined, and this means that because the data can be 'sliced and diced' in different ways by different organisations it may be incommensurable between organisations and EPR systems. This is problematic for clinical researchers seeking to draw on EPRs from multiple organisations as data sources, and for those aggregating clinical data at national level, because fields, data formats, structure and content are likely to be incompatible (P08, P10).

6.5   Work practices & settings

There are differences in perceived usefulness and benefits of EPRs according to role and specialism depending on how well EPR use fits with existing work practices and settings, and what functionality is available to different user groups.

Different healthcare settings (such as a hospital ward or GP surgery) and clinical roles (e.g. consultant or community-based occupational therapist) are associated with distinct work practices and ways of working in relation to the use of EPRs, particularly in relation to material considerations involving hardware and physical access.

GPs and clinicians who operate with an outpatient-style consultation model see patients in a fixed location where patients come to the clinician's office, and therefore have dedicated access to a computer to view and input into EPRs. Non-clinical users also have dedicated computing hardware and therefore physical access at least is not problematic. Other roles are more mobile, moving through various settings and therefore have to weave their access to the EPRs around the times and spaces and hardware available in those contexts.

Yeah, outpatients is different obviously cos the doctor will have his own computer so he can quickly, they aren't going to have to fight to use something are they. You can be on a computer, "I need to use it really quickly, blah, blah, blah", so then you stop and let them use it and then you've got to start all over again and go back … (Nurse P15, Hospital B)

The use of EPRs relies on accessibility across various dimensions, closely tied to healthcare settings, roles and associated organisational structures. Computing hardware presents physical considerations of whether there are enough computers and whether they are available in the locations they are needed as desktop or mobile devices, and the suitability of any given hardware for particular settings and clinical functions, such as ward rounds or home visits.

Users depend on having network access in terms of an adequate broadband connection, which was highlighted as an issue for community services where individuals go out on home visits (P12). Mobile broadband had been trialled with community occupational therapists using 'toughbook' laptops to access electronic records, which presented problems in some geographic areas due to poor network coverage. Even where available the EPR could take a long time to respond, and intermittent coverage meant that OTs could sometimes be unable to execute functions in the application (P12). Access to a Trust's broadband network is also an issue for some users such as consultants who regularly conduct work outside their own Trust's sites (P17).

A further level of access permissions have to be managed by users at the level of EPR applications using username and password logins, with Smartcards needed for access to Summary Care Records on the NHS Spine (as distinct from the Trust's internal systems). Users commented on the inconvenience of regularly changing their passwords in order to use the EPR system (P17, P16).

6.6   Users' experiences of benefits

There is consensus that electronic patient records are beneficial in supporting clinical work through being more accessible than paper records on a number of levels. All clinical users agreed that EPRs are a significant improvement on paper records in terms of legibility and not getting lost or being misplaced, which means there are no difficulties with finding the records themselves. They can also be accessed concurrently by multiple users rather than being tied up by a single user at a time.

So whilst there may be, it may have drawbacks, it's a damn sight better than anything that's paper based because you can, multiple people can access it at multiple times, at the same time sorry, but you can all access it, and you can all

access the same record from multiple sites, which is also important and useful. (Consultant P16, Hospital A)

This brings advantages in terms of the efficient use of resources, for example, reducing time and effort that would previously have been spent tracking down paper case notes, and reducing delays in communicating and taking clinical decisions which could affect the responsiveness and timeliness of patient care (P17). The flexibility and convenience of 'anytime, anywhere' access to electronic records was noted by a number of clinicians, in relation to enabling EPR access from different locations within their site(s), or off-site, including from home with a VPN for some users (P16, P17, P06, P02).

You don't have to go into theatre any more to check it, you can, if you had a VPN you could do it at home. But you can check the list, and then you can do the whole electronic review of the patient at any time. So you don't have to do it in the 2 minutes before the operation so it gives you a greater length of time to assess the patient in some ways. Yeah, so you can do that the day before instead of having to do it, like, on the day, cos you couldn't get access to the notes because the secretaries have had them, or….its historically there's always been an issue about operations is that you can't find the notes. (Consultant P16, Hospital A).

A second key area in which EPRs are seen as beneficial is straightforwardly in terms of access to more and better quality clinical information about patients (P13, P09). In hospitals users can access the contributions of different professional groups, i.e. doctors, nurses and Allied Healthcare Professionals (AHPs), where these were previously separate sets of records that would have been relatively inaccessible between professional groups (P18). Easier access to clinical information also supports communications with healthcare professionals in other organisations because EPRs enable clinicians to respond more quickly and accurately to enquiries about patients (P03, P14).

So in terms of the electronic record, that's really valuable to us because we can look at what our colleagues in secondary care have done or are asking us to do, or what the ongoing care plan is for that patient. (Nurse P05, Community A)

There is a perception of improved efficiency of clinical communications, supporting ordering and requests for treatments from a range of specialist healthcare functions such as pathology labs for blood tests, MRI scans, and occupational health services for example, and communication of results and outcomes electronically through the EPR. As a type of clinical information that is critical to clinical decision-making, quicker and more convenient access to results, both in primary and secondary care is cited by many interviewees as highly valued functionality (P10, P13, P15, P17) and avoids costly duplication of work.

Being able to manipulate information in new ways is seen as beneficial. A number of users mentioned that the ability to graph and visualise clinical data, such as blood sugar readings, for individual patients is particularly useful in supporting the patient consultation as a means to show the patient trends, supporting patient empowerment and self-care agendas (P05, P07).

Participants noted a risk with the need to be oriented towards the screen when using the electronic patient record, which could interfere with patient interactions, although whilst acknowledging this they did not believe it to be a significant problem (P10, P07). A few users indicated awareness of a general tension between the drivers for recording data, and the clinical relationship in terms of patients' perceptions of clinicians' use of EPRs, and also concerns about retaining a focus on patients' clinical needs (P07, P11, P10). P07 suggests that clinicians need to take care that (through using the EPR) the consultation does not become target oriented and focused on 'ticking boxes' over and above attending to the patient.

Access to greater quantities of information can pose challenges in terms of finding particular information within EPRs (P18, P10), although it was also noted that functionality allowing users to filter content by category (e.g. test results, clinical notes), and thumbnails and bookmarking for scanned documents help to mitigate this. Training and familiarity with the system were suggested to be important in this respect (P14, P18).

Now, absolutely everything's on there, the stool chart, nursing evaluations, but you can filter all this so it only looks at the things that I'll be particularly interested in

looking at clinical notes. Some of the things, like the stool chart may not be as relevant, so I can take all that out. (Consultant P18, Hospital A).

Medications are a subset of clinical information where sharing between primary and secondary care is particularly valuable (P18, P02, P05) and significant to the patient safety agenda (P03). This is the only area where use or potential use of the Summary Care Record was mentioned by interviewees.

Benefits and disbenefits are not equally distributed, with hospital consultants noting that, for example, junior doctors do not have secretaries who will do the work of inputting clinical entries into records on their behalf (P18, P16, P17). In this respect secretaries and other staff such as ward clerks shield consultants from having to alter their work practices too much and in this way consultants experience the benefits of the EPR without as many of the disadvantages. Although not necessarily experienced as a burden or disadvantage by them, the use of EPRs is reliant on the work of secretaries. In this sense gains in efficiency (in terms of clinical activity) from the use of EPRs must be offset against the increased demands for secretarial time.

Access to hardware also operates hierarchically so that if there is a shortage of computers, there is a tacit expectation that other staff including junior doctors would give up a computer they are using to allow a consultant to use it (P18, P15).

If you can get onto a computer there's enough computers on the wards. And I as a consultant can quite often get a computer even if someone else is using it, which is wrong but unfortunately that is a choice. I think for the junior doctors it is a real problem and we have had this numerous times at Directorate meetings etcetera but it hasn't as yet been given the priority it should be. (Consultant P18, Hospital A)

There are also differential benefits experienced depending on role and specialism as discussed below. Outside of primary care the content of EPRs does not yet encompass all clinical roles or activities, even if this may be a long-term systems development objective (P15, P16, P03). Therefore differences in access to functionality present limitations to the benefits experienced for some groups of users. For example, many of the nursing activities on a critical care ward, including recording fluid balance, food charts and the drug kardex, are still paper-based whilst discrete aspects of nurses' work, such as care plans, are input into the EPR (P15).

Reduced duplication of recording is cited as an anticipated benefit of EPR systems (National Institutes of Health 2006, Greenhalgh, Stramer et al. 2010, NHS 2011, Department of Health 2012), particularly in relation to the integration of previously disparate records systems (P03). For example, clinical entries made in the EPR can be reused for hospital discharge letters sent to GPs by cutting and pasting content, thereby reducing work (P16).

One of the things I think it's done is transformed us from the situation where you record information because you've got to record information to, it's part of the clinical care, we need to record that information anyway and then we can use it for 10 other different functions rather than it feeling like we record things twice and we record something because the Department of Health says we have to record it, it's more about why we should assess every patient's VTE and then at the end of it we find out how many we assessed. So there's a lot more from that side. (IM&T Manager P03, Hospital A).

When we link up we can also see what they've had done at the hospitals, so say if a patient goes into a doctor and say, "well, I only had a full blood count two week ago", they can go and have a look so they don't have to have it done again. (Practice Manager P14, General Practice B)

However, the efficiency and value of EPRs in terms of capture and sharing of (close to) real time patient data are predicated on the assumption of contemporaneous recording. Where consultations are not office-based and clinicians are unable to enter data into the EPR contemporaneously at the bedside they rely on recording notes on paper, or recording using a dictaphone, which they or their secretaries then input (P18, P10, P17). Therefore EPRs are more efficient in some respects but less so in others.

And I think what we look towards doing is giving all the doctors some kind of mobile device that they're responsible for, so just an iPad or something. Yeah cos you waste a lot of time, or you do exactly what we don't want them to do is people making notes on the ward round and then going and writing in the notes. (Consultant P18, Hospital A)

Users highlighted a number of ways in which using EPRs generates new demands and responsibilities. Some users complain that inputting clinical notes within the EPR can be time-consuming because it forces them to complete certain mandatory fields.

> And I still need that currently because there's not a way of entering that information into the electronic record within the constraints of time. So I could type it all in but if I had to then dictate a letter as well then I'd be doing the same thing twice … (Consultant P10, Hospital A).

Moreover, more detail is recorded in EPRs than would have been when users were handwriting in paper records (P15, P13, P06, P17, P07, P09), although it was acknowledged that recording on paper could also be similarly time-consuming (P07).

It was also noted that using EPRs and moreover having an input into their ongoing development (and the longer term technology strategy) requires users to invest time in keeping up to date with technical developments, particularly where systems are being actively implemented or upgraded. Users need to spend time on training modules and familiarising themselves with the functionalities of the system, and those who represent the interests of users in EPR development also need to take time to attend the relevant meetings, identify aspects of the agenda to influence, and communicate outcomes to their colleagues (P18).

It must be acknowledged that some of the difficulties and concerns with EPRs are no different to those experienced with paper records and on some occasions EPRs users admitted this. Significantly none of these difficulties and concerns changed the overall sense from users that EPRs are the only way forward.

6.7   Multiple roles of EPRs

Users in information related roles confirm that the data from EPRs is used at Trust level and beyond for a range of management purposes including enabling comparisons of clinical activity, resource usage, patient 'casemix' and outcomes between Trusts (P09, P14). EPRs are also used as a source of primary data for research purposes, and for example, anonymised clinical data is extracted from GP EPR systems for inclusion in a research database under the GP Extraction Service (P10).

Unsurprisingly users with an interest in clinical research, clinical audit and management-related uses of data are more concerned about the availability of structured data in EPRs than with narrative recording (P10, P09, P08, P04) because it can be easily aggregated and, for example, be used to identify prospective participants for clinical trials.

In this respect it was noted by one participant that in previous iterations of the Trust's EPR clinical notes had taken the form of a free text commentary making it impractical to pull information out to aggregate and compare it, and for this reason development of more structured EPR fields were seen as an improvement (P17).

All that information was always there in those notes it's just being able to retrieve it, and that's the biggest advantage over narrative type data. Because this one, as soon as you put it into a structured form, it's immediately retrievable. So immediately searchable, immediately filterable, you know, just show me, you know, patients with T1N0, x cancer. Show me those, because it knows to search through the fields. (Consultant P17, Hospital C)

In primary care incentivised care quality improvement schemes such as the Gold Standards Framework for end of life care generate demands for clinical data to evidence meeting care quality targets, whilst in hospitals Payment by Results (PbR) is the model for reimbursement, which generates a requirement to track and quantify aspects of care, and EPRs provide the data to support these demands.

EPRs are also seen as enablers of a range of transformative improvements to the ways in which healthcare is delivered, for example, virtual consultations (P02), and patient-accessible electronic records (P11, P03).

6.8   Clinical specialisms [ACTOR #2]

Clinical specialisms are a significant driver for and shaper of EPRs in the context of both the specialisation of clinical roles and the medical conditions themselves. In hospitals EPRs are perceived as supporting work practices better in medical rather than surgical work, and there is a perception that the A&E function has less need for EPRs than other areas of medicine (P03). One participant for example notes the challenges of fitting EPR use and the physical constraints of the hardware around unpredictable work practices on a critical care ward (P15). In contrast diabetes as a

specialism has a well-developed and discrete sub-section within the EPR in Hospital A.

There continues to be demand for specialism-specific electronic patient records systems within Trusts because of their unique information needs (P16, P10), which may or may not be on the agenda for development as part of ostensibly enterprise-wide EPR development. This in turn reflects and entails a piecemeal approach to expanding the scope and use of EPRs, certainly within hospitals. P16 notes that the surgical aspect of his role is not supported by an EPR, although there is an established hospital-wide EPR system, and it was not clear whether and when this might be addressed by ongoing EPR development.

A number of conditions are the targets of significant DoH resources as part of the strategy for the NHS, notably chronic conditions for which care tends to be long term and complex, frequently associated with multiple co-morbidities, and which are therefore costly to treat in the long term (Department of Health 2011). These include, for example, depression, asthma and diabetes. For chronic conditions that entail an ongoing demand for healthcare services cutting across different providers, clinicians have highlighted the importance of having a 'whole health economy' view (P02), which generates the need for better sharing of information.

For this reason, perhaps, diabetes is an area of medicine where the EPR is perceived as particularly beneficial, and it is acknowledged as having driven local EPR development within Hospital A, independently of the NPfIT (P03, P02).

It's been transformational to be perfectly honest. I work in a specialty which is one of these long term conditions that you hear about so an episode of diabetes is the rest of your life and you accumulate a lot of things on that journey. And it wouldn't be unusual for someone who'd had diabetes for a period of time and maybe to have 3 or 4 volumes of standard paper case notes. As you can imagine finding anything in those is quite difficult. Access to them is jolly difficult as well because storing them and retrieving them is difficult and looking at things longitudinally, which is what you often need to do in long term conditions, to see patterns, is very difficult. (Consultant P02, Hospital A)

EPRs are seen as essential for effective management of chronic disease because of the need to track and monitor a range of clinical information for the patient, which is impossible without structured records that enable easy filtering and organising of information (P06).

There's certain things that are very difficult to do without a computer, chronic disease management is one of them. (Business Change Manager P04, PCT A)

For many of such conditions large quantities of clinical data from tests and readings are collected over time, often in numeric form, for example from regular testing, measurement and monitoring of a patient's weight, blood pressure or blood sugar levels, for which the EPR's ability to produce visualisations of numerical data is seen as supporting patient interactions (P07, P05).

Participants mentioned being able to graph patients' readings over time to show them the consequences of behavioural changes in managing, or failing to manage their condition, as being a valuable and effective means of getting their message across in areas of medicine where patient self-management and behavioural change are critical (P07, P05, P02). The use of visual evidence is also seen as a useful tool for challenging patients with 'facts' from the EPR, providing an authoritative account of their use of medication, or adherence to lifestyle-related regimes, for example for high blood pressure, or weight management (P06, P05, P13, P07, P03).

6.9   Care quality [ACTOR #3]

In addition to efficiency objectives EPR development is expected to support improvements to the quality of care, whether directly or indirectly (Burns 1998, Care Record Development Board 2007, Greenhalgh, Stramer et al. 2010). This objective is embedded in a wide range of NHS processes through clinical governance, which provides standards for clinical practice and targets which embody minimum standards of care. These standards are inscribed within EPRs, informed by 'best practice' guidelines from national bodies such as NICE, which operate to disseminate and encourage evidence-based practice, including through establishing standards within clinical practice.

In primary care minimum standard sets of activities for certain conditions are stipulated under the Quality Outcomes Framework (QoF) for which GPs are

financially incentivised, and these include chronic conditions amongst others. Various care quality initiatives are sources of targets around clinical activities, some of which are condition or specialism-specific, for example, the 18 week time frame for cancer treatment, and these may be tied to financial incentives.

This creates a dual demand for clinicians to have checklists that support their clinical activities so that they achieve the required standard, and also for a means to document and evidence those activities in reporting back to central bodies (P07). The use of EPRs supports provision of the evidence of meeting targets by enabling easier capture and extraction of structured information (P14).

EPRs can be configured to produce condition-specific templates which ensure that the information needed for reporting on target conditions can be collected, and that activities and information that need to be provided to ensure payment of financial incentives are not omitted (P14). These therefore act as aides memoire for care activities associated with particular conditions and feed into care quality related audits and payment schemes. Particularly where patients are likely to have more complex care trajectories, EPRs can be used as checklists of activities at critical points in the pathway (P02).

What we do have on the e-patient records is what we call the 'guidelines', so say for example somebody comes in for an asthma check, the nurses would go into the guideline and it would show everything that they need to do for that asthma. Yeah, there's loads of things, like asthma, diabetes, you know, heart disease clinics. So that would ensure that they're putting the right Read codes in and they're putting all the right things onto the journal. Yeah, and that would help the QoF counts as well.

Yeah quite a lot, like depression, alcohol, cancer registration, every, a whole load of things, and unless they had a manual checklist I think they'd forget what. They tend to, sometimes the doctors don't use them so say for example if somebody had high blood pressure, they'd come in and see the doctor and get their blood pressure taken, but that's all that they'd do, record the blood pressure but they wouldn't ask them all the other bits that relate to that review so the patient would then get called in again and then we get a phone call "we've already had it done" so we try and push that. (Practice Manager P14, General Practice B)

Some users suggest that these targets shift the focus of clinical activities so that for non-targeted conditions the focus on the patient may be neglected during consultation, or certain conditions may be under-recorded because GPs want to avoid those that call for a cumbersome series of 'best practice' activities (P11).

There are also more explicit inscriptions of care quality standards within EPRs, for example, in the form of protocols for prescribing medications, which presents doctors in a participant hospital with pre-configured sets of analgesics for different patient categories in the form of a drop-down menu (P16).

There is also a demand for EPR development arising from new care initiatives that need to be supported by documentation (P03). 'Intentional rounding', a local hospital Trust initiative intended to ensure that nursing staff make hourly checks on patients' needs and comfort, generated a request for the means to record these activities within the Trust's EPR. Similarly, nationally deployed initiatives such as assessments of patients' risks of pulmonary embolism have been incorporated in the EPR for a participant Trust, enabling reports to be more readily produced, rather than using spreadsheet-based recording, as would happen in Trusts without an EPR system.

League tables of healthcare providers' performance, such as those produced for the NHS by Dr Foster (Dr Foster Intelligence 2014) indirectly drive EPR use as they are used as the source of evidence for these league tables. The ability to better structure and extract information using EPRs as compared with paper records implies a strong evidential role for them. One consultant noted that whilst league table data used to be extracted from paper records by an external body, the use of a structured EPR now enables this to be done within the Trust, which supports them in more accurately representing and justifying outcomes such as patient mortality rates (P17).

6.10   Clinical audit [ACTOR #4]

Clinical audit feeds into the care quality agenda as a process of reviewing clinical practice against best practice guidelines, and is a core element of clinical governance (National Institute for Clinical Excellence 2002). This translates into one-off responsive or intermittent reviews focused on specific aspects of care measured against certain criteria. For example, where new guidelines are produced by a

pharmaceutical company about the safety of prescribing particular medications together, an organisation must audit their prescribing to check whether and where this is happening in order to take remedial action (P14). The structured nature of EPRs facilitates targeted searching of an organisation's body of records to enable clinical audit to take place in a way that would be unfeasible with paper records. In this respect users suggested that clinical audit is a significant driver of EPR development (P02, P03).

