Materialising the electronic patient record: reshaping medical practices on NHS wards

Dr Victoria Reay

School of Medicine

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Abstract

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Dr Victoria Reay MBChB MRCP PGDipPallmed

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Electronic patient records (EPRs) are replacing paper notes in hospitals across the National Health Service (NHS). Digital records have been promised to provide increased accessibility, legibility, safety, and efficiency, but despite costly national programmes, adoption of EPRs in hospitals, as replacements for paper, has been slow. In addition, research has shown that removal of paper records as a central communication and collaboration device appears to have unintended consequences for the ways that clinicians work together.

This project, based in an NHS hospital, used ethnographic methods to observe an EPR in use on paperlight inpatient medical wards. Informed by actor-network theory, this thesis gives an account of how the relocation of information, from paper records to the EPR devices, is changing the ways that medicine is practiced.

Through following the use of computers on wheels and handheld digital devices, the findings of this research emphasise the role that the materiality of the medical record has in both the evolution and holding together of clinical practices. These findings form the central contribution of this thesis, which is the development of the concept of the materialised EPR and how the physical housing of the electronic record has effects in collaborative and communicative healthcare settings. The findings emphasise the ways in which mobile digital devices lack the material and tangible properties of paper records, which functioned as a sophisticated network of physical coordination tools in the support of medical practices.

This research provides novel insights on the utilisation of medical records, and how their materiality participates in shaping medical practice. This reconfigured work has consequences, not only in the way that communication and collaboration are changing between professionals, but also in influencing care.

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List of Abbreviations and Acronyms

ANT	Actor-network theory
CCIO	Chief Clinical Information Officer
CPOE	Computerised physician order entry
CPR	Computer patient record
CQC	Care Quality Commission
CSC	Computer Sciences Corporation - acquired iSOFT in 2011
CSCW	Computer-supported Cooperative Work
CSW	Clinical support worker (also known as HCA)
DXC	Formed in 2017 by the merger of CSC and the Enterprise Services Business of Hewlett Packard Enterprise.
ED	Emergency department
EHR	Electronic health record (the lifelong longitudinal record which combines information from all healthcare providers, see section 2.2.2)
EMIS	Egton Medical Information Systems
EPR	Electronic patient record (a record of periodic care provided by one institution, see section 2.2.2)
GP	General Practitioner
GMC	General Medical Council
HCA	Health care assistant (also known as clinical support worker CSW)
HCI	Human Computer Interaction
HISS	Hospital Information Support System
HIT	Healthcare Information Technology
IM&T	Information management and technology

iSOFT	Previous producers of Lorenzo software
IT	Information technology
MDT	Multidisciplinary Team
NHS	National Health Service
NHS CFH	NHS Connecting for Health
NHS CRS	NHS Care Records Service
NPfIT	National Programme for Information Technology
PACS	Picture archiving and communication system
PAS	Patient administration service
PCIS	Patient Computer Information Service
PTWR	Post-take ward round
QOF	Quality and Outcomes Framework
RCP	Royal College of Physicians
RCT	Randomised Controlled Trial
RMI	Resource Management Initiative
STS	Science and Technology Studies
TTO	'To take out' – medications to be taken home
UIC	Unintended Consequence

Declaration

This thesis has not been submitted in support of an application for another degree at this or any other university. It is the result of my own work and includes nothing that is the outcome of work done in collaboration except where specifically indicated. The word length of the thesis does not exceed the permitted maximum.

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1 Introduction

1.1 Setting the scene

> *'But it has got to be done. A lot of people will have to change the way they work. The NHS can only face the challenges of the new century if it has the most modern information technology and systems in place. Nothing less will do for a service which looks after the health of the nation.'*
> *Frank Dobson, Secretary of State for Health, 1997 – 1999, in 'An Information Strategy for the Modern NHS' from Burns (1998).*

> *'Across the world, new technology is transforming healthcare, with medical innovations set to transform humanity in the next 25 years in the same way as the Internet has done in the last 25. The breakthroughs, disruption and progress we have seen in other walks of life are now sweeping through healthcare, and we can ensure our NHS harnesses their benefits like no other healthcare system.'*
> *Jeremy Hunt, Secretary of State for Health, 2012 – 2018, in 'Powerful Patients, Paperless Systems' (Mak, 2018).*

As the quotes above begin to illustrate, the technological transformation of the National Health Service (NHS) has been an important political priority for over 20 years. Successive health secretaries have repeatedly claimed that digitalisation will reform the delivery of healthcare; it will, '*make our lives easier, and make money go further*' (Hancock, 2018). This story of technology has taken on a sort of mythological status (Mort and Smith, 2009), projecting a future that combines flowing information with efficient and safe care.