In certain Trusts where I sought research permissions the form I was asked to complete as part of the approval process indicated an assumption that my research would take the form of clinical audit of some aspect of clinical services, reflecting the high profile of clinical audit within the NHS.

6.11   Performance management [ACTOR #5]

The need to measure or to otherwise evidence performance as an individual clinician, department or Trust whose activity is being measured or assessed is a key driver for the use of EPRs.

Now you have to be able to not only do things to patients, you have to prove that you've done it. (GP P06, General Practice D).

EPRs are used by those in clinical roles to review and monitor their performance for individual or department purposes, helping them to defend and justify their performance to NHS management both within the Trust and also externally (P16, P17, P09). Data from the EPR is used to justify levels of productivity (P12), and to identify pressure areas in relation to the kinds of work done and types of patients treated (P16), and the consultants in a specialist hospital Trust use their EPR for internal performance monitoring purposes to review trends in patient outcomes over time (P17).

Users have an interest in presenting an accurate and also flattering account of their work as individuals, departments and Trusts within reports and in order to meet targets and achieve incentives. This is not only a response to the use of EPRs by management at various levels to support accountability for clinical activity, but also involves users actively co-opting these accountability mechanisms to maximise benefits to themselves. In this study users report using data from EPRs as evidence

to support their own performance appraisals and exploiting the ways in which EPRs focus attention on particular measures to present themselves and their organisations in the best light in various externally-facing figures such as those used in national league tables.

Recording also has significance for other forms of accountability, and users are highly aware of the medico-legal role of the EPR in terms of documenting and justifying decisions and actions (P07, P15), for example in relation to documenting thought processes behind diagnosis and treatment decisions (P06).

> When I think back to when I started in practice the GPs that've now retired didn't tell the full story in the written [paper] records, they put very little, you know. Well I think they thought if they just put a bit down, that'll be fine, but however, I think of people suing and you know, litigation, we're all very much aware that we need to put the facts down. Cos if it's not there it's not happened has it? Legally people would say, you know, a lawyer would say, "however, ok it may be that A, B, and C was so but ….you didn't tell us that". (Nurse P07, General Practice D)

Although medico-legal accountability is also relevant to paper records, there is nevertheless increased sensitivity to what is recorded in the EPR compared to paper medical records, associated with their wider visibility, as reported in the literature (Hardstone, Hartswood et al. 2004).

6.12   Information Governance [ACTOR #6]

Access to records and to particular aspects of functionality is restricted by the 'need to know' based on a users' role and organisation. 'Appropriate' access to EPRs is mediated by the concept of a legitimate care relationship, which defines individuals who have a need to access clinical information about a patient. The legitimate care relationship is inscribed within access permissions to a user's local EPR system (using a password or PIN), and also inscribed in the monitoring of records access through information governance (IG) audits, which stem from the legal requirement to maintain patient confidentiality.

Information governance is evident at all levels, visible in the form of Smartcards and discussion of systems and network access, and referred to in the form of the NHS Spine and Trust firewalls. It arises in discussions about the scope of sharing of

records, contrasting EPRs shared between organisations with situations where there is no access or access is restricted. It is also apparent in situations when interviewees were or were not able to show me elements of the EPR on screen whilst preserving patient confidentiality. On-site observation of participants using EPRs in-situ therefore supports the credibility of and enriches the interview data in this respect.

Consultants from a participating specialist hospital hold peripheral clinics at 12 different Trusts across the region, generating a need to be able to work around the lack of access to their own Trust's EPRs when off-site (P17). As a specialist service which cares for patients who primarily 'belong' to other Trusts they have also had to find ways to enable external clinicians with a need for access to view their electronic patient records by allowing restricted access through their organisation's firewalls. A number of users report using Smartcards, which are needed to allow local EPR systems to connect to and reconcile data with the national patient database, the Spine, and to access Summary Care Records. However, there was some general confusion amongst users about the purpose of Smartcards and their relationship to centrally-held patient data.

Access to EPRs is constrained by the need for users to be within a given Trust's firewalls i.e. on one's 'home' NHS site, and by the requirement for a password or PIN to gain access to the local EPR system, or a Smartcard to gain access to national records. However, as noted by a user based in an acute hospital setting systems access protocols fall down where staff forget to log off or leave their Smartcards in the computer in a shared workspace. In this respect a number of interviewees acknowledge the risks to patient confidentiality from increased opportunities for misuse and abuse of the easier access that EPRs afford.

6.13   Deferral of benefits and temporal messiness

There is a temporal dimension to users' accounts of EPRs in so far as a number of interviewees talk about planned or 'in-development' functionalities, and/or expectations about idealised EPRs, alluding to future systems and developments as a means to frame discussions about their uses and experiences of existing systems. For example, one nurse anticipated future benefits to his work practices as nursing processes, currently still largely paper-based, are incorporated into the EPR.

> There's too much paperwork in one area for one patient. Things do get lost don't they as you know, you're trying to manage something, you've got all paperwork on it and information gets lost. So everything, if it was electronically…then it would be a lot more easy to access, a lot quicker as well. (Nurse P15, Hospital B)

It is therefore challenging to pick apart the current status of EPRs within users' work practices in relation to actual experiences of use as distinct from anticipated uses and ideal visions of EPR functionality. For example, P10, a hospital consultant and clinical researcher discussed his experience of EPRs largely in terms of recommendations for EPR development that would support the needs of clinical research not currently being met.

In terms of users' experiences of EPR technology there is an expectation gap, which causes frustration because people know what technical functionality is available 'in theory'. An IM&T Manager suggests that staff in her Trust have become accustomed to using consumer technologies such as iPads and therefore expect their experiences of new workplace technologies such as EPRs to be similar so when they have to use more dated devices and interfaces there is some dissatisfaction (P03).

Where individuals have experience of a more mature EPR system elsewhere this also sets the bar high in terms of expected functionality and overall experience (e.g. P18, P12, P03). Users may also have heard about EPR technologies implemented in other Trusts and know what is practically feasible so when their own Trust fails to deliver similar functionality there is disappointment (P06, P03). A participant GP, for example, comments on the poor choice of software supplier by her PCT that resulted in a less impressive product than she had experienced elsewhere (P06).

The scope for individuals or departments to influence the development of their local EPR system varies depending on existing requests for in-house development, where available (P03), agreements with suppliers and their willingness to make changes (P17), and funding available (P16). This means that the needs of some user groups and specialisms are neglected (P16), at least in the short term. It also reflects the challenge for large organisations such as hospitals and Foundation Trusts that can

include a number of different sites and healthcare settings in meeting the needs of a wide range of users (P03).

6.14   Material aspects of EPRs

The material aspects of the EPR constrain use and limit the achievement of certain benefits, and can also bring new risks and disadvantages.

6.14.1 Hardware [ACTOR #7]

Individual hardware devices such as desktop computers, iPads, mobile devices and Computers on Wheels (COWs) mediate access to the EPR. The material arrangements through which EPRs are accessed places constraints on their use and can restrict access to EPRs, making access more or less convenient. Hardware as an actor is a question of presence or absence and of quantity as well as one of type and suitability for particular settings and functions, tying EPR use to particular devices and/or locations.

That's another hardware issue is that there's not enough, because it's not just the doctors who want to be accessing, the nurses need to be accessing it as well and the healthcare assistants and the physios and pharmacists and everybody needs to be accessing the same. So hardware where you haven't got enough, on the surgical ward we haven't got enough hardware certainly. (Consultant P18, Hospital A)

Computers on Wheels (COWs), provided for doctors to access EPRs at the bedside on hospital wards, are reported to be cumbersome (P15, P03) and unsuitable due to lack of physical space (P15). The shortage of workstations within hospital settings is also noted (P15, P18), generating practical challenges and limitations to EPR use.

We do have something that's called a COW. Yeah well the doctors use them. Normally when they go round to do the ward rounds with the patients the doctors will take them with them, but these big ugly things take up too much room. They're just, huge, well they're this big and this wide [gestures] and you've got to wheel them around with you. And it's just like, you're wheeling them around and they're like, in the way. You can't move anywhere and they're just ugly, horrible things to use. (Nurse P15, Hospital B)

> Even here it comes down to hardware, even here some clinics struggle with the amount of space because most clinic rooms were not designed for EPRs, they were designed for case notes, so you take the case note with you. Then people are in a clinic with only 3 rooms…. (Consultant P17, Hospital C).

Users report that the technical aspects of using the system present real practical challenges, noting for example that EPR systems may run slowly and crash on occasion. A number of interviewees highlighted the greater risks implied by reliance on electronic rather than paper records systems; P04 noted for example that organisations have to mitigate the risks of technical failure to ensure business continuity using hosted servers and back-up generators.

6.14.2 Paper [ACTOR #8]

The physicality of paper records, which are a persistent presence in both primary and secondary care, can present challenges in terms of storage and the logistics of efficient retrieval, and as such a reduced need for storage of paper records is seen as a major advantage of EPRs. The NPfIT's original objectives in relation to implementing EPRs were "to reduce reliance on paper files, make accurate records available at all times and enable rapid transmission of information between different parts of the NHS" (National Audit Office 2011 p4), however the outcome to date has been 'paper light' organisations rather than the 'paperless' ambition (Department of Health 2012).

> You can't put a system in place and say 'go paperless' unless you satisfy this very basic need of being able to access those notes from somewhere else. (Consultant P17, Hospital C)

Paper remains indispensable within healthcare processes, even where there are mature EPRs in place, because organisations continue to rely on paper to bridge the gaps (P16, P17, P14). For example where ambulance Trusts are organisationally separate from hospitals paramedics' handovers of patients to hospitals involves producing a patient summary on carbon copy paper, which functions poorly in terms of passing on information (P03). Paper records continue to affect administrative and clinical processes because whilst Trusts may use an enterprise-wide EPR system within the organisation, *inter*-organisational processes rely on the use of paper in the

absence of interoperable electronic systems. Paper also fulfils functions that the EPR as yet cannot, in a medico-legal capacity, and in managing disconnects around the myth of real-time recording.

> They're paper light really rather than completely paper free because in my outpatient clinic I still have sheets of paper in front of me and I'll write my notes on that and then I'll dictate a letter, and the letter is the electronic record. They will scan my paper sheet that I've made the notes on, I don't ever go back to it, but, were there to be litigation or something I probably would because that's where I've place *all* of the notes I have, most of which will make it into the letter but not all of it. (Consultant P10, Hospital A).

Whilst internal Trust systems may be paperless, paper still flows into Trusts from outside and then has to be managed, usually by scanning into PDF format and uploading into the EPR, an electronic document management system or by maintaining both paper and electronic records side by side. Interfaces between paper and electronic processes have to be managed and in this sense they generate work for staff (P06, P14, P17). This is to some extent unavoidable because there will always be a boundary to the EPR system, however broad its scope. Lack of interoperability between different Trusts' systems is at the heart of this issue.

> The electronic record is fantastic for general practice. The burning question of course is though; we've all got a different electronic record. (GP P06, General Practice D).

Widespread GP2GP capability enabling exchange of GP-held EPRs between practices with compatible systems remains partial and imperfect in the sense that the record itself does not transfer cleanly and needs work to address gaps in information and how it has been reconstituted. Where GP2GP transfer is used the patient's record must nevertheless be printed when patients leave the practice and a paper copy sent on to the receiving practice (P14), re-duplicating the record.

Several users argue that using scanned documents is the most significant disadvantage of EPRs because they are slow to open (P18) and make it time consuming to find content (P16), with users having to sift through a lot of irrelevant material to find information (P18).

There are some problems associated with it and in particular there's problems in terms of scanned records from my perspective, there's a problem with scanned records. Because they're slow to open, so the scanned records are all of paper documentation. So before you'd get your EPR and you'd also get the case notes which had all the incoming correspondence, but that's now all scanned and it's put into the EPR. It can be very hard to find what you want and there's also a lot of duplicates and a lot of dross to be honest in there, you've got to wade through and that's a real problem. But you *can* bookmark stuff but you've got to be able to find it to bookmark it. A bookmark means you can make it so you can find it again. (Consultant P18, Hospital A)

Moreover, where documents being scanned are originally handwritten, particularly hospital discharge letters on carbon copy paper, they are often illegible (P13).

6.15   Summary

This chapter has sought to analyse the findings of the primary research through examining users' relationships with the various instances of EPRs encountered as an indication of the enrolment of those users as allies and as a manifestation of the stabilisation, or otherwise, of the different EPRs. By identifying actors and discussing the interests at work in relation to these concrete instances of EPRs I have identified key interests at work in the construction of the actor-network for the EPR as a technological phenomenon in the NHS in England.

The following chapter will draw on Actor-Network Theory concepts introduced in Chapter 3 to provide a theorisation of the EPR as an actor-network, building on the analysis of key actors and relationships in this chapter. The discussion chapter considers what this understanding means in relation to the literature about EPRs and the question of whether they benefit clinical work practices.

CHAPTER 7 – DISCUSSION

This chapter sets out to map the actor-network for the EPR in terms of asking, 'what is the EPR as a technology?' in relation to the findings about the constitution of the actor-network. In doing so I aim to be faithful to my methodological approach through reflexivity about my role in the research and about the use of Actor-Network Theory by 'telling it as it is'.

I have reported findings from interviews about users' experiences of EPR use, with acknowledgement of the existence of multiple instances of EPRs. As part of the analysis in Chapter 6 I identified a number of actors that play a significant role within the actor-network for the EPR, analysing the roles of these actors in relation to their influences on the actor-network.

Revisiting the research question of whether EPRs bring benefits to users I employ Actor-Network Theory to theorise the findings about benefits and disbenefits, and discuss how that theorisation can provide insights on this topic. I conceptualise benefits in terms of the ways in which users' interests are reflected in their experiences of EPR use as supporting (or not supporting) their work practices. I also examine how the networkedness of the EPR relates to clinicians' experiences of benefits in the context of the original motivations for the research to question the evolution towards a nationally networked EPR.

EPRs support clinicians most straightforwardly by improving their access to information. Clinicians record more in EPRs than on paper (P07), and the contributions of different professional groups are integrated into a single record, providing more convenient access to greater quantities of information. Furthermore its role as a communications tool at organisational level mediates information flows to and from external clinical services and healthcare organisations. There is greater organisational attention directed towards EPRs than paper records, as evidenced in the integration of clinicians' day to day clinical and non-clinical work practices with EPRs so that it is hard to avoid, unpick or disentangle them.

Here it's very much; you can't physically run a ward round if you don't have an EPR. If you sit in clinic without an EPR they don't actually have anything to say about any of the patients because they don't know who they are because all the information.

We don't pull sets of case notes in the same way that you would in a normal hospital. That's 10 years of information is sat in that computer, if that is not there their ability to actually function is just… that's now part of what they do. (IM&T Manager P03, Hospital A).

Whilst all users are positive about changes brought about by the introduction of EPRs, they nevertheless have differing experiences of use. Some clinical roles benefit more than others, with divides along the lines of existing professional hierarchies and differences in practice between roles and specialisms.

The improved access to patient information afforded by EPRs is constrained in certain respects by information governance processes, material challenges, and misconceptions and simplistic assumptions about clinicians' work practices that are inscribed in the technology design, such as the assumption that clinicians work on-site within a single Trust. For example, the government strategy envisioned contemporaneous updating of records (Eason 2007, Sheikh, Cornford et al. 2011), which has not been realised in hospital settings where clinicians may not, for various reasons, record clinical notes in the EPR 'at the bedside'.

Workarounds are therefore necessary for some users, particularly for more mobile and split-site roles. This supports the contention that the design of EPR systems needs to meet the requirements of work practices as they really are and not as they are assumed to be (Berg, Langenberg et al. 1998), and that contextualisation to the use setting is important (Takian, Sheikh et al. 2012).

7.1   Macro and micro designs

The aim for all NHS Trusts to implement local, organisation-level EPR systems is the first step towards realising ambitions for an NHS-wide information infrastructure (Burns 1998).

For any individual user experiences with EPRs may cut across a number of different instances of the technology, for example, an inter-organisational record shared between local GPs and their local general hospital, and a hospital discharge letters application within a GP-held EPR. Within this context EPRs are explicitly envisioned and designed to serve multiple purposes, and as such benefits to clinical users are dependent on the purposes for which they are being used and the additional

responsibilities and risks implied by the inscriptions of non-clinical interests and purposes.

The findings of the research suggest that these tensions embody a gap between the macro level design for EPRs set out in UK government strategy for the NHS as a whole, and micro level designs for EPRs as realised within individual NHS Trusts; noted by Waterson (2014). The gap between macro and micro design is evident in the differing purposes and agendas inscribed in EPRs as they have been realised in participant organisations. Clinical coding and the structuring of EPRs embody purposes that are primarily non-clinical because they enable the production of aggregate EPR data for reporting purposes e.g. (P07 interview thumbnail, P16 interview thumbnail, P17 interview thumbnail, Practice Manager P14 quote, section 6.4) and are the basis for a type of EPR data sharing via reports that serves non-clinical information demands from the centre, supporting a macro design. In terms of micro design, locally-specific forms of data sharing have grown up as mechanisms to support clinical needs for information, for example, in the form of the Diabetes EPR e.g. (Table 3, Consultant P02 quote, section 6.8), and there is widespread use of, for example, tests and results as a clinically useful form of EPR data sharing e.g. (P02 interview thumbnail, P10 interview thumbnail, P13 interview thumbnail) that are evidence of clinically-driven design.

A key rationale for EPR development hinges on opportunities for secondary uses of patient data for care commissioning, administration and research (Department of Health 2002); an agenda dictated at national level and manifested in the government's vision for EPRs. This entails certain disconnects between design and use for clinicians in so far as non-clinical agendas influence the evolution of the design.

It can be argued that the tensions between these conflicting sets of interests are manifested in the macro level design being only partially realised. This is therefore also a discussion about ontology in terms of the multiple and partial nature of the EPR. I discuss the partialness and multiplicity of EPRs in relation to variations in the networkedness, or scope of sharing of the multiple instances of EPRs as a means to anchor the discussion around a fundamental aspect of the technology.

As noted in the literature review EPRs may be variously conceptualised as electronic documents, software applications, patient data, and information infrastructure. The research findings, supported by the literature about clinicians' experiences of EPRs, suggest that the main benefits to clinicians to date are legibility, concurrent access making content consistently available to anyone, searchability of record content, retrieval of records themselves and 'always on' accessibility anywhere and at any time (Sheikh, Cornford et al. 2011, Takian, Sheikh et al. 2012).

> They're easier to access, easier to find, you can obviously you can put more information on them than you would do on a piece of paper; you're less likely to make mistakes as well. And also with electronic information you can read it easier, it's easier. Notes, trying to read a doctor's handwriting is just sometimes it's impossible, its gibberish. (Nurse P15, Hospital B)

This study also indicates that clinicians' experiences of benefits largely derive from the EPR as a *locally* implemented software application, emphasising digital characteristics that relate to anytime, anywhere accessibility of records and their content. Clinicians not only report that their local, intra-organisational EPR system is well used by them, but indicate that this is because of improved access to locally-generated clinical information. Therefore the concept of what counts as local is a key part of the discussion about the benefits of EPRs.

> "It's accessibility of information, but it's actually accessibility of the information that we put in ourselves more than anything else." (GP, General Practice B)

In this respect it is recognised that inputs into patient records are made with an audience in mind, and one which, with paper records, would have been largely local to the organisation and therefore somewhat a known quantity (Hardstone, Hartswood et al. 2004).

In this respect the interpretability and therefore value of content are informed and enhanced by shared context (Ellingsen and Monteiro 2000) and by orienting content towards the audience's context (Oborn, Barrett et al. 2011). Shared context and the targeting of content towards a particular audience is reflected in the sharing of EPR data within a local health economy (encompassing a geographic region and set of organisations with existing relationships) for particular purposes, within which a

common need to share patient data has been defined that has driven the development of data sharing mechanisms through the EPR e.g. the Specialist Hospital EPR (P17 interview thumbnail, p115) and the Diabetes EPR (P02 interview thumbnail p104, P05 interview thumbnail, p105, Table 3).

For this reason Berg & Goorman (1999) propose a 'law of medical information' that the work required to make such information usable increases with distance and detachment from the context of production.

Clinicians use inter-organisational aspects of the EPR mainly for communications functionality such as 'tests and results' and hospital discharge letters e.g. (P07 interview thumbnail, p107; P10 interview thumbnail, p109; P13 GP interview thumbnail, p115; P15 interview thumbnail, p116) and hospital discharge letters e.g. (P02 interview thumbnail, p104; P12 interview thumbnail, p113; P18 interview thumbnail, p121).

The contrast between the reported non-use of the Summary Care Record and reported use of the shared diabetes record and such communications functionality in local EPR systems indicates that inter-organisational EPR exchanges are used where they support existing clinical work practices. Importantly these can be observed to remain relatively local in terms of their fit with established relationships and ways of working with other departments and healthcare organisations. For the shared diabetes EPR and the specialist hospital EPR, each are accessible within the shared context of a given specialism and local geographical area.

'Localness' in this sense, therefore, means local to the Trust or healthcare organisation and/or within the health economy, such as between GPs and their patients' nearest and/or most used general hospital or between a specialist hospital and the GPs and general hospitals in the geographic area whose patients they serve. This also indicates there are strong enough local clinical imperatives for such inter-organisational EPR sharing amongst geographically and functionally connected NHS organisations to engender stabilisation in these instances of EPR use.

Secondary uses of data from EPRs are intended to support non-clinical interests related to the management and administration of the NHS relying on the ability, mediated by the technology, to enable patient data to transcend organisational

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boundaries in various ways. By comparison with clinicians' need for content which implies shared context, secondary uses of aggregate EPR data are based on the decontextualization of record content, for example in the form of clinical coding. That decontextualized content is of greater value for non-clinical than clinical purposes is perhaps obvious. Uses include reports generated from Trust level EPR systems that feed into national datasets, such as those used to audit diabetes services against the diabetes National Service Framework (NSF) standards (NHS Information Authority 2003) for which the dataset specification is shown below in Table 4 as an example.

Type of Information	Example Items	Coding Language
Identifier	• NHS Number	• id
Clinical	• Presenting complaint code • Issue on discharge flag • Reason for admission	• SNOMED CT • Boolean • SNOMED CT/structured text
Prescribing	• Medication code • Form • Quantity • Dosage • Route of administration • Reason for administration • Prescriber ID • Prescription date/time	• dm+d • structured text • number • structured text • SNOMED CT • SNOMED CT/structured text • Identifier • datetime
Tests	• Test Code • Result • LabID • Ordered by • Ordered date/time	• SNOMED CT • SNOMED CT/structured text • id • id/name • datetime
Ward	• Ward ID • Ward description • Arrival date/time • Departure date/time	• id • structured text • datetime • datetime
Feedback	• Patient Reported Experience Measure (PREM)	• dataset
Incidents	• Incident code • Incident date/time • Adverse	• SNOMED CT • datetime • boolean

Table 4. NHS Hospital Data and Datasets: A Consultation

(NHS England and the Health and Social Care Information Centre 2013)

Benefits related to non-clinical uses of EPR content derive from the EPR as an NHS-wide infrastructure exactly because they are predicated on the development of standardised recording practices for clinical activity which enable the (worthwhile) sharing of patient data outside a Trust, and aggregation, centralised collection and comparison of those information products of EPRs on a national scale.

This activity is based on the provision of (easy) means to report on and extract data at the level of whole patient cohorts, presupposing the capabilities that the EPR

provides. Morrison, Fernando et al. (2013) argue that structured recording through the use of coding for example, primarily benefits non-clinical uses of information, and therefore clinicians may not see the benefits from the additional work required from them.

This study also supports findings from Eason and Waterson's (2013) study of EPR use across care pathways that found that bottom-up i.e. locally-driven design of information systems provided a better fit to clinical needs, as compared with top-down design, which favours managerial objectives for those systems e.g. the Specialist hospital's EPR (P17 interview thumbnail p119 and P17 quote p152).

Certain non-clinical demands for data are met through the automated extraction of certain datasets from organisational EPR systems, for example for the purposes of Quality Outcomes Framework data collections. NHS Trusts must also provide reports to central NHS management bodies about patients and clinical activities that increasingly can only feasibly be produced from EPR systems.

7.2   Partialness and multiplicity

Confronting the government's model for the EPR as one of inter-organisational sharing of whole electronic records the findings indicate that these are only partial in the sense that whole records are shared by few NHS organisations and certain aspects of the record might be shared more or less widely. This is arguably an indication of both the multiple and the partial nature of EPRs.

The EPR as a networked object is partial in the ways in which it manifests networkedness with, for example, the shared diabetes EPR being networked only for that specialism, and only shared with healthcare organisations within a given geographic area. Similarly the Summary Care Record is only partially rolled-out at a national level, and contains only core biographic and high level clinical information, far from the government's long-term vision for a 'cradle to grave' longitudinal national record.

While a number of instances of networkedness have been documented in this study, these too are partial in the sense that the EPRs in question are not universal to all participant organisations. There remain geographic constraints which define potential and actual usefulness of EPRs and therefore benefits to clinicians because

stabilisation of instances of inter-organisational EPR use are restricted to the local health economy. Table 3 in Chapter 6 indicates the ways in which EPRs in the NHS can be said to be partial in relation to the ideal of the nationally shared, whole, longitudinal EPR.

The findings of this study have provided evidence from participant Trusts that the patient data within EPRs is being shared between healthcare organisations to varying extents and for particular subsets of information for specific purposes. The EPR conceptualised as a complete clinical record shared between NHS organisations is, in this respect more concept than reality, however EPRs are nevertheless beginning to fulfil their infrastructural potential within the NHS in being partially networked objects. The implications of increasing networkedness are discussed below.

7.3   Networkedness and custodianship

If clinical users are not aware of the uses and destinations of their patients' information this has implications for their ability to take responsibility for the confidentiality of patient data, and moreover for their ability to tailor their input, if appropriate, with knowledge of the audiences and purposes envisaged (Hartswood, Procter et al. 2003). In the case of electronic patient records the potential readership is much broader and may be unknown to those recording, and this presents challenges with respect to clinicians' control over the distribution of information (Hardstone, Hartswood et al. 2004).

The low level of awareness and use of the Summary Care Record, as the only inter-organisational EPR at a national scale and comprised of data extracts from local level EPR systems, could be considered problematic in the context of clinicians' control over that data.

If I look blank it's because I am blank, I don't know what that is. (Consultant P17, Hospital C)

Were the Summary Care Records the thing that was floated a couple of years ago, wasn't it, is that the one where initially it was going to be medication, that the hospital could see what medication a patient is on etcetera etcetera…. Yeah, I mean my

impression was that it was another of these things that was the great white hope and never actually happened. And again with a lot of these things, as a GP the whole point of that was that the hospital could access data not that we could access it back. (GP P13, General Practice B)

Moreover, there is potential for clinicians to lack awareness of automatic data extractions from local EPR systems more generally, including for example, those made by the GP Extraction Service.

The clinicians may not even be very aware that they're providing the data cos they just do their usual practice and at some point the data gets extracted. (Consultant P10, Hospital A)

This has implications for the ownership and responsibility, or custodianship of patient records, which would previously have resided directly with the GP, and indeed the GP remains the default destination for clinical information as 'owners' of the patient. One (non-clinical) participant working in a regional data management role commented on the difficulty of acquiring patient data from GPs because many of them argue for not sharing on the basis of preserving patient confidentiality.

GPs are therefore set up as the principle guardians of patient's records, even whilst those records have become increasingly 'leaky' with or without the explicit knowledge of users. When an electronic record is shared between multiple healthcare organisations the responsibility for their integrity and confidentiality is diffused away from individuals and local organisations and devolved to the systems and processes concerned with managing patient data.

Non-clinical agendas for patient data in so far as they generate demands for reporting and data extractions from EPRs which obscure the destinations and uses of patient data therefore have implications for information governance generally, and specifically for patient confidentiality.

In the analysis chapter a number of interrelated non-clinical agendas were identified as actors, indicating that there are multiple purposes envisioned for EPRs and the patient data within them. That health information systems, including EPRs, are used for a range of managerial information purposes is well recognised in the literature

e.g. (Bloomfield 1991, Doolin 1999, Checkland, McDonald et al. 2007, Reich 2012). In this respect these data demands are also inscribed within the design and use of EPRs, shaping and constraining clinicians' experiences of the technology.

Inscriptions which relate to secondary uses agendas are highly apparent within local EPRs, and this is an indicator of the extent to which non-clinical interests have successfully been translated within what is intended to be principally a clinical tool. These inscriptions are discussed below in relation to how they are manifested and how users experience them in terms of benefits and disadvantages of EPR use.

7.4   Inscriptions and power

The research question for this study, which asks whether EPRs benefit users, draws in issues of power in terms of whose interests dominate in the pursuit of a particular technology agenda, and depends on the success or otherwise of the translation of those interests in a bid to bring about stabilisation of the technology project. Power is a central theme within Actor-Network Theory (Law 1992, McLean and Hassard 2004) and as such discussions about benefits in relation to network formation for an artefact that serves multiple sets of interests must address issues of power. Disbenefits experienced by clinicians can be conceptualised as outcomes of power relations resulting from non-clinical interests inscribed within the EPR.

In this study I operationalize the concept of power as an expression of non-clinical interests manifested in controls over and constraints on clinician behaviour, mediated by the EPR. It must be acknowledged that this is not a clear-cut issue because clinicians undoubtedly benefit indirectly from supporting wider organisational and professional interests, which may entail additional work which is not clinically relevant, but which is expected to be absorbed as an 'overhead'. Moreover I do not intend to suggest that non-clinical activities supported by EPRs are unwarranted. The aim of critically examining benefits to users is to highlight the ways in which the balance of clinical and non-clinical agendas may disadvantage clinicians and potentially raise wider ethical concerns and challenges for EPR development.

The findings indicate that non-clinical interests are inscribed within EPRs in a number of ways, which are discussed below. Many of these inscriptions relate to

standards and standardization endeavours, signifying an aim to establish commonalities in practices both related to EPR use, and in relation to the clinical activities being recorded in EPRs.

7.4.1 Standards

Standards may be more or less strongly inscribed within EPRs reflecting the extent to which compliance is encouraged or enforced. There has been significant attention within ANT and STS-related literature to the ways in which standards inscribe politics through investigation of how they are developed e.g. (Bowker and Star 1996, Hanseth and Monteiro 1997, Rolland and Monteiro 2002). Moreover there is substantial IS literature on healthcare about the ways in which standards reflect particular models of the patient and of clinical work e.g. (Goorman and Berg 2000, Checkland, McDonald et al. 2007), and this highlights that there is a need to critique IS development in this respect.

The development of a networked EPR, however narrow or broad the scope of sharing, creates a demand for standardisation of recording practice that in turn entails standardisation of certain aspects of broader work practices. Moreover, inscriptions within EPRs serve as tools to enforce standards in relation to clinical activity, not only through focussing attention on the achievement of care-related targets and reinforcement of measurable indicators for care, but also by selectively enabling and constraining particular recording practices which in turn feed into clinical behaviours. For example, medication protocols within the EPR exploit a 'path of least resistance' strategy to encourage doctors to use the protocols rather than select drugs themselves by reducing the work involved in prescribing.

For anaesthetics and pain management Hospital A's EPR has pre-configured sets of drugs for use with certain categories of patient within a drop down menu, encouraging the use of standard prescribing protocols by making it easy to prescribe and also discouraging clinicians from going 'off-piste' with their prescribing (P16). The protocols themselves derive from National Institute of Health and Care Excellence guidelines (National Institute for Health and Care Excellence 2014), thereby also making the EPR a tool for legitimising the evidence-based medicine agenda within the clinical professions. It is notable that the EPR is explicitly used as

a mechanism to bring about standardisation of clinical work in the case of medication protocols.

What we've done for that is protocolized it. So when you go onto the prescribing you can choose…there are a whole list of different protocols of pain relief for different things. So there's a list for day case surgery, there's a list for patients under the age of 17, a list for patient over the age of 17, so that they get different drugs. And then there's ones for epidurals and there's also ones for patients who are 'difficult' pain patients, so ones who failed the original pathway and, what do you go onto next?

So we've managed to standardise medication more than if you have handwritten prescriptions. Because essentially if you've got a pre-selected group of drugs and you make it easier for people then they will tend to use those pre-selected groups rather than prescribe them individually each individual drug, so those are group sets for all medications, epidurals and all those sorts of things, that allows you to force behaviour…force is probably the wrong word, well it is to force behaviours. (Consultant P16, Hospital A)

A similar observation is also made in the literature in relation to nurses' use of EPRs for care planning, in which authors highlight the risk that individualization of care will be compromised through the use of standardised care plans (Stevenson, Nilsson et al. 2010).

The requirement to use highly structured fields for recording imposes constraints by restricting the articulation of treatment requests. This entails limits to what can be recorded and communicated due to the need to be able to make records or parts of records interoperable across multiple organisations, as well as placing demands on clinicians to record what might otherwise be unnecessary for clinical care.

However, the current limits of EPR standardisation were highlighted in relation to ambitions to use EPR data for clinical research, serving as a further indicator of the patchiness of EPR implementations at national level, particularly in hospitals.

…The thing is we can't do this nationally because [Hospital X] haven't got an electronic system so we can't suck out their rheumatology-specific information if they haven't got a record to suck it out from. And even if they did it wouldn't be in a format

that I could use. And even if it were, the plumbing isn't there to take it out. So doing some of those things on a local basis will, kind of, at least lead the charge. (Consultant P10, Hospital A)

7.4.2 NHS Operating Model

The cost model for the NHS positions GPs as 'owners' of patients and makes them responsible for commissioning (and paying for) secondary care, which means that both primary and secondary care organisations must provide evidence of numbers of patients treated and services provided. Furthermore this means that access to information about which general practice any given patient belongs to is important in order for secondary care organisations to claim reimbursement for their services.

'Owning GP' is one of the details which is captured in the Summary Care Record, supporting its envisioned use as a tool to support unscheduled care for more mobile populations who may seek care outside their local healthcare organisations. In this way the cost model for the NHS is inscribed within EPRs and implies certain recording activities not directly related to care.

Obviously we have, I do a lot of searches and reports too. Well, for example, Dr X said can you find, give me a list of all the patients on methotrexate or something, she'll give me a drug and I'll do a search and bring up a report of how many people we have that are on that medication. Well I do that for my claims, so obviously every quarter I would, for example, run a search for how many patients have had implants in that period and then I would claim for them. (Practice Manager P14, General Practice B)

Clinical coding in the EPR has a critical role in financial management. "Payment by Results", the payment model and criteria by which reimbursements to hospitals are calculated, takes into account information including numbers of patients treated, length of stay and treatment services provided. A clinical coder interviewed in one hospital Trust reported that in comparison with working in a Trust which uses paper patient records, having an EPR enables 'deeper' coding, explaining that it allows her team to code the record of a patient's care more accurately and in more granular detail. This in turn enables more accurate claims for reimbursement, with reference to the increased volumes of information and increased detail being recorded in

EPRs, which was highlighted by a number of participants. It is notable that this participant observed a shift in the status of the coder's role as their significance to hospital finances increased, which could be considered an indicator of the EPR's central role in an information-driven NHS.

7.4.3 Performance indicators and targets

In relation to performance management an occupational therapy team manager reports that the visibility and manipulability of information afforded by the EPR system supports performance management of her team. Reports are produced by another team using extracts of the EPR system and sent to her, and she is able to monitor individual and team 'productivity' in relation to overall caseload and numbers and types of patient contacts.

> She sends us through something called the contract report, which is literally; it will tell us how many referrals we've seen at the end of each month. Yes. I can see who's working and who's not so efficient. It'll tell me how many contacts we've had and then it'll take it down into how many were face to face, and how many were non-face to face. So how many are we actually seeing the patient and how many are we not? It'll tell me the DNA rate, so, how many do not attend and the percentage. It'll tell me any of the cancellations that have been made and these can be broken down into staff cancellations and also it'll break down into patient cancellations. And then it'll tell me what my waiting list is. It'll tell me the percentage of patients seen by the 6 weeks but then it will also tell me somewhere percentages of patients seen within the 18 weeks and as you can see we're at 100% at the moment. (Occupational Therapy Team Manager P12, Community B)

In General Practice Quality Outcomes Framework (QoF) targets are linked to financial incentives such that if they are not met, or if it cannot be demonstrated that they have been met there are financial implications for the organisation. For example, GPs must evidence regular blood pressure checks for those diagnosed with high blood pressure, and by incentivising provision of that evidence as a proxy for the care itself, GPs are encouraged to adopt these care activities as a minimum standard for that condition.

One of the common chronic disease areas that are picked up, it's usually ones that require a lot of management and can be measured, for example, diabetes. A diabetic patient should have, every 12 to 15 months, I think the criteria is, every 12 to 15 months should have a set of things done to them and the practice gets paid, they get the percentages. So foot checks, HP1C, which is a blood test, smoking status seems to be in them all, chronic diseases. And if the smoking status is positive then making sure they're offered smoking cessation advice and then the next stage goes on. So you can actually pick up the criteria off the website and it's on the primary care contracting website and it's all the QoF stuff, it changes slightly every year. There's quite a few, it's all influenced by NICE, things from NICE, NICE influence it. It has to be best clinical practice so it's well researched. (Business Change Manager P04, PCT A)

Indicators are defined annually by NICE in relation to specified conditions and associated care activities, drawing organisational attention and resources towards documenting care to ensure that the required evidence is produced by GPs. This supports the argument that information systems such as EPRs may shift organisational attention (Vikkelso 2005) and that they may change what is regarded as important to the organisation (Brigham and Introna 2006).

Yes, so that's what QoF has improved, the areas that it's looked at because it *has* to be coded correctly. And therefore QoF has improved coding out of all recognition *for* the areas in which its, the domains that it's using, which is interesting. (GP P06, General Practice D)

One participant observed that performance targets imposed by the UK Department of Health have skewed clinical recording such that it had become a running joke amongst GPs that the Quality Outcomes Framework "cured depression overnight" (GP P11, General Practice C), alluding to the observation that GPs are more reluctant to record diagnoses that involve setting in motion a chain of clinical activities that are perceived as laborious.

Back in 2000 the EPR was just an electronic record. QoF was the next big change as suddenly GP income depended on how you care for certain groups of patients. Adoption of IT systems became a necessity and not an option. If you have patients

with high blood pressure for example then you have to check their blood pressure every 6 months and the record would flag up if a patient with high blood pressure had not had a check in the past 6 months.

This causes behaviour change in GPs so they deliver what QoF require but it's also skewed information. It's said that one of the best things that QoF did was to cure depression overnight. That's because now GPs try to avoid recording a diagnosis of depression. It shows you can't performance manage GPs with targets.

For anything QoF-able great. You have the 'super-patient': heart disease, diabetes, high blood pressure, who ticks all the boxes and they get lots of attention, we would be going out on home visits and offering them help and they'd think it's great, because they're worth a lot of money. But if you come into the surgery because your mother died and you're crying the GP is not interested then its 5 minutes then get out. Osteoporosis, things like that. If you're a smoker you get hounded, it's best not to say you're a smoker and the GP will leave you alone. (GP P11, General Practice C)

This manifestation of power falls short of controlling GPs' behaviours because they are self-employed, and in organisational terms actually sit outside the NHS. This means that whilst there are financial incentives offered to GPs for certain activities they are under no obligation to perform them as QoF is a voluntary incentive scheme, albeit most GPs participate with 99.7% of registered patients covered by the programme in 2009 (Health and Social Care Information Centre 2013).

Under legislation which came into effect in April 2013, however, the Health and Social Care Information Centre (HSCIC) has the power to mandate that GPs provide certain information about their activities, and therefore whilst QoF serves a purpose as a mechanism to acquire care-related information from GPs in a partial and imperfect way, this demand for information is now much more strongly inscribed within the EPR by virtue of the relationship with the HSCIC as an ally, and its new legal powers.

7.4.4 Care quality improvement

The care quality improvement agenda links care quality related targets in the form of carrying out and, importantly, documenting care activities within the EPR to

payments and financial incentives, as recognised by Checkland, McDonald et al. (2007). Therefore the EPR comes to serve as evidence of those activities and is used to produce reports that constitute such evidence.

Furthermore, by making the EPR perform as a checklist of 'minimum standard' care activities for specific conditions or types of care, the technology supports and justifies itself in relation to established indicators and mechanisms such as clinical audit. Care quality indicators are not only therefore linked to payments, but also feed in to measures of performance.