At the commencement of this project in 2018, the reality of the average NHS hospital ward did not reflect the projected vision of technological transformation. Although computers had been used for decades, the widespread replacement of paper and fax machines with integrated electronic record systems (EPRs[1]) was far from complete. While there was near-universal computerisation of UK general practice, secondary care was, and still is, a long way from achieving this, with very few NHS acute trusts using digital technology to a level that is 'paper-free at the point of care' (NHS Digital, 2016a).

But this thesis is not just about technology. As previous Secretary of State for Health, Frank Dobson, put it in 1998, '*a lot of people will have to change the way they work*' (Department of Health, 1998). That is to say, transforming technology in the NHS is not just about linking up systems and information, but also about changes in how medical work is done. This project is about drawing attention to those changes.

In the following sections, I will describe the context in which this project has come to be. I will introduce my own professional experiences with the implementation and use of technology in the NHS through how I experienced the use of an electronic patient record whilst working as a hospice physician. Firstly, I will describe the background to the information technology changes that have been ongoing throughout my career in the NHS, including the National Programme for Information Technology (NPfIT). This will begin to shed light on the complexities and challenges inherent in the digital transformation process and explore how these changes are reshaping the landscape of healthcare practice in the NHS.

1.2 Health information management in the NHS

As the quotes above, on page 3, from past health secretaries illustrate, the current narrative of technology-as-saviour has persisted for decades, despite slow change and programme abandonment. This section gives a summary of the background to previous major NHS IT transformation programmes. These stories help to account for the construction of what has come to be in modern-day secondary care computing systems.

[1] An explanation of the use of 'EPR' can be found in '2.2.2 Defining the electronic record'

Before information technology in the NHS became an organisational objective, individual practices and hospitals began introducing computers from as early as the 1960s (Roberts, 2013). Doctors (often general practitioners) enthusiastic about computing found ways to use the emerging technologies in their workplaces. One of the first to do so was Dr John Preece, a general practitioner who developed a computer record system for use in his Exeter practice in the 1970s (Benson, 2002). Egton Medical Information Systems, known now as 'EMIS', was also developed by general practitioners in a small rural practice in Yorkshire in 1987, and is now used by 10,000 healthcare organisations across the United Kingdom (EMIS Health, n.d.). The trend of locally-grown computing initiatives, in both primary and secondary care, dominated until 1988, when an attempt was made to join together some of the information systems with the launch of the Hospital Information Support System (HISS) (Brennan, 2005).

1.2.1 The Hospital Information Support System (HISS)

In the late 1980s, it was common for the patient administration systems and systems used in hospital departments and laboratories (for example, pathology, pharmacy, radiology, and theatres) to run separately. The HISS attempted to link these together in a pilot initiative of 25 hospital trusts across England (National Audit Office, 1996). It was also hoped that the management information gathered would help to support NHS trusts in collecting data for the concurrent NHS reforms, in which managers wanted to more carefully track the activities (and spending) of clinicians and clinical specialities (Thomas *et al.*, 1995). Although the HISS, which was 'primarily there to support clinical activity, not to provide management information' (O'Kane, 1993), was reportedly successful, implementation was slow, more expensive than expected, and failed to spread nationally. Only around one-quarter of trusts were operating a HISS before the start of the National Programme for Information Technology (and the renewed focus on a centralised electronic patient record system) in 2002 (Brennan, 2005).

1.2.2 The Resource Management Initiative (RMI)

It has been reported that, in the late 1980s, the Thatcher government was looking to save money on NHS spending by closing hospitals (Brennan, 2005). The problem was that it was hard to tell which hospitals were working efficiently and where they were spending their money. The government wanted to know if the differences in 'case-mix' (such as tertiary referral centres managing more complicated patients) could account for the disparities in spending. At the time, getting accurate figures to respond to this query proved troublesome, so the Resource Management Initiative (RMI) was introduced to try and monitor hospital spending. It planned that each part of a person's hospital visit would be coded, costed, and entered into a computer. But the system, which cost £300 million, was eventually abandoned. Brennan (2005) explains that this failure occurred for several reasons. The initiative lacked clinical leadership (it was led by the finance directorate at the Department of Health) and was not part of the national NHS IT strategy. As well as being expensive, it did not integrate with existing systems and was not perceived to have any useful clinical purpose to the clinicians who had to input data retrospectively.

Despite their lack of widespread success, the HISS project and the RMI opened the NHS to the computer software market. Hundreds of different software providers, from the UK and internationally, competed to provide systems, and relationships were formed between providers and NHS trusts. It was at this time that a group of ex-KPMG[2] employees started a healthcare software business. They called themselves iSOFT. The same iSOFT (later CSC then DXC) would go on to provide the EPR, 'Lorenzo', to 3 out of 5 geographical clusters in England under the NPfIT (Brennan, 2005). A more detailed description of 'Lorenzo' – the EPR I investigate within the context of this PhD research – follows in section 5.3.

[2] KPMG stands for 'Klynveld Peat Marwick Goerdeler'. KPMG is a multinational company which provides audit, tax, and advisory services.

1.2.3 The National Programme for IT (NPfIT)

The focus on a single centralised electronic patient record system was reportedly driven by a meeting in 2002, between the then Prime Minister, Tony Blair, and the CEO of Microsoft, Bill Gates (HC Debates, 2011). The Prime Minister was 'bowled over' by the idea of a technologically-advanced NHS, and soon after, a 10-year strategy to introduce a national electronic health record was released. This strategy later became known as the National Programme for IT (NPfIT).

As I have described, preceding the political ambition for a single national EPR, a plethora of different computer systems were used in the day-to-day functioning of hospitals. These could include patient administration systems, laboratory department reports (biochemistry, histology, microbiology – often different), and discharge letter systems – not integrated, accessed separately, and all with different log-on details. A multitude of different software systems were in use and could vary completely both within and between NHS trusts.

In brief, the primary aim of the NPfIT was to integrate all of these systems into a single electronic record. The objectives of NPfIT also included the digitalisation of several other workstreams, some of which were successful (see Table 1). However, the project, as a whole, was discontinued in 2011, far from achieving its primary aim of a national EPR, and widely condemned in the media as an expensive 'fiasco' (Baldwin, 2013).

Table 1. The remaining components of NPfIT

The Spine	The Spine supports NHS IT infrastructure and allows information to be shared securely (which supports services such as the Summary Care Records, e-Referral service, and the Electronic Prescription Service).

N3 Network	The N3 is the secure national broadband network for the NHS. It links every GP, hospital, and clinic in England and Scotland.
NHSmail	Department of Health approved secure email service, which can be used to share identifiable and sensitive patient information.
Choose and Book	Now known as the e-Referral Service. This is the digital platform used to make referrals from primary to secondary care services (NHS Digital, 2018)
Secondary Uses Service (SUS)	The SUS is a secure data warehouse for the storage of healthcare data. In addition, it enables the reporting and analysis of data for secondary purposes, for example, to support NHS planning and commissioning processes.
Electronic Prescription Service	Allows prescriptions to be sent electronically from GP practices to pharmacies.
PACS	The Picture Archiving and Communication System securely stores and shares digital images (most commonly radiological images).
The Summary Care Record	Accessed through the Spine (as above). Contains patient demographics and key pieces of medical information such as current medications and allergies.

Table 1 presents a snapshot of what remained of the NPfIT at the commencement of this project in 2018. These components have continued to evolve over the last five years. For example, the 'N3 Network' was replaced by the 'Health and Social Care Network (HSCN)' in November 2020 (thereby moving from a single network supplier to a market of accredited suppliers) (NHS Digital, 2022b), and the 'Summary Care Record' aims to be transitioned to a 'National Care Record Service' by September 2023 (NHS Digital, 2023).

Multiple reports and authors (Coiera, 2007; Maughan, 2010; Campion-Awwad *et al.*, 2014) have drawn conclusions about why the NPfIT did not deliver what it promised. It is not within the remit of this PhD to fully explore the reasons for the 'failure' of the NPfIT, but I will summarise the main points as described by American physician Dr Robert Wachter (2016). Wachter was commissioned to write a report on the issues and challenges of implementing healthcare IT systems, by Jeremy Hunt, the then Secretary of State for Health (Hunt, 2016). As chair of the National Advisory Group on Health Information Technology in England, Wachter released the report; 'Making IT Work: Harnessing the Power of Health Information Technology to Improve Care in England' (2016), which included the following reasons for the 'failure' of NPfIT:

- Problematic centralised procurement of services

NPfIT attempted to centrally negotiate contracts with the local service providers (LSPs) to save money by 'buying in bulk'. But the centralised procurement meant that local NHS trusts had poor communication channels with the LSPs, especially when things did not go to plan. As a result, smaller suppliers (who could not compete) were pushed out. In some cases, well-established long-term working relationships were forced to end (formed through previous initiatives, the HISS and the RMI – as described above).