> It acts as a checklist, an aide memoire, gold standard. It also makes sure the data's entered in a particular way. (Business Change Manager P04, PCT A)

And with regard to the patients we've got lots of checklists that relate to critical times in the patient's journey; at admission; somebody has to check through and because they're all there as checklists they're on the electronic record it can be easily ascertained whether they've been done or haven't been done. They're not on a bit of paper somewhere where someone is unaccountable or there it can be seen, all members of the team can see it. (Consultant P02, Hospital A)

EPRs act as a source of evidence for meeting care-related targets and justification for outcomes related to care and resource usage. In so far as data products such as reports are made use of by clinicians and non-clinicians they are complicit in stabilising the EPR. Participants acknowledged the use of EPR reporting capabilities to support accountability for individual, group or organisational activities, and this provides reciprocal legitimacy for performance measures, performance management mechanisms and for the EPR itself.

A number of studies observe that those subject to power mediated by information systems may resist the demands of the technology in various ways e.g. (Timmons 2003, Stevenson, Nilsson et al. 2010), or may try to minimise the impact on their work practices (Eason 2007, Mensink and Birrer 2010). It has been recognised that users are not necessarily passive subjects in this respect, and may use EPRs to 'play the system' to their advantage e.g. (Doolin 1999).

Then the other thing we use the electronic patient record for in terms of the acute pain work is actually looking at how much acute pain work we do, so there's information databases within the system for how much time we spend with each patient so that we can then pull off how much time we're spending doing acute pain on wards.

It allows us to show everyone what we're doing essentially, what work we're doing. It allows us to give us some idea of what sorts of patients we're seeing and what our pressure areas are. But most importantly it's just to prove we're actually doing, you know, that we're seeing the patients and that we're doing the work. (Consultant P16, Hospital A).

Moreover, in relation to coding becoming central to the quantification of clinical work, there is a risk of 'over-coding' and inflation of reimbursement claims (Pitches, Burls

et al. 2003, Baldwin 2013), and therefore, as noted by one participant (P09) there is a need for external audits of coding to verify that claims are accurate. Although such inflation of claims no doubt predates EPRs it is one example of subversion of the non-clinical mechanisms of control that are mediated by the EPR, and is exacerbated by the increased emphasis on the EPR as a source of evidence for payment. The quantity and content of recording is also influenced by the EPR's evidential status.

What that does is back up for what you're doing so anything you do you can be held accountable for so if anything went to coroner's you've got proof that you've been doing your job. But anyone can write anything on a piece of paper and sign off on it, it doesn't mean you've done your job; you can just tick and write to say you've done it. (Nurse P15, Hospital B)

Inscriptions therefore tie the use of EPRs to activities that are already embedded within clinical work practices. For example, care quality improvement initiatives, whether tied to payments, financial incentives or mechanisms of accountability and performance management, are already an aspect of the contemporary NHS, embedded in organisational structures and processes and endorsed by the clinical professional bodies, such as the Royal College of Nursing Royal College of GPs and Royal College of Physicians. This may account for the finding that users see EPRs as beneficial overall and are relatively uncritical of the whole 'package'.

7.4.5 Accountability

The inscriptions that have emerged from the research data reflect a number of clinical and non-clinical agendas that constrain modes of EPR use, impose certain informational activities and responsibilities on clinicians, and shape how care is delivered. The emergence of new informational activities associated with EPR use supports findings from the literature that suggest far from being a mere by-product of clinical recording accountability inscribed in EPRs generates additional work for clinicians (Bossen 2011).

Whilst recognising clinicians' experiences of the benefits of EPRs over paper records, the research nevertheless supports findings from the literature that the

'macro' level design for EPRs, derived from managerial agendas for the NHS dominates at the expense of clinical information needs (Eason and Waterson 2013).

Inscriptions of managerial agendas such as clinical audit and performance management, outlined in the analysis and identified as key actors in the network, are intended to fulfil information needs for management and thereby shape recording and clinical practice accordingly. Whilst administrative and other non-clinical activities are inevitably entangled with clinicians' work practices and accepted relatively uncritically by clinicians as part of the reality of contemporary healthcare delivery, EPRs nevertheless mediate managerial intentions related to a variety of controls over clinical and non-clinical activities and as mediators of power relations need to be questioned.

EPR systems inscribe mechanisms for control of clinical work through enforcing compliance with recording regimes by requiring clinicians to record certain data as proof of carrying out prescribed clinical activities and to meet certain targets, echoing conclusions from Eason & Waterson (2013). This confirms the influence of accountability as an overarching actor, interests of which are highly visible in the inscriptions of non-clinical agendas such as care quality and information governance at macro level in relation to its prevalent role in the ethos of 'new public management' (Strathern 2000).

7.5   Use, non-use and stabilisation

This study has generated findings in relation to types of EPR and aspects of EPRs that are used or not used by clinicians. It is beyond the scope of the study to speculate about reasons for non-use of certain types or aspects of EPRs, however I propose that findings about use and non-use are pertinent to users' experiences of benefits, and therefore may be considered a useful proxy. The table below relates inscriptions in EPRs, as derived from the primary data and discussed above, to various roles to which EPRs are assigned in use.

EPR role	Interests inscribed	Examples
Care activity checklist	Care quality standards	Structured condition-specific templates within the EPR for conditions targeted by the Department of Health for care quality improvement.
'Objective' recording tool	Medico-legal accountability to patients and the public.	Replication of legal function of paper consent forms and processes in electronic form.
	Performance management	Clinical codes including Read codes, ICD10 and OPCS schema used to quantify clinical activities and healthcare services.
	Public accountability e.g. via Dr Foster league tables	
	Evidence of clinical activities for commissioning, payment and administration.	
Clinical communications tool	NHS 'internal market' healthcare model with clinical service providers commissioned to provide specialist services such as radiology and pathology.	Hospital discharge letters to GPs delivered directly into the GP EPR.
		Inter-organisational requests for tests and treatments and results notifications via an application integrated within the EPR.
Knowledge management tool / clinical information repository	'Single truth' record and authoritative source with associated reduced duplication of effort.	Longitudinal electronic patient record that integrates content contributed by different clinical professional groups.
Primary research dataset	Aggregated extracts from EPRs.	Automated extraction and centralised aggregation of subsets of EPR data via GP Extraction Service.
Standardised recording tool	Promotion of standardised clinical practice to establish a minimum standard and to facilitate comparability of care between Trusts.	Prescribing protocols for pain medication sets embedded in drop down menus in the EPR.

Table 5. EPR roles and inscriptions

Using a performative conception of EPRs as defined through use means acknowledging that where an EPR is not used or relevant to clinicians it has failed to

translate their interests, it has not stabilised for clinicians and they are not enrolled as allies in the actor-network. Certain types and elements of the EPR are heavily used, indicating usefulness and conversely others are not used and users may be unaware of their existence, suggesting an absence of benefits.

The Summary Care Record is manifested in this study as a conspicuous absence, and in Actor-Network Theory terms users' lack of awareness of the Summary Care Record may imply a failure in stabilisation of the actor-network for this entity. Nevertheless in spite of non-use and low awareness, the Summary Care Record programme continues to be rolled out across NHS Trusts (Health and Social Care Information Centre 2014), indicating that other,non-clinical interests involved are sufficiently powerful to sustain that momentum. As a technology which continues to be implemented but which is nevertheless below the radar of most clinicians and rarely used by them, it reflects ambitions that EPRs should play an infrastructural role which transcends clinical usefulness.

In relation to the diverse roles and purposes, and the multiple incarnations of EPRs encountered in this study, Star's (1991) notion of multiple membership has value in theorising an entity such as the EPR as having membership of multiple actor-networks simultaneously. Moreover, Law and Singleton (2005) argue that research objects may be 'fluid' and that there are not only multiple interpretations of an object from different stakeholder perspectives but multiple realities. For this reason analysis of my findings has involved conceptualising the ways in which EPRs are used, i.e. performed by clinicians. I have chosen to make the EPR's ontology explicit by identifying each performance from the findings as an instance of the EPR actor-network, indicated in the roles identified in Table 5 above.

By exploring clinicians' conceptualisations for the EPR I acknowledge that there are multiple actor-networks for this technology. Furthermore, in deconstructing EPRs in relation to their meanings to users, I emphasize their meanings in use rather than the 'facts' about their technical capabilities and setting-specific functionalities, acknowledging that they arise from the lived reality of artefact use that performs them into existence rather than being pre-given.

7.6   Methodological implications of using ANT

My choice of Actor-Network Theory as a theoretical and methodological approach has influenced the course of this research and facilitated insights about EPRs in the NHS that I might otherwise not have reached. I discuss these below in the context of challenges, or 'controversies' about ANT itself, which I originally highlighted in the Research Methodology chapter, using these sources of tension to provide meaningful structure to the discussion of methodological insights.

7.6.1 Mess, performativity and temporal ambiguity

The findings suggest that there are temporal aspects to EPRs, and that these are significant to the understanding of the actor-network. EPR users may conflate present and anticipated future uses of EPRs in their accounts, so that it was difficult on occasion to unravel them. Benefits are conceptualised not only in relation to current incarnations of an EPR, but also in relation to expectations of new EPR systems, upgrades, additional functionalities, fixes and longer term evolution of a system. These potentialities are ranged along a spectrum of concreteness from functionalities that will be imminently implemented and idealised visions for EPR use. This begs the question of what it might mean to say the EPR exists, and presents the EPR as temporally multiple.

The temporal dimension to researching EPRs has been largely neglected, particularly by narrowly functionalist accounts which tend to focus on the assumption of an 'installed' technology that is used and functioning properly (Takian, Petrakaki et al. 2012). Recognising the dynamic nature of the EPR implementation context gives rise to uncertainty about the consequences that requires a more accommodating stance with respect to a range of possible outcomes; one which demands a performative understanding of the technology that theorises it as useful and effective only when and in so far as it is enacted as such (Takian, Petrakaki et al. 2012).

It also creates a somewhat 'messy' and complex field of research in relation to pinning down exactly what is being researched. In relation to the tolerance (or intolerance) of 'mess' within research methods Law & Singleton (2005) propose that a typical response to apparently messy findings is to conclude that there is a 'technical' defect in the research process, for example, that perhaps I had not been assiduous enough in my questioning in interviews. They argue, however, that this is

beside the point, and that the 'ill-defined' character of the research object is not a flaw of the research process but part of its nature (Law and Singleton 2005). In this respect I propose that overlapping accounts of the EPR across different temporal frames is not something that needs to be 'tidied up', but a characteristic that is revealing about the actor-network.

My own experience of the analysis process is one of slipping between different conceptualisations by variously talking about the EPR defined as its content, i.e. the patient data inside it, particularly in relation to secondary uses; talking about it as a digital version of a paper document, as an organisational information system and as an information infrastructure at NHS level. Again, this 'messiness' is not necessarily just methodological sloppiness, but is, I suggest, a reflection of the multiple instances of the actor-network that have come to the fore within the findings.

A number of authors have recognised Actor-Network Theory's value in accommodating the shifting nature of reality and the evolution of objects of study because it attends to the processes by which a particular 'version' of the phenomenon comes about through the translation of diverse sets of interests e.g. (Hedström 2004, Lee and Oh 2006, Cho, Mathiassen et al. 2008). In allowing researchers to give accounts of shifting realities and evolving research phenomena, Actor-Network Theory facilitates new insights.

In this respect it is suggested that discussion of future iterations of a technology alongside 'concrete' versions of it is a mechanism by which a future reality can be shaped so as to accommodate the technology e.g. (McGrath 2002, Jensen 2005, Moser and Law 2006, Mensink and Birrer 2010). This is an aspect of the negotiations by which diverse sets of interests are engaged as part of network building.

McGrath's (2002) case study discusses how IS development became possible again after a high profile information system failure in the London Ambulance Service. She argues that the use of 'factish' in discourses following the failure of a new computerised dispatch system served to create enabling conditions for IS development to start afresh at a time when it was problematized (McGrath 2002). The concept of 'factish' from Latour (1999) describes action as a combination of fact

and beliefs (fetishes), such that actions are always fabricated, and this enables actors to exploit the opportunities at hand as they arise (McGrath 2002). In relation to IS development, factish was an enabler of action and debate about information systems, allowing the IT Director to recreate conditions for IS development.

Not only do expectations about technological innovation help to shape technological development and its outcomes (Mensink and Birrer 2010), it is also argued that the rhetoric which surrounds large-scale IT programmes tends to be Utopian in character and therefore associated with unrealistic expectations (Moser and Law 2006, Mensink and Birrer 2010). This is significant because it emphasises that such rhetoric is performative and therefore has consequences for the future (Moser and Law 2006).

Moreover, Utopian expectations can tend to overpower potential criticism and critical debate about the technology's value, not least because they tend to be characterised as such from the perspective of the dominant ideologies, and the actors whose interests are served by such expectations (Mensink and Birrer 2010). For this reason Gregory (2000), in her study of EPR prototyping, uses the term 'incomplete Utopian project' to characterise the unrealizability and the equivocal goodness of achieving the Utopian state set out for a technology programme

In so far as talking about future versions of the EPR before they are implemented helps to enact those futures, the success or lack of success of a given vision in terms of whether it comes into being is indicative of the translation of dominant interests in realising a particular material reality. In the case of the NPfIT government rhetoric serves a purpose in prefiguring and helping to establish the possibility of and conditions for future changes.

Jensen's (2005) research on the Dutch national EPR proposes that it can be conceptualised as a 'future generating device', which he defines in relation to the concept of a 'boundary object', described as an entity that becomes a focus for diverse interests and work practices whilst not reconciling them (Star and Griesemer 1989). A future-generating device can also be flexibly taken up within diverse sets of circumstances, however, unlike boundary objects, future-generating devices are characteristically loose, vague and incoherent, both in terms of not yet being

complete or materialised, and in terms of the political discourses which surround them not being fully coherent (Jensen 2005).

Jensen argues that these characteristics of vagueness and incompleteness are significant to the trajectory of the EPR and instrumental in its evolution by serving to restructure reality to make the technology inevitable such that 'healthcare cannot be conceived of without it' (Jensen 2005).

It is suggested that Utopian technology projects are always incomplete because projects are only ever realised through activity i.e. through being performed, and as such they are only ever partially realised (Gregory 2000) . Gregory (2000) also argues that rather than being problematic incompleteness is desirable in Utopian technology projects because it facilitates openness to opportunities for adapting a technology, and allows different actors to have an influence on its development.

This discussion of incompleteness in the context of future-generating devices and incomplete Utopian projects points to the gap between users' experiences of actualised EPRs and discussion about what is anticipated in terms of development, future functionalities and how the technology will be used.

Studies of EPR implementations in the NHS have found that users are generally positive towards and supportive of EPRs as an ideal, but report greater ambivalence towards them as locally realised e.g. (Halford, Lotherington et al. 2010, Robertson, Cresswell et al. 2010, Takian and Cornford 2012). Users' ambivalence and lack of criticality about EPRs may arise in part in relation to their incompleteness because the findings suggest that users may be tolerant towards usability issues and as yet unfulfilled functionalities if they anticipate they will be addressed by future system developments.

The way that healthcare is changing; the likelihood that more services will be delivered in the community. Hospitals will become more about theatres and that side of things meant that we needed to be more responsive to that, we needed to have a solution that was flexible and adaptable to the changes in the healthcare environment. Whereas what we have at the moment we're using it, it does what it needs to do but there's a very clear line where it stops. So there was really a sort of innovation partner element and a feeling of flexibility we wanted.

There is some bits about filling in slots in functionality. What we've got right now doesn't really do very much for A&E; it's such a high flow area. The system is usability-wise not really functional enough to fulfil that area. They're a very very busy group of people but they still record on paper at the moment in like a big cardboard folder that we scan and no one can ever find again. But that, critical care was another big area. They've done a lot of documentation but we wanted to integrate monitors and things like that, anaesthetics is another area where we have a bit of a gap in the record. So those are sort of our 3 big gaps in terms of wanting to fill. (IM&T Manager P03, Hospital A)

Brigham and Introna (2006) argue that deferring full functionality of technological innovations to the future facilitates acceptance by users, whilst also accommodating the 'articulation work' that continues to be needed in relation to the continued use of paper documents and workarounds to bridge the gaps. The findings support this in terms of participants' expectations that inconvenient aspects of use will be addressed with future upgrades and enhanced functionality will become available.

At the moment it's scanned, it's scanned but eventually it'll all be electronic. And you have to have paper records because you actually have to have people's signatures and you can't sign electronically at the moment but you will be able to. We're gonna have, you know, so that patients sign on a mobile device. (Consultant P18, Hospital A)

The ways in which government rhetoric about the future of EPRs has helped to shape them is apparent in the ways that NHS reality has been reshaped to accommodate the technology in respect of patient privacy. In the context of an NHS information strategy based on increased sharing of data and improved information flows (Burns 1998, Department of Health 2011, Takian and Cornford 2012) the evolution of the privacy debate with respect to the confidentiality of patient data is indicative of the reconstitution of reality to allow EPRs to exist such that the privacy debate too has shifted.

In so far as there is a gap between the vision and the reality of the development of EPRs in the NHS in England, the government rhetoric about EPRs has created the impression of an order that does not exist, and, which it is clear only subsequently

since the abandonment of NPfIT, never did exist. However the incompleteness and partialness of the EPR is productive in enabling a 'making do' under the circumstances to be acceptable to users and in helping to shape a future where EPRs have an assured place within NHS healthcare.

By recognising the role that discussing the future of the EPR takes, I intend to highlight that this is significant to benefits in so far as it may make an incomplete and imperfect system acceptable to users, and moreover that it is important as an element of network building. It provides a more authentic account of a technology because it recognises the role that future-oriented discourses and actions play in its development.

> And the other big thing is the expectation has massively increased. So if you talk to a hospital where they haven't got an established EPR they'll just be really chuffed if they can see results from pathology on a computer quickly instead of 3 days via paper, whereas we've got someone going "can you show this via this?" or "can we push it out via that?", "I want to be able to audit this", "can you pull all of this information out?".
>
> And the system has got to be slicker, quicker, like an iPad. Their expectation of what it should do, "you should be able to dictate into it", the user interface is what we have with a 10 year old system it looks like something you ran on an old BBC probably …It's a tad grey and clunky but their expectations now, "it should have a cover view like my iPad", "I should be able to flick it like this", all their technological expectations have developed so they ask for that. Their information expectations have massively increased, suddenly we're recording all this structured information, they want all of it out the back end and we don't have an army of information analysts there to pull that out. (IM&T Manager P03, Hospital A)

7.6.2 Actors' knowledge of the actor-network

It was acknowledged in the Research Methodology chapter that choosing to use Actor-Network Theory implies a challenge in relation to whether interviewees know enough of the actor-network to be able to give an account of it. In this respect Bowker and Star (1996) observe that individuals are complicit in creating a world in which they are blind to what is excluded.

The findings somewhat bear this out in that there is a lack of awareness amongst many participants of the scope of sharing of their EPR, or elements of it, as discussed in relation to custodianship, and supporting findings from Morrison, Fernando et al. (2013). This is supported by the observation from one participant who noted that GPs may be unaware that their practice's patient data is being extracted for the General Practice Extraction Service which uses patient data from primary care to construct a database for clinical research. This situation arises because once an organisational data sharing agreement has been put in place with a general practice data extractions may be all but invisible to clinicians. This is an indicator of the increasing pervasiveness of the technology, which may contribute to making it hard to resist because, as Lowe (2001) argues, organisational technologies restructure users' entire social world so that opposition is overshadowed.

The issue of actors' knowledge is therefore in part a result of the infrastructural nature of the EPR, through which transactions may be automatic and invisible to users, and therefore this is significant challenge for mapping actor-networks for information systems in general. Moreover actors' lack of knowledge of the network is a reflection of the size and complexity of the NHS, which precludes many clinicians and non-clinicians from having a whole view of the organisation.

Participants can therefore only give an account of *their* actor-network for the EPR, as broad or limited as that may be. For the researcher mapping an actor-network for the EPR as a technology therefore entails identifying areas of overlap and also aspects of actor-networks that may be unique to a particular use context and therefore irreconcilable.

7.6.3   The boundary of the actor-network

Recognising the partial and multiple nature of the EPR means that it cannot be defined in straightforward technical terms in relation to functionality, or in terms of a neat boundary for the object as a software application or information system. For individual instances of EPRs encountered in participants' accounts defining a boundary involves consideration of the scope of sharing of the record and their knowledge of it as the boundary of the actor-network for any given instance, as indicated in Figure 6.

Moreover the boundary of the actor-network for the research object is the boundary of *my* actor-network as a researcher in relation to the field of research because I am implicated in its production. My role as a researcher positions me as part of the actor-network that I am investigating and therefore I have an influence in terms of shaping it, and also am influenced by it. Therefore it is important to acknowledge the ways in which my experience of conducting the research has influenced the outcomes, as discussed below, following the proposal to contextualise the phenomenon as a means of defining what to include and exclude (Miller 1997).

The boundary is defined largely in terms of the limits of my access to various parts of the NHS. It has restricted me largely to direct 'hands on' users of EPRs, who are mainly clinicians but also include a number of non-clinical users. Participants referred to a range of secondary uses of EPR data, and therefore other actors related to research, administration, performance management and other functions within the machinery of the healthcare system. While being aware of them it was not feasible to investigate further as it would have entailed gaining access to participants in multiple healthcare bodies outside the participating NHS Trusts (due to the multiple secondary uses of the EPR data). Moreover their distance from use of the technology as compared with hands on users would make it more difficult to obtain their accounts of the EPR actor-network. Therefore I suggest that secondary uses of the EPR sit at the boundary of the actor-network for this study.

The NHS' ethics processes and norms around research and patient confidentiality have influenced the research process by constraining my access to Trusts and participants, thereby shaping possibilities for data collection. Figure 6 below shows participant Trusts and interviewee roles in relation to the scope of inter-organisational EPRs encountered, which are associated with the boundary of the actor-network for the research.
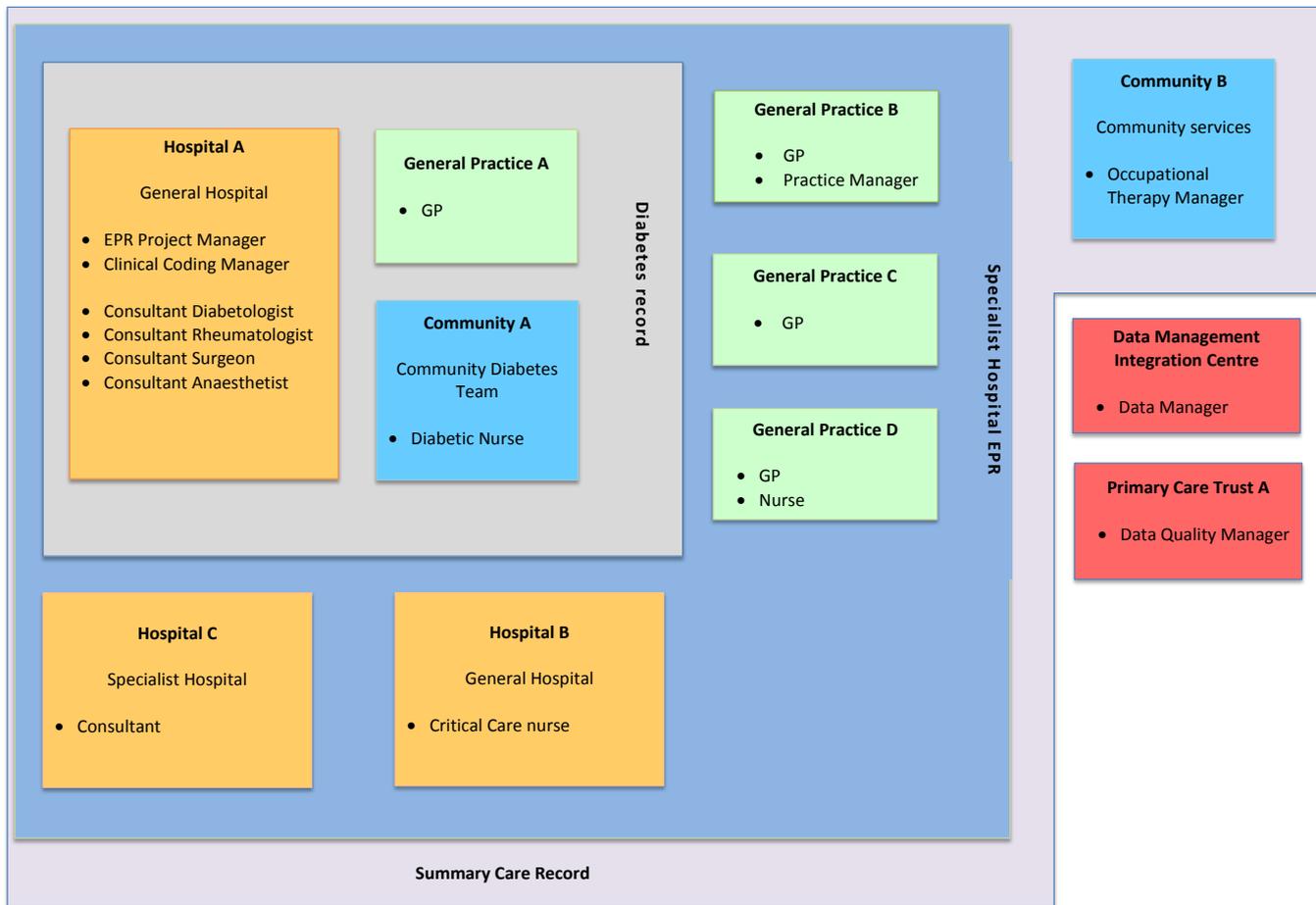
Figure 6. Outline of participant organisations and EPR boundaries

Each Trust has differing demands in relation to securing research permissions. In Trusts where I had not already identified potential interviewees the opportunity to assess the suitability of the Trust against my criteria was constrained by the difficulty of gathering enough information informally about their EPR in advance. This also applied to identifying potential individual interviewees within a Trust where prospective interviewees were unwilling to share information informally prior to research permissions being granted.

In certain Trusts although I had identified participants willing to be interviewed the mechanisms to gain formal consent at Trust level took considerable time to agree and in one case this resulted in the loss of opportunities to collect data. There was therefore a risk involved in managing the overall data collection strategy by applying for research permissions in a Trust where I may not secure willing participants when processes for research approval varied from a couple of weeks to almost 12 months.

Research access to the NHS requires a relationship with an insider who can both share informal insights which serve to turn a particular phenomenon into a potential research object, and which provides the researcher with legitimacy from the organisation's perspective when approaching potential participants. It was necessary therefore to explicitly identify an internal sponsor as part of acquiring research permissions in a number of participant Trusts.

The legitimacy of my research in the eyes of R&D managers goes to questions of accountability and how the relevance and validity of research is assessed. Whilst Actor-Network Theory has been used in numerous studies of healthcare, including studies on the NHS e.g. (Bloomfield 1995, Berg and Goorman 1999, Bruni 2005, Vikkelso 2005), nevertheless my experience suggests that the legitimacy of my study may have been in question because it is at odds with what is considered to be research within clinical and healthcare contexts. This reflects the fact that disciplines have different conceptions about what it means to conduct research, what counts as research and what is a valid contribution (Woolgar, Coopmans et al. 2009). Following dissemination of the study report to participant Trusts one R&D manager expressed surprise that the research does not constitute an improvement project, reflecting an expectation that evaluation and improvement-focussed research are the norm within a clinical context. Lack of discussion of practical issues such as access to the field of study in academic publications indicates that they do not tend to be considered legitimate topics of discussion, which raises questions about the implied rules of inclusion and exclusion for different disciplines and within academic research overall.

As an exception Winthereik et al (2000) make access to the field of research an explicit topic of discussion, proposing that the process of engagement with the field is in itself insightful. Their position is informed by an anthropological perspective which takes the field as an analytical abstraction rather than a physical space (Winthereik, de Bont et al. 2000). This implies that the field of study only comes into existence and takes shape as a result of the researcher's activities, rather than pre-dating them as a thing 'out there' waiting to be discovered (Winthereik, de Bont et al. 2000, Law 2004, Woolgar, Coopmans et al. 2009). This has obvious parallels with Actor-Network Theory's notion that entities emerge from networks of relationships

and acquire their characteristics by virtue of their roles and positions within the network.

As an aspect of the need for reflexivity and to contextualise the phenomenon it is necessary to acknowledge the shifting context of EPR implementation as a significant characteristic of the actor-network; discussed below.

7.6.4 The NHS as a moving target

Since the launch of the NPfIT in 2002 there has been change of governing political party from a Labour government to the incumbent (as of 2014) Conservative-Liberal Democrat coalition that took power in 2010. The change in the political landscape is was inevitably accompanied by changes in policy and strategy for the NHS which has influenced what would always have been a long term programme of technological development with regard to EPRs and therefore subject to such influences (Takian, Petrakaki et al. 2012).

During the lifetime of this doctoral research the NHS has undergone significant restructuring, which, in so far as the rationales for those changes influence the organisational context within which EPRs are being implemented, reflects shifting interests and membership of the actor-network. This includes the introduction of Foundation Trusts in 2004, which is argued to be a factor in the failure of NPfIT in so far as it gave certain Trusts greater autonomy in making decisions about IT development and therefore undermined NPfIT's top-down approach (Robertson, Cresswell et al. 2010).

Moreover the changes to NPfIT objectives during the programme shifted the focus towards implementing local EPR systems where they do not already exist and to specifying and aiming for compliance with standards which will facilitate inter-organisational interoperability (National Audit Office 2011). This emphasises the shift to a locally-led EPR development strategy which may preclude the possibility of achieving the nationally shared longitudinal EPR (National Audit Office 2011).

More recently the establishment of the Health and Social Care Information Centre (HSCIC) in 2013 (Department of Health 2013) reflects the NHS information strategy with respect to objectives to enable greater sharing of patient information; increasing the amount of information collected from healthcare organisations and through newly

acquired legal powers, mandating the provision of particular data, which was previously, for example, in the case of GPs, voluntary.

Furthermore a number of NHS bodies have been renamed, accompanying shifts in their remits. For example, the National Institute for Clinical Excellence set up in 1999 became the National Institute for Health and Clinical Excellence and again changed its identity in 2013 to become the National Institute for Health and Care Excellence (National Institute for Health and Care Excellence 2014). Therefore this thesis needs to be read with the understanding that it was written during a particular period of time, and the NHS bodies referred to may no longer exist in the same guise.

As acknowledged above Actor-Network Theory is of particular value in accounting for 'moving target' research objects because of its attention to the processes of network-building and to the ways in which changes in the actors involved and their multifarious interests in turn change the nature of the actor-network. This supports my use of Actor-Network Theory rather than another approach that might focus more narrowly on understanding the EPR as a software application. Only by using ANT am I able to recognise this aspect of reality.

7.6.5 Black boxes and criticality

Users' perceptions of EPRs as beneficial or otherwise relate to the discussion about whether this technology could be said to be black-boxed. Despite the expectation that users would be critical of non-clinical agendas implicated in their use of EPRs, they were largely not so. Users were ambivalent but also accepting of EPRs as a technology, creating a sense that use is inevitable and that it would be unthinkable to revert to paper records.

There's very much a feeling of "it's here to stay, we can't go backwards" but there are bits that are kind of, if you asked every single person list your top ten things that really annoy you about EPR, everyone will find 10, maybe more. (IM&T Manager P03, Hospital A)

The EPR was created specifically for GPs to make life easier for GPs. Every single UK practice has an EPR and if you said to GPs that in the US they still use paper

> and maybe we should go with the majority and go back to paper people would say "no, we're wedded to it now, there's no going back". (GP P11, General Practice C)

This lack of criticality is recognised by other studies that investigate the implications of health information systems e.g. (Checkland, McDonald et al. 2007, Mensink and Birrer 2010), and arises, I suggest, because system use is tied up with the use of inscriptions such that non-use is all but impossible and would disadvantage users. This is an indication that EPRs as an organisational technology are accepted as a taken for granted element of the organisation's infrastructure. By contributing inputs to the system, users, as much as they may complain or resist in certain ways, are implicated in the system becoming black-boxed (Lowe 2001).

Moreover, critical and questioning voices may be eclipsed by the Utopian expectations set up around EPRs (Mensink and Birrer 2010) and established policy commitment to health information technologies (Halford, Obstfelder et al. 2009). This is unsurprising from an ANT perspective given that an alternative reality would entail the disruption of a complex and intricate network of relations on which government IT policy is contingent. This observation helps to justify the use of Actor-Network Theory because the objective of unpacking an actor-network is to reveal how it is established such that it becomes an accepted part of the local reality.

The pervasiveness of EPRs therefore has implications for the ability of users to challenge or avoid non-clinical agendas. Their embeddedness within clinical activity means that EPR use tacitly acts to stabilise those inscriptions and legitimise the agendas of which they are a part.

It has been argued that an actor-network reshapes reality so that its existence becomes taken for granted (Bowker and Star 1996). In terms of users' limited criticality about EPRs it can also be argued from an Actor-Network perspective that the stabilisation of the EPR in any organisational context necessarily entails a reconfiguration of reality to accommodate the technology such that it is hard to imagine the world without it, making EPRs a natural and inevitable progression for healthcare organisations. This EPR-friendly reality is apparent, for example, in the sense that patients already expect that data in their medical records is shared pro-actively between healthcare organisations (Singleton, Pagliari et al. 2009).

> It's still patient data at the end of the day, we treat it with respect. We are but we probably take it further than the public actually think we do because they think information is being shared with the hospitals and other care providers more than it is. The Summary Care Record, most think it's happening and it's not. (Business Change Manager P04, PCT A)

Once established and 'black boxed' such an entity may be taken for granted, hidden from view and closed to debate and scrutiny. The literature suggests this is particularly the case for infrastructures, which are, by definition, intended to become 'part of the furniture' (Star 1991, Scott and Wagner 2003).

In this respect EPR use has become part and parcel of what clinicians do on a daily basis not only on a clinical level but also in relation to non-clinical activities associated with various forms of accountability. In this sense users are aware of and acknowledge that they need to do a certain amount of recording within the EPR for the wider benefit of the organisation. The integration of clinical and non-clinical functionalities within EPR applications is another aspect of this, for example in General Practice B and Community B where users discussed the scheduling and diary functionality for patient appointments.

Actor-Network theory and related approaches theorise how artefacts become taken for granted in the context of stabilisation and eventual black-boxing so that they become enduring, irreversible and 'fact-like' e.g. (Latour 1987, Ormrod 1995, Kaghan and Bowker 2001). Black-boxing involves the simplification of the actor-network such that its inner workings are no longer noticed (Callon 1991, Tuomi 2001, Law version of 25th April 2007). However it is also emphasized that in the achievement of this appearance of order, actor-networks must be continually performed, and that arrangements which constitute an actor-network are only ever temporarily stable (Law 1992, Law and Singleton 2000, Law version of 25th April 2007).

In the context of technologies it is suggested that digital artefacts and phenomena may be characterised by a state of 'perpetual beta' (Kallinikos, Aaltonen et al. 2010), and as such some entities are arguably never black-boxed. In this respect Jensen (2005) warns against mechanistic application of Actor-Network Theory such that

researchers must posit black boxes just in order to be able to unpack them. He argues that the fluidity and instability of certain research objects (in his case study a national EPR implementation) means that artificially building black boxes as starting point for analysis is disingenuous (Jensen 2005).This echoes Law's critique of applications of ANT which tend to 'fix' it so it can be used instrumentally, exactly because its value arises from negotiating its own fluidity as a theoretical approach (Law 1999).

The findings indicate that whilst EPRs are taken for granted within healthcare organisations the EPR as a technology is far from complete from the perspective of the NPfIT and government objectives. The EPR is therefore arguably not yet black-boxed. The EPR as a class of technology is being performed as a multiple and overlapping actor-networks in diverse use contexts and often as apparently different instances of the software implementation. Although certain aspects of the EPR content and functionality and certain versions of the software are stabilised all nevertheless remain partial and incomplete.

In terms of the enrolment of allies, the 'data-driven NHS' generate demands for Trusts to provide certain data, which, as from April 2014, effectively necessitate implementation of an organisation-wide EPR system (Hoeksma 2013). It could be said, therefore, that it is not possible to disentangle EPRs from other changes of which EPRs are a part, such as the new information demands on NHS organisations associated with the launch of care.data (NHS England 2014). EPRs 'fit' the new organisational reality and vice versa through a process of co-evolution.

7.6.6 Accounting for non-human actors

This would not be an Actor-Network Theory study without consideration of non-human actors, the principle of generalized symmetry being a defining characteristic of ANT. It has been noted that researchers who use ANT nevertheless tend to neglect non-human actors in their analyses (Rose, Jones et al. 2005), and it is suggested that Actor-Network Theory accounts remain human-centred because of the need for humans to speak on behalf of non-humans (Pels 1996). I address non-human actors both in terms of the material aspects of EPRs and also as abstract entities.

It has been acknowledged that during data collection the number of potential non-human actors identified from interviews can become unmanageable e.g. (Bonner, Chiasson et al. 2009) not least because they may be abstract entities, and this demands a rationale for selecting actors to pursue (Miller 1997). In time a number of key non-human actors emerged more clearly as actors worthy of following in relation to their influence on the actor-network, and this occurred incrementally as a result of understanding of the actor-network developed through successive interviews in combination with investigation of sources including websites and government documents.

My decision to take a meso level approach in relation to understanding the EPR as a generic technology in the NHS in England means that most, if not all actors in the actor-network for are non-human, representing classes of actors at meso level which are manifested in multiple specific instances at micro level. The actor-network is therefore an abstraction, but nevertheless one grounded in the micro-organisational realities of EPR use.

In this research non-human actors have come to the fore particularly in relation to the materiality of EPRs. Whilst I have discussed clinicians' experiences of disbenefits of EPR use in relation to non-clinical interests, there are also challenges experienced in relation to material issues, which demands discussion of the interests of particular non-human actors. Accounting for materiality is a way of taking the technology seriously, as argued by Mitev (2009).

The table below presents an account of the interests of key non-human actors in the network, applying Vidgen & McMaster's (1996) approach, which they used to analyse the non-human stakeholders in a car park access control system.

Non-human Actor	Associated actors	Interests
Information Governance	• Software audit trails • EPR access audits • Patient EPR opt in / opt out consent forms • Smartcard • Password authentication • N3 network infrastructure • Caldicott review • Public information leaflets about care.data and Summary Care Records • GP Information Group	• Accountability to the public for protection of patient privacy and confidentiality. • Ensure only clinicians with a legitimate care relationship to the patient access their records. • Prevent and/or discourage unauthorised access to patients' records. • Track unauthorised access. • Keep patient record data within the NHS. • Enable wider sharing of patient data from records within the health service whilst maintaining public trust and ensuring public acceptability of data use. • Encourage public opt-in / non opt-out to ensure critical mass of uptake required for feasibility.
Computer on Wheels	• Hospital wards	• Mobile EPR access within a given site and setting.
Toughbook laptop		• Mobile EPR access in an ambulatory care setting. • Secure access that prevents unauthorised individuals from accessing EPRs. • Robustness with respect to physical damage. • Wireless Internet access.
Computer workstation		• Utilitarian computing. • Shared access to EPRs in communal workspaces.

Clinical Coding	• Read codes • ICD10 codes • SNOMED codes • OPCS codes • Clinical coders • Coding audits • Data quality	• Classify patient conditions and treatments using standardised classification schema. • Quantification of treatments and services provided for the purposes of payment. • Enable analysis of patient casemix. • Enable searchability within and between records • Enable reporting for financial, performance and other management and accountability purposes by facilitating comparability of individual records within and between Trusts. • Provide inputs for central returns datasets.
Paper records	• Letters from outside a Trust • Paper patient records/case notes ('Lloyd Georges') • Surgery consent forms • In-theatre patient charts • Drug kardex • Nursing charts • PDFs of paper documentation	• Enable communications between Trusts. • Enable legal requirements for patient consent for surgery to be met and managed. • Support nursing and other processes that are not integrated into the EPR. • Enable integration of and access to paper-based documentation via the EPR.

Table 6. Analysis of non-human actors and their interests

The interests of material non-human actors are significant to the actor-network for the EPR, and to users' experiences of benefits and disbenefits. A number of the disbenefits noted by participants relate to the ways in which such non-human actors constrain EPR use in ways which are perceived as inconvenient or time-consuming, for example the slowness of accessing and reading PDF documents within the EPR.