- A top-down approach to implementation

The implementation process was too centralised and overly top-down, which did not allow a nuanced understanding of local and regional needs and variations.

- Insufficient financial support to local trusts

Although large sums of money were spent centrally, trusts were given little to locally support the implementation of the nationally purchased systems.

- Perception of a politically-driven agenda

The programme was seen to be focused on reducing the cost of healthcare, rather than improving it. Clinicians felt that there was not enough evidence to prove that change would be beneficial and that the programme was relying on the deterministic belief that IT would make things better.

- Lack of clinical engagement

Partly for the reason above – that there was no evidence (particularly randomised controlled trials) that healthcare IT would improve care. The usual level of scientific scrutiny which had to be applied to other healthcare interventions was being bypassed. In addition, the use of large commercial IT providers was judged sceptically, with concerns that they would introduce a market-driven rather than a public sector ethos.

- Workforce Issues

Throughout the programme, there were frequent senior leadership changes, and within the NHS, there was a shortage of qualified and experienced health informatics staff and technicians.

I will revisit some of these issues in the literature review. However, it is worth noting that, of the numerous reasons given for the programme's failure, the information systems were not blamed. Instead, the finger was pointed firmly at the people involved and their inability (be that through lack of leadership, proper attitude, commitment, or planning) to deliver the project.

Wachter (2016) emphasised the importance of learning from these experiences in future health IT implementations, and the report set out a new plan for digitalising the NHS. Wachter outlined a series of findings and principles, drawing on his own experience of the digitalisation[3] of healthcare in the USA. For example, 'digitise for the correct reasons' and 'it is better to get digitisation right than to do it quickly'.

[3] Dictionary definitions currently suggest that 'digitisation' and 'digit**al**isation' are two terms which can be used interchangeably (Oxford English Dictionary, 2023), but distinctive meanings have been emerging whereby digitisation is viewed as the technical component of the overall digit**al**isation process, which encompasses broader sociotechnical change (Yoo *et al.*, 2010).

The report was supported by the then Secretary of State for Health, Jeremy Hunt, who initiated work to act upon several of the recommendations. A new NHS 'digital academy' was formed, a national Chief Clinical Information Officer (CCIO) was appointed, and a 'CCIO network' was formed. Despite stating that speed was not a priority, a new target was set; 'all trusts should be largely digitised by 2023' (Wachter, 2016).

In July 2018, Matt Hancock was appointed Secretary of State for Health and Social Care. Previously the Secretary of State for Digital, Culture, Media and Sport, and with a background in software, Hancock was keen to declare his commitment to delivering a technology-driven NHS, and soon after released his vision for the future of technology and digital in health and social care (2018). The report stated that the NHS needed to 'take a radical new approach to technology across the system and stop the narrative that it's too difficult to do it right in health and care.'

Despite the commitment to pursue digitalisation at pace, throughout the duration of my research, the timeline has continued to shift. At the start of my project, it was hoped that the NHS would be largely digitalised by 2023 (Wachter, 2016). The latest target is that all integrated care systems (ICSs) and their NHS trusts should have 'core digital capabilities, including electronic health records, in place by March 2025' (NHS Transformation Directorate, 2022).

1.3 My own experience

From pre-registration house officer jobs[4] in 2004 and onwards, my medical career travelled alongside the most infamous of IT projects: The National Programme for Information Technology (NPfIT), latterly Connecting for Health. Working as a junior doctor across England, in various specialities and hospitals, allowed me to compare how information technology was implemented and used (or not) from one NHS trust to another. I remember mobile computers being wheeled onto the wards in 2005, and the digital radiology viewer, PACS (Picture Archiving and Communication System), arriving in 2006. These systems, along with features such

[4] Equivalent of Foundation Year 1 (FY1) doctor

as electronic ordering and prescribing, came and went depending on which part of the country I was in. I remained enthusiastic about technology use, seeing small pockets where it helped rather than hindered, and wondered why successful systems had not spread nationally.

Then in 2014, my workplace (an NHS-aligned hospice) implemented an electronic patient record (EPR) to replace the paper-based medical files we had previously been using (A4-binders, which contained multidisciplinary clinical notes). An EPR called EMIS was selected by the medical director, who knew of it from her background working in general practice. It was a system which, up to that point, had rarely been used outside of primary care. EMIS was developed for general practice by general practice and has continued to be shaped by the needs of general practitioners through a national user group (EMIS National User Group, n.d.). In general practice, patient records record multiple short encounters over long periods of time, often (at least traditionally) with the same health practitioner.

The EMIS patient record is organised around a 'problem list', which is formed through the coding of diagnoses, within which the clinician provides some history or free text describing the problem. The coding of diagnoses within the EMIS is important for both organising information within a patient's record, as well as providing data for clinical governance and payment through the Quality and Outcomes Framework (QOF) (NHS Digital 2022c). There are also areas within the EMIS software where you can upload documents, receive laboratory results, and organise prescriptions.

In the hospice, we were using EMIS within an inpatient environment. In contrast to primary care, we generally saw patients for long encounters over short periods of time (days to weeks, sometimes months), and there would be multiple encounters with numerous staff (two to three shifts of nurses, healthcare assistants, and one or two doctors) over the course of a single day. In an inpatient environment, the notes began to grow in size rapidly, which made the location of information within the system more difficult, especially with longer lengths of stay.

I also found that how I got to know a new patient, who could have decades of information within their primary care record, was more time-consuming using the EPR. Prior to electronic records, we would have relied on the information included on a paper hospice referral form. The referral form was completed by the referring clinician and asked the referrer to give a reason for the referral along with a brief medical history. GPs often accompanied this form with a print-out of the patient's primary care electronic record summary (which normally consisted of active and past diagnoses) and a medication list. Any additional information had to be requested by phoning the GP or hospital consultant and asking for a fax of the relevant letter or piece of information.

EMIS made all of this information digitally-accessible, including the referral form. When I opened a patient record on EMIS, I was presented with a front page containing an overview of diagnoses (formed from the use of codes), but this view was orientated to GPs. As a hospice physician I needed more detailed information. My route to more detail was via scanned letters from hospital-based oncologists, which gave diagnoses, problem lists, plans, and usually some form of a patient narrative in one place. I valued the ability, through the EPR, to have access to all of this information, especially when the patient had been on a long and complex treatment journey. But, with it all being available, it was hard to know when to stop reading, and meant even longer sitting in front of an office computer, rather than being with patients.

When we started using EMIS in the hospice, we had the opportunity to begin applying codes to our patients' EPRs. Generally, despite training, the inpatient ward staff did not use the coding system. One reason may have been that there was no apparent incentive to do so; the hospice was not funded through any data generated from these codes, and clinical governance and audit ran alongside on paper. But without the codes, finding information within the long stream of numerous entries from multiple staff members over days and weeks was, at times, challenging and time-consuming.

Furthermore, healthcare assistants expressed that using EMIS was moving them away from patients. It was not just a matter of the time taken to update the computer notes but that the physical location of the documents had moved from paper at the bedside to within the office computer. Patient care plans (such as what the patient had eaten that day, when they had last been to the toilet, and descriptions of their pain) were one example of why this movement of staff mattered. Previously, care plans, so important to a holistic hospice approach, had commonly been filled in with and alongside the patient, but now were completed on the computer and apart from the patient.

In EMIS, these care plans were stored as Microsoft Word documents, which were direct electronic copies of the previous paper forms. EMIS (as a primary care system) did not have a pre-made template for this type of care document, so it was decided to place this information alongside external files (such as referral letters, clinical letters, and scanned-in papers). The structure of EMIS meant they were stored in a separate tab, away from the integrated notes of day-to-day clinical care. Moving them away from the main clinical interface meant that they were relatively hidden and required a greater number of steps or clicks to access. Consequently, it was easy to forget the care plans were there, and it was felt they were not accessed by the whole multidisciplinary team as frequently.