In the clinics it's a real problem now because if you've got a 20 minute slot to see a new patient who, you know, you would have seen the referral letter before but you might have seen it 3 weeks before, so you need to look at the referral letter, you

need to look at all the incoming correspondence and if it takes, even if it only takes 5 seconds for every single document, to load it up, that's a lot of time. So that's causing real problems and there's lot of work going on to try and improve that and I'm sure it will improve. But that's one of the problems with EPR for us at the moment. (Consultant P18, Hospital A)

And then we get into the whole issue of scanned documents and I don't know who else you've interviewed in the Trust but scanned documents are a real pain in the ass. Because they don't open quickly and are not as fast as reading a paper document and with the electronic document it's supposed to be *at least* as fast as a paper document, and it doesn't give you that facility to scan it as fast as a paper document.

It has got better, they've made it simpler but it's still not as fast as scanning a paper document and that is a *huge* drawback with historical records that have been integrated and they can be in a huge wodge. But of course the difficulty is if it's an old document it's a historical document, it's gonna be paper and therefore you have to have it scanned. (Consultant P16, Hospital A)

In addition to materiality, non-human actors are also apparent in the findings as abstract entities, in particular information governance, especially in how it relates to patient confidentiality. These two non-human actors are highly visible due to the ongoing tensions and controversies surrounding the privacy of patient data apparent in debates in the health professions and the media e.g. (Kierkegaard 2011, Todd 2011), and also because use of EPRs is mediated by the institutionalised processes and practices associated with information governance and patient confidentiality.

…..we then starting hitting problems of the governance and of the infrastructure that allows that data to flow. So that's, kind of, why I've come up with these requirements, because although the Summary Care data might be available, you know I've requested access [to the Integrated Record] for research, there are governance processes in place for that but when I've tried to do that I don't know what's available to me; the steps in receiving it weren't at all smooth, and it just needs to be better. (Consultant P10, Hospital A)

7.6.7 Tracing an actor-network through its actors

In interviews the number of destinations and uses of EPR data quickly multiplied, and this has had implications for the methodological approach of following the actors as a means of mapping the actor-network. I initially envisaged producing a complete map of the actor-network for the EPR, however it became clear that this is impossible, and moreover implied taking up a position as a detached observer outside the actor-network. Moreover failing to acknowledge the interplay of processes of investigation and the phenomenon being investigated would position the researcher them self as a black box (Ziewitz and Pentzold 2013).

The use of common sense and nonetheless arbitrary categories for clinical roles and healthcare settings to structure the research design was useful in providing a starting point for the research. It enabled me to target certain participants under categories of doctor, nurse, Allied Healthcare Professional and non-clinical user, in hospitals, general practice and community settings. However, up close these categories become less distinct, as in the concept of the 'certainty trough' (MacKenzie 1993). Clinical roles and healthcare settings as categories were therefore used to structure the research process with acknowledgement of internal variations in these categories.

7.6.8 Meso perspective

The government vision for EPRs that link NHS organisations, ultimately on a national scale, makes a meso level view is valuable in comparing this vision with the local realisation(s) of EPRs. Actor-Network Theory enables the researcher to take a meso level view that can keep in view both the macro and micro level aspects of the actor-network through tracing the connections between entities. In this respect ANT has facilitated flexibility in the selection of organisations and individuals to engage with as participants, which other methodologies would not. I iteratively adapted my data collection as my own understanding of the actor-network developed, allowing me to address the need to gain user perspectives from a range of healthcare settings and from users in the role categories set out.

7.7 Summary

I have set out to ask 'what are EPRs?' as a means of challenging and questioning the ongoing development of a technology which promises to become pervasive on a

national, and highly public scale. Using Actor-Network Theory to investigate what EPRs *are* in relation to the diverse instances and conceptualisations of the technology has meant exploring the actors and relationships that constitute it, and their associated actor-networks.

In the chapter that follows I draw conclusions and identify contributions in relation to my original research question about the benefits of EPRs to users, and place this in the context of the current strategy for NHS information systems. These conclusions can inform policymakers at national level as well as those developing and implementing IS strategies locally by providing greater awareness of the influences and considerations at stake from micro-organisational through to macro-social level in the context of ongoing developments of EPRs within and between NHS organisations. I also consider the implications of the research in relation to the decision to use Actor-Network Theory, in doing so seeking to address the objective to evaluate its role in researching messy and elusive phenomena and identifying contributions to theory and methodology.

CHAPTER 8 - CONCLUSIONS

This chapter will draw conclusions from the study by revisiting the research question and associated research objectives, going on to produce generalisations in relation to the themes that have emerged. This leads on to a summary of the contributions to knowledge, relating the research findings to the literature about electronic patient records, in doing so identifying an audience within the Information Systems discipline, and establishing contributions to Actor-Network Theory as a theoretical and methodological approach. Finally I reflect on and evaluate the research approach, noting learning, limitations, and providing suggestions for further research.

This PhD thesis has been decentred in so far as it has not only drawn in topic literature about electronic patient records, but has also brought the chosen theoretical and methodological approach, Actor-Network Theory, into the foreground. For this reason I draw conclusions to my research question in relation to how mapping the actor-network for the EPR has provided insights about EPRs in the NHS in England and in doing so has contributed to appreciating benefits to users. In arguing the significance of my choice of research methodology in shaping the outcome I draw conclusions about the value of using Actor-Network Theory in relation to understandings that may not otherwise have emerged from the use of another theoretical and methodological approach, thereby offering methodological contributions from the study in the form of operationalizing ANT.

8.1   Revisiting the research question and objectives

The research set out to answer the primary question: How does the electronic patient record produce benefits to users?

In doing so the study set out to address the following research objectives:

- To map the network of relations which the electronic patient record simultaneously creates and emerges from.
- To identify whether and how the electronic patient record benefits user-stakeholders i.e. individuals and groups who use the EPR as providers or consumers of information for the purposes of healthcare delivery.

- To discover whether it is possible using Actor-Network Theory to give an account of the electronic patient record as an elusive and 'messy' object and as such contribute to the debate on research methodology.
- To produce practical methodological insights for the application of Actor-Network Theory to empirical research.

8.1.1 Mapping the actor-network for the EPR [OBJECTIVE #1]

Mapping the actor-network for the EPR addresses an ontological question about what this technology *is*, not only as an IS implementation within a specific NHS organisation but as a technology which exists in different forms across multiple NHS organisations and healthcare contexts, and which is intended to become (where it is not already) inter-organisationally networked. This has involved identifying the actors and relationships that constitute the EPR as a technological phenomenon.

The actor-network for the EPR in the NHS in England is comprised of the EPR implementations encountered in this study, EPR users and other human stakeholders and a range of non-human actors. These actors are necessary to the existence of the EPR and influence the shape of the technology as it is actualised within different use contexts. The interests of these actors conspire to stabilise (or if not translated fail to stabilise) any given incarnation of the EPR. Therefore I have identified constituent actors and their inter-relationships for what this tells me about the actor-network for the EPR.

The EPR of the government vision as a nationally networked record does not exist. With reference to the discussion of temporality, this has been attributed to interoperability and NPfIT programme-related issues and deferred to the future. This not only suggests that the programme was unsurprisingly not a little Utopian, but as a failure or breakdown in the actor-network for the envisaged EPR, it is revealing about the actors involved.

The failure to establish a single, whole, longitudinal and nationally interoperable electronic record for each patient is indicative of the interests involved in this endeavour. I have related findings about EPR use and usefulness to the enrolment of actors' interests.

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That non-clinical interests alone are insufficient to stabilise the actor-network for EPRs is suggested by the current lack of relevance of the Summary Care Record to clinicians. Conversely the success of the inter-organisational diabetes record suggests that there are strong clinical interests in an inter-organisational EPR that supports the needs within this specialism for significant collaboration between healthcare professionals in different organisations.

Findings that other inter-organisational EPRs (the specialist hospital EPR and the Integrated EPR) are under-used by clinicians suggests that they do not meet clinical needs in relation to existing work practices, and have failed to enrol clinicians in their actor-networks. It must be acknowledged that the success of 'local' organisational EPR systems does not mean that the interests involved with them are solely clinical; it does however suggest that *clinical* interests are translated where EPRs are actively used by clinicians.

By investigating actors beyond the micro level of individual NHS organisations I am able to account for the ways in which government and other macro-level actors influence the development of this technology and the forms it takes, and also relate micro level actors as perceived and experienced by EPR users to those macro-level actors and agendas. This allows for a much richer and more realistic explanation for the status and benefits of EPRs.

It may be argued that it is impossible to adequately account for a phenomenon within an (artificially constrained) micro-organisational field of research because this neglects macro influences, or consigns them to background context through which their status in terms of influence may be underplayed, and in which there is a separation between background and foreground that introduces a disconnect, a leap of faith between what stakeholders experience and macro level actors such as government policy, or clinical professional standards and norms. Bringing that context into focus inevitably produces a more complex picture of the phenomenon and also enables consideration of the question of benefits to clinical practice that is much more subtle and comprehensive.

By investigating the actor-networks for instances of local and inter-organisational EPRs encountered and experienced by clinicians I am able to draw insights that

relate not only to a specific software or implementation site, but which provide an understanding of how those instances (and users' experiences of them) are related within a wider actor-network for the phenomenon of EPR development in the NHS in England, and indeed how they contribute to the status and nature of that phenomenon.

8.1.2 EPRs and benefits to clinicians [OBJECTIVE #2]

The research question for this thesis has for pragmatic reasons, and influenced by the literature and my critical motivations, come to focus on benefits to clinical users, reflecting an evolution in my understanding of the actor-network as discussed previously. Whilst EPRs bring benefits for clinical practice there are also real material and social constraints on achieving broader and more equitable benefits with fewer disadvantages.

For clinicians there is also a trade-off involved in gaining the benefits of EPR-use in relation to buying in to the non-clinical agendas inscribed in them. In so far as these agendas to some extent pre-date EPRs they can be said to have legitimised EPR-use and are not new to clinicians. However as acknowledged in the IS literature inscriptions of managerial agendas and representations of the organisation within information systems are associated with mechanisms of control e.g. (Bloomfield 1991, Orlikowski 1991, Doolin 2004, Reich 2012).

It is not possible to say whether there is a clear-cut overall benefit to clinical work practices because clinical and non-clinical activities are intertwined. In this respect it was perhaps naïve to assume that support for clinical work practices from EPRs could be distinctly demarcated. Nevertheless I have made the assumption that clinicians' interests (in terms of their work practices) are primarily clinically-related. Moreover this does not detract from the arguments made by Berg, Langenberg et al (1998) and Berg & Goorman (1999) that secondary uses agendas should not dominate EPR design at the expense of adequately supporting clinical work practices.

There may be different translations offered during the process of negotiation (Callon 1986) and in so far as this involves persuading actors that a given translation addresses a need or solves a problem for them, there are inevitably winners and

losers because this demands compromise (Pipan and Czarniawska 2010). Discussion of benefits to clinicians indicates that clinicians (and some more than others) bear at least some of the costs of such compromises because they are all to a greater or lesser extent information suppliers *and* consumers, with the burdens of supply variably distributed.

Non-clinical agendas consume this supply, both driving demands for capturing particular data and capturing it in particular formats, therefore inevitably creating additional burden for clinicians. This burden comes in the form of additional work and responsibilities, time consuming or inconvenient processes and risks, such as those that relate to the potential for surveillance of work or of penalties for inappropriate EPR access. That there is an awareness of the potential that EPRs may generate additional work is apparent in the Health and Social Care Information Centre's stated aim to 'minimise the burden of NHS data collections'[1] (Health and Social Care Information Centre n.d.).

In relation to the rationales for investigating EPRs, I have considered the technology in opposition to paper records; however this could be somewhat misleading. Paper records have not disappeared, continuing to play an articulation role in the gaps left by EPRs, which are indicative of the boundaries to networkedness. Moreover, paper plays a more substantial role in organisations where EPR implementation is as yet partial for certain functions or users such as for nursing staff in Hospital B, and occupational therapists in Community B. It is not a case of which of paper records or EPRs are better, of having one or the other; rather it is a case of the role of EPRs extending further into different aspects of clinical and non-clinical work in the domain of healthcare provision.

A number of the risks and inconveniences associated with EPR-use that the continued presence of paper brings are due to the limits of the EPR system at the organisational boundary; without a universal EPR it will be impossible to get rid of paper records. Moreover paper performs other functions that EPRs as yet cannot, as

a mechanism for signed patient consent, for example, for surgical procedures. As acknowledged in relation to excluded user groups, there will always be a scope-related boundary and therefore paper, and the work associated with it will endure.

8.1.3 Using ANT to research mess [OBJECTIVE #3]

I set out a research objective to find out whether Actor-Network Theory is of value in researching an elusive and 'messy' research object. Recognising partialness and multiplicity is an aspect of defamiliarizing the research object (Jensen 2004), which is arguably important for producing a credible account because it removes the assumption of a singular and whole research object. It allows the researcher to illuminate a context such that new approaches might be taken and new questions might be asked, and by acknowledging this other approaches to understanding emerge (Jensen 2004).

In relation to the postmodern tendency to critique and reject conventional approaches but not to offer any answers, Law (1999, p2) suggests that "there are dangers in lionizing that which cannot be fixed". However, the accommodation of mess is not merely taking methodology to a postmodern extreme in order to 'have your cake and eat it', but, as Passoth & Rowland (2013) argue, is a necessary and inevitable aspect of researching something messy. That is to say it is not possible to create an account of mess that is not in itself messy (Jensen 2004, Passoth and Rowland 2013, Law version of 19th January 2006). Moreover as researchers researching what is inherently messy we ought not to manipulate the object of research to make it fit into neat categories and models (Law version of 19th January 2006). This includes not assuming a clean 'before and after' approach to evaluating technology (Takian, Petrakaki et al. 2012).

Takian et al (2012) argue that "telling the whole story" produces greater insights into the research phenomenon, and I suggest that by using Actor-Network Theory to produce a messy account of a messy phenomenon I have produced a more authentic account of the current status of the technology in the NHS in England for users of EPRs, where an instrumental approach might have focused narrowly on EPR systems' stated functionality and how it is intended to support clinical work.

I suggest that this goes directly to the quality and ethical texture of the research in relation to its truth claims about the realities being researched. By recognising and including the messiness in accounting for EPRs I expand the discussion to legitimise a range of enactments of EPRs, including use, non-use and everything in between; including whole and partial networkedness from local organisational level to the national Summary Care Record, and consider included, partially included and officially or de facto excluded users. This generates a more accurate depiction of the research phenomenon than might have been the outcome if the research had demanded that the EPR as a research object be a 'smooth' and well-defined technology in a well-defined time and place.

Despite having sought such a well-defined EPR at the start of the research I did not find it, and for this reason have suggested that the EPR is an elusive object that demands a shift in the approach to research to appreciate.

8.1.4 Practical methodological insights about ANT [OBJECTIVE #4]

The partialness and multiplicity of the EPR approached at meso level blurs the boundary of the actor-network and makes it hard to define. Boundary construction has to be done there and then, it cannot be defined before starting thereby adhering to ANT's principle of grounding the research in reality, and of not imposing order a priori ensuring it is always justified on the basis of the reality at hand.

This means that the research object was elusive in relation to identifying what is being researched. This has demanded that I engage in an ongoing process of actively carving out a position for the research, deciding what to include and exclude and constructing a boundary through a necessarily iterative and contingent methodology that has involved progressively defining parameters as the research object, in its complexity, has gradually come into sharper focus.

This boundary construction particularly transpired in relation to access to and emergence of the field of research, for which I highlight a number of insights under the contributions.

8.2 Topic Contributions

From the themes outlined above I will discuss how this study contributes to theory about electronic patient records in the context of the wider health informatics and IS

literature. I will also discuss how my findings about the use of Actor-Network Theory contribute to Actor-Network Theory and research methodology literature.

8.2.1 Networkedness vs localness [CONTRIBUTION #1]

A central contribution to the literature is the conceptualisation of the EPR as a networked object, connected across multiple Trusts, roles and healthcare settings.

Considering the EPR as a meso level phenomenon, the situation is partial in so far as there are inter-organisationally networked elements and capabilities which are present in limited ways; limited in content, functionality and the scope of stakeholder organisations and clinical roles with access. Discussion of what the degree of networkedness means for clinicians using EPRs has revealed actors and interests involved in the various EPR actor-networks and provides an indication, in relation to the overall actor-network for EPRs in the NHS in England, of their relative stabilisation and durability for different stakeholder constituencies. In this study the focus has been on clinicians as a key user constituency because they conduct the core business of healthcare.

Access to patient records held in organisational EPR systems supports sharing of clinically relevant information *within* a healthcare organisation (e.g. a GP practice or hospital). This EPR data sharing also applies to a limited (i.e. partial) extent within a broader local health economy between hospitals, GPs and the community in certain geographic areas, as evidenced by the Diabetes EPR and the heavy use of tests and results communications between service providers and treating clinicians requesting them. These forms of sharing are geographically proximate but defined by established collaborative relationships i.e. most patients from GP A will be treated at Hospital A, rather than by geography per se. The networkedness of EPRs beyond the local NHS organisation can therefore be said to be stabilised in relation to *clinical* usefulness i.e. in so far as use supports existing clinical practices and relationships.

Inter-organisational sharing of electronic patient records encountered in this study has, except for the Summary Care Record, developed independently of the top-down directives associated with the NPfIT. This supports findings from Eason, Dent et al. (2012) that suggest a better national strategy may be a middle-out approach that could accommodate development driven by both local (clinical and non-clinical)

needs and national level imperatives, and which might provide a means of reconciling tensions between macro and micro designs.

The existence and relative success of the Diabetes EPR (albeit restricted to a single specialism and therefore not a 'whole' EPR) indicates a translation of clinical interests around managing a chronic condition collaboratively across multiple organisations into a specific instance of an inter-organisational EPR. This highlights the significance of the clinical specialism as an actor. That the Diabetes EPR has ostensibly come about independently of the NPfIT is an indicator of where clinical interests lie, where this might otherwise have been perceived under NPfIT, a programme which can be seen as having been imposed on NHS Trusts, as a non-clinically driven technological development.

However the lack of relevance and low or non-use of other inter-organisational EPRs including the specialist hospital EPR, Integrated EPR and Summary Care Record suggest that the idea of inter-organisational EPRs as a clinical information resource in the knowledge management mould has failed to translate in other roles and specialisms.

Whilst the Summary Care Record exists, in places, and supports non-clinical agendas related to financial management, the clinical knowledge management role envisaged for it cannot be said to be stabilised. In this respect there is an illusion of ordering that masks a failure of relevance and legitimacy of this particular actor-network in relation to its existence 'on paper' but non-use by clinicians. This supports the contention that stabilisation, or order, is only ever the reality for some of the actors (Star 1991, McLean and Hassard 2004).

The clinical relevance and value of the EPR to clinicians is therefore largely local, both to the healthcare organisation (i.e. intra-organisational EPRs) and to the health economy of collaborating healthcare organisations.

In relation to non-clinical purposes, the production of aggregate EPR data, whilst useful for organisations' internal information requirements as a means to manage and review their own processes are nevertheless fundamentally driven by central NHS demands for data through the internalisation and a transfer of those

management responsibilities downwards, as observed by Wilkinson and Willmott's (1995) critique of the 'quality management' ideology of new public management. Increased demands for reporting that have evolved alongside the enhanced reporting capabilities enabled by EPRs could be said to constitute de facto networkedness, despite the lack of 'plumbing' because if networkedness is considered to be digitally mediated inter-organisational sharing of whole or partial patient records as a consequence of having an EPR system, then not only do features such as tests and results 'count' but also arguably so too do indirect modes of data sharing enabled by the EPR. This means that although reporting does not necessarily involve direct sharing of information from the EPR system, in relation to non-clinical interests to some extent this does not matter because it nevertheless happens *by virtue of* having an EPR.

In so far as inter-organisational sharing of subsets of patient information within EPRs is occurring in indirect ways, whether with central health service management bodies or with other Trusts, these therefore serve to establish the infrastructural nature of EPRs. It could be said, therefore, that in spite of the overt failure of the NPfIT in the development of a nationally networked EPR, delays in implementation notwithstanding, EPRs are becoming networked objects in unexpected and roundabout ways.