The changes in the way we were working were made more apparent by a period of computer breakdown. We were disconnected from the NHS network for over a week, which meant we could not access EMIS. After an initial flurry of activity to find suitable paper (the lined paper used for ward rounds had been removed after the EPR implementation), we soon settled back into old routines. We had the choice to complete documentation at the bedside again. When the computer did not need 'feeding', sitting and chatting with a patient was easier. Without an overwhelming amount of information available, we did not have to spend so long reading a screen. Writing it up was quicker, as there was not as much to look back over (and picking up a folder and finding the right page was faster than the log-ins and clicks required to use the EPR). The nursing staff told me they were looking forward to coming to work more than they had in a long time.

The seemingly 'common-sense' assumption that technology would lead to efficiency and better care did not relate to our experience. But it was not just that the EPR took longer to use than paper, it was also changing the way we worked.

Most EPR research in the NHS in England has focused on the implementation process. Very few NHS trusts have integrated hospital-wide EPR systems. At this time, the hospitals that have managed to remove paper records (or at least partially, becoming 'paperlight') are rare, but starting to emerge. Given the experience I had with this process in the hospice inpatient environment, I embarked on this PhD to look critically at how the removal of paper records is changing practice on a larger scale, in NHS hospitals. I wanted to apply my experiences and understandings to how I found the EPR shaping working practices on NHS wards, focusing on communication and collaboration and how care is delivered.

This introductory section has given a background to the ongoing process of digital transformation of medical records in the NHS, up to the commencement of this PhD project. It was my own experience of using the EPR in practice that drove my curiosity to undertake a PhD. My research aims and questions have arisen out of that, supported by the gaps I discuss in the following literature review.

1.4 Overall aim and research questions

Medicine as a practice has been adjusting and adapting to technologies for hundreds of years (Reiser, 1981). From the stethoscope to the microscope, each has led to changes in the way medicine is carried out. The formation of the medical record has been part of that evolution, with 'the note' growing from a doctor's personal archive to a multidisciplinary institution-held file. Digital, or electronic, records are replacing paper notes in hospitals across the NHS in England.

NHS hospital trusts, although long used to computers for various individual functions (such as checking blood results), do not all have electronic records. Instead of a repeat of a 'national programme' of implementation (as per NPfIT), individual trusts are moving at their own pace and selecting their own EPR providers. The rate of change varies enormously from hospital to hospital, with some NHS trusts no longer using paper patient records at all. An example of this is the site of this research project, Compass Hospitals NHS Trust, where they have made incremental progressive steps towards digitalisation using their chosen EPR provider, Lorenzo.

At Compass Hospitals NHS Trust, patient notes are digital in both inpatient wards and outpatient clinics, across their hospital sites. The Lorenzo EPR is used to document the majority of data that would have previously gone into a paper record – for example, admission clerkings, daily ward rounds reviews, prescription charts, and results.

The literature review of this thesis will demonstrate how it has been found, beyond my own personal experience, that the removal of the paper note as a central communication and collaboration device appears to be affecting how hospital-based clinicians work together.

This project examines how the electronic patient record (EPR) is shaping how clinicians do their work and how they communicate and collaborate. How has the relocation and transformation of information, from paper to computer, changed the ways that medicine is practised on NHS hospital wards?

1.4.1 Overall aim

To examine how the electronic patient record is shaping the way that hospital staff communicate, collaborate, and care on NHS hospital wards in England.

1.4.2 Research questions

The research aim will be explored by answering the following questions:

How is the use of an electronic patient record system shaping the way that hospital staff communicate, collaborate, and care?

- How does the material housing of the electronic patient record on ward rounds shape the way that medical staff collaborate?

- How does the physical replacement of paper with mobile computers change the way that care is carried out and delivered?
- How does the use of an electronic patient record reconfigure communicative practices between clinical staff groups in hospitals?

1.5 Structure of the thesis

This section contains an overview of the thesis and a brief synopsis of each chapter in order to provide context for the remainder of the work.

Following this introduction, in chapter two, I review the literature relevant to the research aims of this thesis. This chapter is split into two parts. The first part focuses on the origins of the medical record, and how it has come to interest as an active part of medical work with multiple roles. In this section, I also discuss how the materiality of the paper record was intertwined with medical practices.

The second part of the literature review turns to the EPR. I discuss how the EPR has been challenging to define and how it is conceptualised differently across academic disciplines. I then look more closely at how the implementation of the EPR has been described as introducing unintended consequences in medical work, particularly communication and collaboration between staff.