Whilst reporting and data extractions from EPRs involve aggregate rather than individual patient records, there are nonetheless patient confidentiality issues at stake and questions of data ownership and consent for non-clinical uses. Therefore, in terms of good governance of patient information, I suggest this makes EPRs 'leaky' and this may generate privacy concerns, discussed further under the theme of custodianship.

EPR networkedness has tended to be addressed in the literature in terms of the strategic information sharing, connectivity and interoperability-related objectives of NPfIT e.g.(Kalra and Ingram 2006, Cresswell and Sheikh 2009, Waterson 2014). Exceptions are literature in which the idea of networkedness is implied e.g.(Berg and Goorman 1999). Therefore explicit consideration of EPRs in respect of their inter-organisational networkedness is a departure from the existing literature and a contribution. This research provides a picture of the current reality of EPR

networkedness in relation to what this means for clinicians, producing insights into the influences that new, broader and often unknown information flows have on clinical work, and by implication on healthcare.

8.2.2   Quantification & the informational paradigm [CONTRIBUTION #2]

"The omnipresence of information technology seduces us into thinking that everything can be regarded in terms of information and that in the final analysis the world is built up of information." (De Mul 1999, p72).

Inscriptions related to non-clinical uses of patient data within EPRs are shaping the form and structure of electronic patient records (Thorp 2007) and driving the development of technical interoperability and content related standards for EPR applications (Royal College of Physicians 2013). This is underpinned by a management objective to quantify clinical activities and outcomes rendering them comparable between organisations, as recognised in the literature on health information systems e.g. (Bloomfield 1991, Doolin 1999, May 2006, Reich 2012), providing a basis for decision-making with the intent to make healthcare provision more manageable. In this respect EPRs support Trusts to meet demands for upwards reporting based on system-wide aggregated extracts from individual electronic patient records. This relies on the structuring of records, particularly in the form of clinical coding.

The quantification of healthcare reflects a managerialist ethos which has come to pervade healthcare, and which has been discussed by a number of authors, e.g. (Harrison and Dowswell 2002, Doolin 2003, Halford, Lotherington et al. 2010). It is suggested that this quantification involves the realignment of the concept of care quality so that it becomes identified with efficiency as defined by healthcare managers, positioning evidence-based medicine as the mechanism by which 'quality' and 'efficiency' are made synonymous (Reich 2012). In so far as EPRs are employed as sources of such evidence this helps to explain the significance of clinical coding as an actor within the actor-network.

The employment of the technology in this way positions EPRs as principle mediators and instruments of an informatization agenda in healthcare and the wider public sector. I have operated on the assumption that the macro level government agenda

is primarily non-clinical. In doing so I recognise that I may be argued that the UK government's agenda advances clinical interests as much as non-clinical ones through mechanisms to promote care quality and minimum standards of care for patients, such as the embedding of clinical best practice guidelines in QoF targets.

However, the way in which care quality is tackled by the centre is to render this objective as standards, which demand measurement, reporting and associated performance targets. This transforms care quality into a control mechanism in relation to clinical practice and renders care an informational issue. This, I suggest, frames clinical issues as non-clinical, and in this way also changes the very definition of what clinical work is.

It is of note that even if all NHS Trusts in England were to have interoperable EPR systems that allow patient records in whole or part to flow between organisations, certain stakeholder groups would remain excluded. District nurses, prisons and social workers are amongst those who have varying degrees of legitimate need for access to information from NHS-held EPRs and who do not currently have any direct access.

As highlighted in the literature review, there are aspirations at government level to enable more straightforward sharing of data that is routinely collected by a range of public sector bodies, not only from the perspective of exploiting public sector information more effectively to improve services, but also to make it available for commercial use (Cabinet Office 2011).

This helps to illuminate the context within which there are strategic aims to enable different public sector bodies to access each other's data about citizens, and patient record data is included within this. This is in its infancy, being trialled through pilot projects for cross-agency data sharing, for example, under the Centre for Excellence for Information Sharing (Centre of Excellence for Information Sharing n.d.). In this respect, therefore, those stakeholders currently excluded from access to NHS-held EPRs might at some point in the future, if government aspirations are realised be brought within the scope of EPR sharing.

EPRs as a concept are founded on an informational paradigm in which information has been placed centre stage as the solution to a range of challenges, both clinical

and non-clinical with respect to provision of healthcare in the contemporary context. Webster (2002) suggests that the informatization of medicine associated with the technocratic strategy responsible for producing EPRs engenders a pursuit of technical assurance that is being addressed through increasing demands for information. It is argued that this transforms moral and ethical judgements into technical ones for which such issues of judgement can never be fully met with more information (Bloomfield 1991, Webster 2002).

I have acknowledged that a critique of the NHS' information strategy is out of scope for this study, indicative as it is of this way of thinking about information and the role of technology. It is nevertheless an insight of this research that the informatized clinical and public services context is part of the broader actor-network for EPRs, even if it has been beyond the remit and resources of this study to pursue.

This creates a situation where the provision of information as a solution will continue to be elusive because there will arguably continue to be excluded groups of stakeholders and a desire to access ever more information. Therefore an outcome of this study is to reinforce a critical concern about the ways in which naïve application of information policy in the development of EPRs, and the associated information demands may have consequences for users.

Rather than merely exploiting the data by-products of clinical processes EPRs extend the recording element of the clinical role, making informational activities more prominent. This makes the construction of recorded content increasingly important in relation to the clinical work being represented, drawing attention towards representational activities and, by implication, away from others.

8.2.3 Custodianship, ownership and control [CONTRIBUTION #3]
Although the vision of a nationally networked EPR has not been realised, this study indicates that inter-organisational exchange of EPR data is evolving in more modest, indirect and partial ways. In this context of increasing networkedness custodianship of records is therefore of concern.

As the locus of custodianship and control of patients' records is shifted away from individual clinicians the responsibility becomes distributed not only among clinicians

but also across a set of processes and structures of information governance in one or more organisations, making it harder to provide accountability for patient confidentiality.

The need to fill the gap left by clinician-led stewardship and custodianship of EPRs has given rise to information governance rules embedded in software, work processes and professional codes of conduct, for example around patient consent for information sharing, technical constraints on EPR access, for example through the use of Smartcards, and the threat of penalties for non-legitimate access, monitored through access audit software.

It is recognised that technologies necessitate new forms of control as the regimes associated with them need to be upheld (Stahl 2010), and in the context of the new set of actors demanded by information governance demands of EPRs alone this arguably justifies questioning the value of the endeavour and the effectiveness of those mechanisms in producing good governance of patient data.

Users' limited knowledge of data extractions and their purposes situates patient confidentiality and information governance within the wider context of the challenges of maintaining control of data, especially one's personal data, within a highly-networked world, as highlighted by Conger, Pratt et al. (2012). The NHS nonetheless has legal and moral obligations to manage patient data in such a way as to protect privacy, and this therefore generates a tension in respect of EPRs.

Clinicians' loss of control and ownership of patient data with the increasing electronic flow of patient data across organisational boundaries, and the low levels of clinician awareness of data sharing in operation present a risk to patient privacy and has implications for the privacy debate more broadly. It presents a risk to the social contract between citizens and state, and also therefore for patients' trust in the NHS where the NHS' custodianship of patient data is a key element of that social contract.

Singleton, Pagliari et al's (2009) review of a UK policy workshop on EPRs suggests that there is a need for this social contract to be redefined in the context of the proposed secondary uses of patient data to support the maintenance and improvement of the healthcare system. They suggest that the public need to be 'won over' to the changing uses of their data for the sake of the wider social good

(Singleton, Pagliari et al. 2009), thereby implying that this is a done deal; the sharing of patient data being presented as a closed debate.

The framing of patient confidentiality as a highly contentious and public aspect of the privacy debate more generally, may ultimately influence our understandings of privacy and what practices are acceptable or unacceptable in relation to protecting privacy. Patient confidentiality has been highlighted as an active controversy that justifies attention to EPRs, particularly as networked objects, and this theme is picked up in the discussion of potential future research.

8.3   Theoretical and Methodological Contributions

I address theoretical and methodological strands of contribution together because Actor-Network Theory's main proponents themselves have rejected the notion that ANT is a theory as generally understood (Latour 1999, Law 1999). Neither is it a research methodology in the sense that there are no methodological prescriptions associated with using ANT (Latour 2004, Bruni 2005) and therefore no guidelines to follow in collecting and analysing data. Instead ANT can be seen as a theoretical and methodological *approach* in which certain theoretical concepts and principles hold, which entail a certain disposition towards methodological concerns.

The use of Actor-Network Theory has been a conscious decision rather than a functional choice of methodological tool from a set of ready-made options, thereby giving the methodological and theoretical aspects of the study greater prominence than they might otherwise have had in a more conventional study. In this respect ANT is a thread running through this thesis rather than being confined to the research methodology chapter, and for this reason I revisit and reflect on the rationales for and the value of doing this.

Figure 7 below outlines the argument running through the research in relation to the use of Actor-Network Theory and how this has shaped the research process. This indicates the logic used in terms of the relationship between the research and the chosen approach, and acts as reciprocal justification for the study and for the use of Actor-Network Theory.
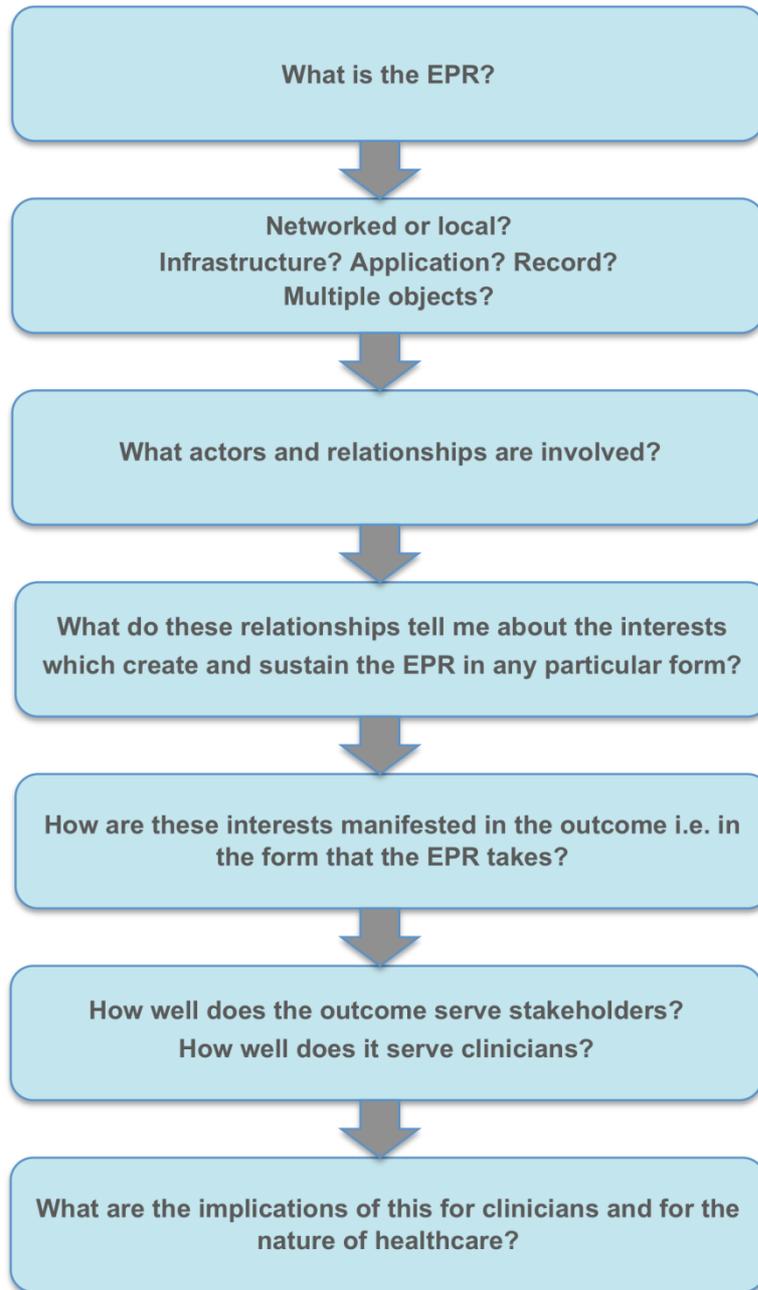
Figure 7. Intersection of Actor-Network Theory and the research question

The contributions of this study to Actor-Network Theory are framed both in terms of the research objectives and also in relation to empirical findings about using ANT.

8.3.1 Evaluating the use of Actor-Network Theory [CONTRIBUTION #4]

It is clear that benefits and disbenefits of EPRs as experienced by clinicians are not attributable solely to the software application but to the whole actor-network of which it is a part. This highlights the value of using Actor-Network Theory as a means of theorising a phenomenon.

The messiness of the EPR is apparent in its multiple and partial nature and in terms of the findings about benefits to clinicians. This study has aimed to respect and preserve that multiplicity and partialness rather than to seek a single core truth. Recognising that EPRs in the NHS are not a singular thing the study used Actor-Network Theory as a means to approach the understanding of the EPR as a technological phenomenon by mapping its actor-network using data drawn from user experiences in multiple different NHS Trusts in England.

Jensen (2004) suggests that understanding why it is hard to define the EPR as an object of study opens up new possibilities for studying it. There is no single correct answer when the researcher is presented with the multiplicity of experiences and concerns about the EPR, because they are incommensurable, and because of this actor-networks for the EPR overlap but are not identical, existing as distinct realities.

Similarly it is argued that the research object may be different objects passing under the same name in different contexts (Mol 2002). Jensen therefore challenges the convention that researchers must start from the assumption that they are researching a specific singular thing (Jensen 2004). ANT is able to accommodate the multiplicity of the research object through conceptualising it as a network of relations, where changes in the make-up and configurations of actors in the network and their inter-relationships account for local differences in the research object. I explicitly set out from the start of this study to recognise the multiplicity of the EPR as part of the rationale for studying it, and this justifies the use of ANT.

The research suggests that EPR actor-networks differ in relation to different places and to different people, invoking a number of common actors and relationships (as might be expected due to the inscriptions of national level NHS agendas for example). However, other actors are particular to certain roles and settings, for example in relation to needs around managing chronic disease.

The EPR as a networked object is partial in terms of how it manifests networkedness in the context of the government's aspirations and macro level design for the technology. If the Summary Care Record were to be considered the archetypal networked EPR it is only nominally so, and in ANT terms has therefore failed to enrol clinicians as allies in the actor-network.

In relation to the objective to investigate the benefits and disbenefits of EPRs for clinicians the field of research itself is also messy. It was noted that EPRs bring advantages for clinicians in relation to both clinical work and in supporting the non-clinical activities with which clinical work is interwoven, including various forms of reporting against organisation and Trust level performance metrics, and evidencing of clinical decisions. It is not possible to easily separate these activities because they are part of the way in which the NHS operates and clinical work is only rendered legitimate and meaningful within the context of non-clinical elements.

Moreover regardless of the benefits to be had from the technical and functional capabilities of any given EPR system 'on paper', material realities such as lack of hardware come into play; organisational boundaries which restrict sharing of information and access restrictions which restrict or deny the advantages of EPR use to some professional groups from EPR use, meaning that there is no single clear answer to the research question. This highlights the messiness of the field of research, importantly a messiness which I have not sought to clean up.

I set out to conduct a reflexive piece of research to satisfy the demand of criticality as defined previously (Cecez-Kecmanovic 2011, Stahl 2014), and of ANT as a postmodern approach (Latour 1996 a few, Passoth & Rowland, Calas & Smirchich). Reflexivity does not offer researchers carte blanche to find what they want (Jensen 2004, Passoth and Rowland 2013), rather the research process can be seen from an ANT perspective as one where the research object and the researcher mutually constitute one another (Jensen 2004).

Acknowledging the role of the researcher involves recognising that the outcome of research is partially constructed. Producing an ANT narrative can be conceptualised using the notion of "factish" (Latour 1999) or as the production of 'fairy tales' (Stahl

2014) in so far as it is neither pre-existing reality waiting to be discovered, and nor is it wholly subjective, but the result of interplay of the two.

This interplay means that the research outcomes comprise both transferable insights from the research and also incomplete answers and elements that are not made explicit. In this respect Strathern (1997) argues there is a case in academia for resisting norms that prize transparency and explicitness, maintaining that there is value also in what is left unclear or implicit, and questions that are left unanswered.

The study provides a nuanced account of EPRs by employing a 'messy' conception of benefits for clinicians that goes beyond simplistic notions of the technology being either beneficial or disadvantageous. While clinicians benefit in some ways from EPRs they lose in others, with disbenefits obscured by the reconfiguration of clinical work to include informational activities that are mediated by the EPR, making their use unavoidable.

8.3.2 Operationalizing Actor-Network Theory [CONTRIBUTION #5]

Addressing the objective to operationalize ANT provides insights that may be of value to other researchers who use this approach for empirical research. It is not possible to step outside of the actor-network in order to explain it, rather the researcher expands the network by being involved with it because a network can only ever provide its own frame of reference (Latour 1996). Using ANT has therefore involved recognising my own role within the actor-network by stating assumptions and making the practicalities of the methodology explicit, and I operationalize these below.

8.3.2.1   *Defining the boundary*

For this study the iterative aspect of defining the boundary of the actor-network came into play in relation to the strategy of collecting multiple perspectives from a range of EPR users recruiting participant users beyond the bounds of a single case study organisation. Whilst the investigation of both clinical and non-clinical user experiences was the original intention, as previously discussed this was impractical because actor-networks multiplied with each participant and organisational setting. This in itself was a finding in relation to the breadth and complexity of the network, which fed into and refined my approach to data collection. I could not have

appreciated this in advance (a priori), as it was a necessary step in defining the research 'on the hoof'.

Seeking to capture an inter-organisational (meso) perspective means acknowledging that actors only have a partial view, which is naturally limited to the clinical and non-clinical purposes relevant to their roles. Moreover in relation to non-clinical users the situation was more opaque in terms of tracing connections between actors than for clinical users. For secondary uses of EPR data it is not necessarily clear where data is derived from and nor would non-clinical users need to be aware of this. Therefore whilst able to talk about actors within their own actor-networks for the EPR, it was not necessarily possible for them to make direct connections between their roles, non-clinical agendas, and how they influence clinical users.

The boundary was also defined in practice by the NHS' research approvals processes encountered and my particular experience of them. With the appreciation of the challenges of accessing the NHS as a research site, the NHS' National Research Ethics Service (NRES) process may have provided a more effective route to facilitate research access and legitimise my research. It would also have served to formalise the relationship with an internal sponsor and to facilitate access to participant interviewees.

The legitimacy of a piece of research from the perspective of the NHS is critical to gaining access and this is achieved through engagement with the research permissions processes, for which my approach being relatively informal and a poor fit for standard systems of approval delayed and frustrated participant recruitment and data collection.

My decision to employ Actor-Network Theory in addition to an explicitly meso level approach has presented a challenge in terms of managing scope and making decisions about inclusion and exclusion from the actor-network. This came to the fore in relation to the challenge of identifying actors where the range of potential actors was vast. Moreover, taking an approach in which the research object itself is open to question (in relation to ANT's acknowledged value in challenging the taken for granted) this entails that the research object and the field are emergent rather

than pre-given. Using ANT to guide the entire research process rather than containing it within a post-hoc data analysis carries a cost in this respect.

8.3.2.2 Ethics

In this study the procedures for gaining research permissions in some Trusts required me to identify an internal contact, ostensibly for the purposes of facilitating access to participants and as a person responsible for taking action on any local recommendations which might arise from the research. This indicates a tacit assumption on the part of NHS organisations that the research will take the form of an evaluation or improvement-focussed audit, and meant that in those cases there was no possibility of participants being anonymous to each other or to the organisation.

There are therefore ethical issues in terms of preserving the anonymity of participant-interviewees within the NHS. Whilst the findings of this research are relatively subtle and therefore perhaps uncontroversial, nevertheless this has potential implications for the ability to conduct critically motivated research.

The slow pace of EPR uptake in secondary care means that my recruitment strategy (outlined in Chapter 4 and Figure 4) of necessity aiming for those with established EPR systems at least local in scope, targeted a number of organisations which are considered exemplars for NHS EPR development and notable in the NHS informatics endeavour more broadly. This means that some Trusts and their EPRs are already well known for blazing a trail for having successfully implemented an EPR system, and whilst the names of these EPR systems have been pseudonymised in this thesis, they and the Trusts they belong to may therefore be identifiable to an audience with some knowledge of the context.

8.3.2.3 Dealing with non-human actors

Mapping the actor-network has involved determining an appropriate level of granularity for an overall understanding of the network that fits the aims of this research. Due to ANT's recognition and equal analytical treatment of human and non-human actors, actors may include abstract (and non-material) or conceptual entities, such as clinical audit and information governance. In this respect the naming of actors was non-trivial in so far as any label had to identify a discrete entity whilst

being generic enough to apply across multiple manifestations and instances as a consequence of my decision to take a meso perspective.

Actors do not always announce themselves and nor do they necessarily present with an easily applicable label. Actors' identities are achieved by the researcher as a process of negotiation that involves retaining a focus on the aims of the research, maintaining a realistic level of scope and granularity and teasing out the key influences in the actor-network that account for the phenomenon of *my* research question.

Certain actors must be determined by inference. Patient confidentiality as a key non-human actor was identifiable only through proxies, by tracing connections, because few participants discussed patient confidentiality overtly, but it was nevertheless present in the use of Smartcards, in the information governance policies and procedures institutionalised in clinical practice and in the use of EPRs.

8.4   Evaluation and reflections on the research

An evaluation of the research process is needed in order to reflect on the value and limitations of decisions made in the context of the original motivations and problematization of the research topic. A number of the observations discussed below relate also to theoretical and methodological contributions to knowledge.

8.4.1 Neglected actors

There is a balance to be struck, even when setting out with a revelatory agenda, as to what should be made visible and what should remain tacit (Star and Strauss 1999). In this study there are, of course, many actors involved who were not interviewed and are not explicitly accounted for. It has already been acknowledged that it is not possible to comprehensively map an actor-network, and this entails the researcher making decisions as to what to foreground (Cresswell, Worth et al. 2010).

In this case individuals with the unenviable job of scanning the backlog of paper documents in hospitals to make them accessible through the EPR are, for example, not accounted for. Nor are secretaries and ward managers who do much of the inputting of clinical notes into EPRs and other articulation work, albeit their roles have been acknowledged. Of those who interact with EPRs clinical user roles have not been exhaustively accounted for, instead retaining a focus on the principle

clinical roles in recognition that they are associated with distinct functions, clinical practices and professional norms which influence their experience of EPR use.

A micro case study of EPR use might have further explored the roles of these actors. However, by virtue of attending to the networkedness (or otherwise) of EPRs I have chosen to focus attention on understanding the EPR at a more abstract level.

Actors in roles of lower complexity and that are less interwoven with the business of healthcare and its management offer less rich territory to the researcher in terms of understanding the broader influences on their uses and experiences of EPRs as a means of mapping the actor-network beyond an individual's role, setting and subjective experiences of EPRs. Therefore the emphasis was on the perspectives of (human) actors whose presence would be felt more strongly beyond their micro context in terms of influences on the actor-network.

The role of patients as actors, whilst clearly central to the whole endeavour of healthcare, were nevertheless out of scope for this study. This decision was an initial step in constraining the scope of the study because patients, whilst undeniably part of the actor-network, are nevertheless highly indirect users of EPRs. Patient perspectives are therefore discussed in the context of potential future research. By emphasising instead the benefits and disadvantages of EPRs in terms of support for 'hands on' users' work practices, I aimed to develop understanding of how EPRs support or do not support the provision of healthcare by those users at the front line of healthcare provision, for which the outputs of this study include consideration of the implications for patients and for healthcare.

8.4.2 Critical agenda

Doing critical research entails addressing themes such as power and control (Cecez-Kecmanovic 2011).I have set out to do this through an intent to challenge the status quo and via discussion of non-clinical inscriptions and standardisation agendas that have managerial rather than clinical intent. This discussion brings to light how power is enacted through such inscriptions, by relating them to user experiences of EPRs.

Without presuming to challenge the entire 'audit culture' of which the secondary uses agenda for EPRs is a product, not to bring to light the role of this agenda in the strategy for electronic patient records would be to neglect its influence on the actor-

network. In this respect Actor-Network Theory could be considered vulnerable because to question any given phenomenon necessarily entails critiquing the whole system (i.e. actor-network) from which it emerges, which is daunting if not impossible. Nevertheless by revealing the interests at work in producing a phenomenon ANT is able to bring to light and open up for debate the rationales and assumptions on which EPRs are founded, and therefore address a critical research agenda.

The research demonstrates how the EPR as a technology is co-opted into the service of broader agendas beyond the requirements for clinical information to support care. By tracing and making visible the connections between clinicians' experiences and the clinical and non-clinical interests of a range of actors in this technology, this study provides empirical evidence of their influences on clinical work practices.

It is proposed that as a consequence of the need to justify interpretive and other 'contrarian' studies (in a way that is not perceived as necessary in positivist or otherwise conventional research approaches) there is an opportunity in interpretive IS research to redefine what counts as research in this discipline (Stahl 2014). This study therefore adds to a growing body of IS research which is substantially engaged with challenging and reflecting upon the philosophical, theoretical and methodological bases of IS research. In doing so it contributes to the legitimisation of alternatives to positivist approaches and to maintaining the momentum amongst these 'exceptions' for continued debate about the roles and the boundaries of IS research.

8.4.3 Generalizability, ANT and complex meso level phenomena

There are particular challenges to address with respect to generalizability in relation to researching distributed and infrastructural phenomena, and also in explicitly taking a meso level approach.

A number of authors acknowledge that for contemporary information systems it is not possible to achieve the overview that one might expect from a traditional, linear, single-site study e.g. (Henriksen 2002, Halford, Lotherington et al. 2010). This has implications for the researcher's ability to make generalizations in terms of a

definitive overview of a phenomenon, which are an expected output of the conventional scientific conception of research.

Renouncing the possibility of clear answers is both a rejection of a reductionist approach to epistemology that seeks to simplify (Law and Singleton 2005, Law version of 19th January 2006), and also an argument for a meso level approach that can offer insights about a multiple research object that extends beyond the bounds of a single micro-organisational use context.

A gap has been recognised between abstract, macro level 'information society' theories of information technologies and studies of specific technologies situated in particular contexts (Kallinikos, Aaltonen et al. 2010). This is used to argue for a theory of information technologies which is able to recognise both their generic elements and also account for their diverse instantiations in different local contexts (Kallinikos, Aaltonen et al. 2010).

Using Actor-Network Theory is of value for researching phenomena at meso level; because it has enabled me to maintain a line of sight between the shared attributes of EPRs as a class of technology, and how they are manifested in particular settings as a consequence of their entanglement with locally contingent processes and practices.

Synthesizing my understandings about individual instances of EPRs and their uses has enabled me to draw some generic insights about EPRs in the NHS in England overall, without claiming them as statistical generalizations. I propose that my insights have what Tracy (2010) calls 'resonance' in that they are transferable to other contexts and organisations by extrapolation beyond data collection sites to those with similar characteristics.

In terms of generalizing from my findings the use of Actor-Network Theory has enabled me to theorise diverse instances of the artefact as distinct but partially connected actor-networks. This has enabled the study to examine the phenomenon of EPRs beyond the micro context without claiming a definitive overarching or essential truth about this technology, which, as I have argued above, is not possible with complex, contemporary phenomena such as information systems.

If generalizations are conceptualised as tendencies rather than predictions (Walsham 1995) then in this respect the drawing of specific implications about custodianship of patient records in relation to privacy provides generalizability. Contributions to the practical application of ANT noted in relation to operationalizing it, whilst inevitably subtle and modest, also provide generalizability to theory about methodology.

Moreover I have provided conceptual generalizability through development of the concept of networkedness in relation to EPRs. Explicitly approaching the study at meso level builds methodological understanding of how one might study something which must be accessed at micro level but for which the researcher cannot gain any kind of comprehensive overview, using the notion of networkedness to frame this issue.

As a principle objective of the NPfIT vision for EPRs, understanding the implications of inter-organisational networkedness was a source of motivation for the study. However, the ways in which networkedness is manifested in practice are subtle and partial, far from the concept of the 'single truth', nationally networked record outlined in the government strategy "Delivering 21st Century IT Support for the NHS" (Department of Health 2002).

In this respect approaches to networkedness that present networked phenomena as a radical and dramatic break with past structures and work practices are arguably naïve. Theorists warn against 'epochalist' views of the information society e.g. (Savage, Ruppert et al. 2010) which posit qualitative changes associated with contemporary information systems as evidence of a clear disconnect with the past, a perspective which encourages the illusion of a divide which provides a justification for research in and of itself. I suggest the use of ANT avoids such a simplistic stance because insights must be grounded in concrete local circumstances. Rather ANT demands 'slow research', rejecting analytical shortcuts (Latour 2005).

I started the thesis with a preconception, derived from government strategy documents and healthcare media, that there was a nationally networked EPR. Finding that the networked EPR did not exist as expected led me to re-evaluate the aim of the research, shifting it towards finding out about the status, nature and

networkedness of EPR implementations in participant Trusts. I therefore set out to investigate in what forms the EPR does exist, and in so doing to acknowledge that networkedness is apparent in less complete and less neat ways than expected.

The field of research therefore shifted from examining the networked EPR as a singular research object, to examining EPRs in varying degrees of networkedness, as multiple objects that exhibit networkedness in partial ways. I have assumed that networkedness on some level is inherent in the notion of the EPR as an information system, but that in this context *inter-organisational* networkedness is of particular interest because of the potential for significant qualitative changes to clinical work and to the nature of healthcare that may arise as a result.

The necessary change of focus might be considered in terms of the 'emergence' of a field of research, which Jensen (2004) argues, is a rejection of a conventional approach to research that posits a singular research object and presumes a well-defined, pre-existing field of research. Henriksen (2002) suggests that in information systems research, empirical fieldwork requires an acknowledgement that locating the research object may be difficult because it may be simultaneously exist in different places. I have therefore made the multiplicity of EPRs explicit in a way that is often not done in studies of information systems.

A number of authors note that for these kinds of contemporary phenomena it is impossible to comprehensively survey an entire field because presence and use are geographically distributed across many organisations, sites and use contexts (Star 1999, Henriksen 2002, Jensen 2004), and therefore they cannot be easily accounted for, or observed within a neatly defined setting.

For each change in the use context for the EPR, from the community diabetes clinic to the consultant's office, from the critical care ward in a general hospital to the 10 minute appointment slots in General Practice, there is a different actor-network to be considered and therefore one is, in effect, studying different objects. This acknowledges a need for an iterative approach to methodology with complex research objects like the EPR, and therefore supports the use of Actor-Network Theory.

8.4.4 Visualising the actor-network

I set out with an intention to visualise the actor-network for the EPR at meso level, however it became evident that within 'mapping the actor-network' identifying and following the actors is primarily a conceptual activity. Whilst diagrams served a useful purpose in analysis they are nevertheless inadequate to express the actor-network(s) involved because they overlap and entail a commitment to consistency and completeness that is not possible. The following attempt at a partial visualisation of the actor-network for the EPR illustrates that the best that can be achieved is of the order of a mind map. This gives the (false) impression that the relationships between connected actors are equivalent, for example in terms of the directness of the relationship, because there is no scope to capture the unique nature of each relationship. This kind of visualisation also does not allow for actor-networks to overlap i.e. for any actor to be connected in multiple different ways with other actors in the network. A more 'honest' visualisation would perhaps therefore show connections between all actors and all other actors in the diagram, making it meaningless other than as a list of actors.
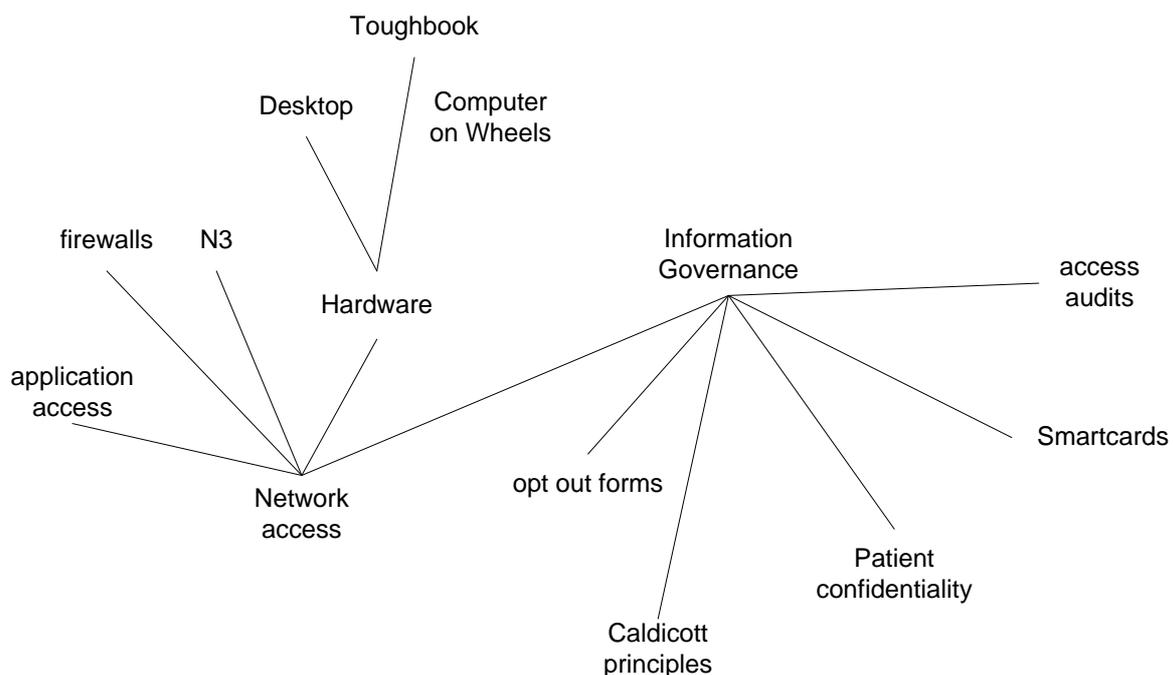

Figure 8. Partially mapped actor-network for the EPR

Visualisation involves imposing an implied and homogeneous order that is ill at ease with the heterogeneity of the relationships between actors, for which a suitable methodology able to capture these relationships might be explored as part of future

research. For these reasons a visualisation of the overall actor-network is out of scope for this study and as an avenue for future research might draw on work around the 'cartography of controversies', including the MaCoSPol project (MaCoSPol n.d.) and Venturini (2010).

8.5   Future Research

A number of topics emerged in the interviews, which, whilst undoubtedly tangentially relevant to the actor-network under discussion, would have involved investigation of more tenuously linked actor-networks, and would have taken me away from the stated focus of the research. Miller (1997) argues that the boundary of the actor-network is not definitive, but is manifested as connections becoming flimsier and less substantial, and therefore harder to trace, even if they may be nonetheless influential in the actor-network. This is apparent in consideration of potential future research areas that were part of the wider actor-network but not explorable from a position within the actor-network for this study. Further research could select a different aspect to foreground and pursue, including the themes outlined below.

New risks and responsibilities entailed by the use of EPRs have been shown to extend beyond clinical users and thereby have implications for wider society. There is potential for future research to move beyond investigation of the benefits and disbenefits of EPRs for clinicians to consider patients' experiences. In so far as EPRs can enable Trusts to allow patients to access their own records this places new and sometimes unanticipated and unwelcome responsibilities on patients. For example, GP P06 recounted a story of another GP's patient who had failed to act on test results because she had not been aware that she was able to and expected to look these up for herself in her EPR. Therefore future research might explore patient-accessible EPRs such as GP-held 'tethered' EPRs through which patients are granted access to their own records in some Trusts.

Another potential focus for research would be exploring the implications of inter-organisationally networked EPRs in relation to the national sharing of patient data within the NHS. This is particularly relevant in relation to data sharing that is happening automatically via system-wide data extractions, and where the uses of and audiences for patient records and subsets of data within them are obscured by layers of organisational process.

It has been beyond the scope of this study to investigate patient confidentiality as a standalone topic. It was apparent when conducting the literature review and background research for this thesis that the nature of the debate about patient confidentiality and ownership of personal data has shifted significantly over the lifetime of the NPfIT.

Whitley & Pouloudi's (2001) study of the privacy debate in relation to NHSNet, the NHS-wide data communications infrastructure project which was a prerequisite and forerunner for the N3 on which the national Summary Care Record is based, presents the core controversy as being about whether there should be electronic exchange of patient information at all. They observe that patient confidentiality was redefined as a technical issue rather than one of judgement (Whitley and Pouloudi 2001). More recently the activities around the Caldicott 2 Review (Department of Health 2013) and the establishment of the Health and Social Care Information Centre have presented the existence of EPRs as a fait accompli.

It would be of value to pursue the theme of patient confidentiality longitudinally to track this controversy in the context of the evolution of NHS information strategy in relation to EPRs. Bonner, Chiasson et al. (2009) use ANT to examine, over a period of decades, how balance is achieved in relation to privacy around the release of data from a Canadian government-held Motor Vehicle Registry, by identifying where the balance of privacy versus freedom (with respect to the use of personal information) is enacted. I suggest a similar approach may be of value for examining patient confidentiality, particularly in terms of increasing inter- organisational sharing of patient records and patient data.

Related to the topic of patient confidentiality, the exploitation, commercial or otherwise, of patient information from EPRs would be worthy of investigation in the context of the implied social contract between citizens and the NHS, particularly in response to the government's care.data initiative. This has developed against the backdrop of broader data sharing ambitions in the public sector, captured in the document "Making Open Data Real" (Cabinet Office 2011) and is indicative of a need to explore the assumptions and trade-offs between ownership and control of personal information, and explicit or implied consent for its use for the public good. Changes to the nature of healthcare implied by shifts towards a data-driven NHS

may therefore require changes to our conceptualisations of privacy and the social contract with respect to the privacy of patient information.

8.6   Concluding remarks

I have argued that the actor-network of which the EPR is a product needs to be questioned because of the investment, financial and otherwise which has been committed, and because of the potentially far-reaching implications of EPRs as a would-be infrastructural artefact. My critical motivation is informed by literature which argues that information systems are associated with a potent myth of progress (Boland and Schultze 1996), one whose power may efface their more equivocal or negative consequences (Mensink and Birrer 2010). Such narratives of progress are associated with normative pressures in relation to EPRs as a technological trend, serving to confer legitimacy on those organisations which comply with societal expectations that healthcare systems ought to be moving towards an eHealth model which includes EPRs (Jensen, Kjærgaard et al. 2009).

Understanding the sources of such imperatives with respect to EPR development is therefore important for the successful implementation of healthcare technology strategies at national and local levels in so far as it may enable more realistic aims for developers and, in relation to the role of EPRs in NHS information strategy, more realistic expectations amongst stakeholders.

The enrolment of allies in the form of non-clinical agendas inextricably links the EPR with institutionalised processes, practices and professional norms, and secures them an assured placed within healthcare strategy. The critical element of this research comes from appreciation that, as Halford, Obstfelder et al. (2009) suggest, there is a risk of being 'locked-in' to a trajectory of which EPRs are a part, and this creates a reality from which alternative realities are difficult to envisage. The use of Actor-Network Theory to 'unpack' the black box of EPRs in the NHS therefore allows us, through understanding how the current reality is constructed and maintained, to keep other possible realities open.

In these conclusions I have sought to frame an answer to the question of whether EPRs benefit the work practices of those at the forefront of providing healthcare. By using Actor-Network Theory to explore multiple instances of EPRs and EPR use a

complex and messy picture has emerged of both benefits and disadvantages to users. Revealing why there are not clear answers provides not only a more authentic account but also generates new concepts for understanding the mess.

For those involved in developing national and Trust level informatics policy and local level informatics strategy I propose that this study may be of value in raising awareness among EPR users about experiences of EPR-use in different Trusts. Attending the British Computing Society's health informatics conference HC2012, aimed at NHS clinicians, managers and academic researchers, it was evident that a central aim of the event was to foster exchange of knowledge and experiences of healthcare technologies, in particular EPRs, between NHS organisations. This highlights a need for such knowledge sharing, and indicates an audience and a contribution at individual clinical EPR user level and at Trust level in terms of developing awareness of the EPR landscape.

In this respect a report of the findings has been disseminated to participants with an open request for comments and feedback. The findings of this study may stimulate reflection on rationales for and expectations about EPR development that may result in more realistic designs, which are oriented towards support for local clinical practices as they are rather than as idealised forms.

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