Chapter three considers the research design used in this project. After setting out my ontological and epistemological stance, the sociotechnical approach to this research is explained, including how I have taken inspiration from actor-network theory. I introduce ethnography and how I will use ethnographic methods to trace the relationships and interactions between actors, including clinicians and EPR systems, with the aim of making visible the more mundane objects and emerging material elements of the EPR.

Chapter four will detail the methods used and how the project was undertaken. The practicalities of the research, reflexivity, ethical issues and other challenges are considered before setting out the analysis process.

Chapter five sets the stage for the findings chapters by introducing the research site, wards, EPR system, and IT team involved in the study of mobile technology use and the electronic patient record.

Chapter six considers findings related to the mobilisation of the EPR. This chapter discusses the impact of the mobile EPR on staff interactions and collaboration on hospital wards, focusing on medical ward rounds.

Chapter seven explores the use of mobile devices at the bedside and the delivery of compassionate care. I describe how an iPod was implemented as a replacement for a paper 'intentional rounding' system and how the challenges it introduced revealed the complexity of how nurses combine rounding into their routine work.

Chapter eight examines how the materiality of medical records has played a fundamental role in supporting interprofessional communication. The shifting materiality of the medication chart is drawn upon as an example of how communication, safety, and trust can become compromised through the affordances of digital records.

The discussion within chapter nine brings together the key themes identified within this research considering the role that the materiality of the medical record has in both the formation and support of medical practices. I then examine how the research questions set at the start of the thesis have been answered.

In chapter ten, I present an overview of the thesis and consider the contributions it has made to knowledge. I discuss the broader implications arising from the findings and the potential for further research following this PhD. This chapter also encompasses a reflection on the strengths and limitations of the thesis.

2 Literature Review

2.1 Part 1: The paper medical record

2.1.1 Introduction

The introduction to this thesis laid out the background of large-scale IT programmes in the NHS. This literature review aims to bring focused attention to the medical record and explore its multifaceted functions and roles in the day-to-day operation of healthcare.

The medical record serves as more than a passive repository of information; it assumes an active and constitutive role in the practice of medicine (Berg, 1996). The literatures I explore in this chapter explain that the medical record plays a significant part in shaping and maintaining a patient's trajectory within healthcare. Contrary to the traditional notion of the medical record as a passive object, this perspective highlights its active involvement in medical work and the representation of patients.

Through introducing an understanding of the medical record as an influential factor in medical work and the production of the patient's body (Berg and Bowker, 1997), it gains importance as a compelling subject of inquiry. Recognising its active role in co-producing the patient prompts exploration into its complexities, as well as the potential impacts of its material transformation on healthcare practices. By examining the intertwined nature of the medical record within medical practices, particularly its materiality and significance in clinical work within hospital environments, this thesis aims to gain deeper insights into the role of the EPR and the implications of its use in medical work.

This literature review is split into two parts. The first section will give a brief historical overview of the medical record followed by a synthesis of literature which helps to broaden understanding of the paper medical record within hospital work.

The second part of the literature review will look towards the electronic patient record (EPR). I will explore how the EPR has been conceptualised and how its implementation has been associated with unintended consequences in healthcare settings, particularly in relation to collaborative ward-based work.

Finally, I draw together literature which impresses the continued need to pay attention to the materiality of 'mundane' objects. Because although the EPR has been extensively researched, how it can be mobilised on wards and interacted with on a physical basis is less well understood.

2.1.2 A brief history of the medical record

The keeping of medical records can be traced back to ancient civilisations. In Greece, Hippocrates is credited with keeping records on clay tablets (Reiser, 1991). During the sixteenth century, doctors began routinely keeping paper records (Kassell, 2018). This practice of note-taking was part of a broader trend at the time, as merchants and scholars sought to utilise notebooks as tools to 'make order' in the first age of 'information overload' (Blair, 2010).

In contrast to the comprehensive, institution-held medical records of today, historical medical records were primarily written and owned by individual doctors. As new technologies (such as the stethoscope[5]) and evolving understandings of the human body emerged, the medical record expanded to incorporate diverse sources of information. There was considerable variation in recording styles and quality among practitioners (Reiser, 1981). Even when records were held by hospitals, they lacked consistency. This was described by Florence Nightingale, who found that even in the 'best conducted' hospitals, there was a struggle to obtain 'hospital records fit for any purposes of comparison' (Nightingale, 1863).

However, this situation began to change as it was realised that the medical record could be utilised as a tool to evaluate and compare treatments. In the late 19th century, doctors began to collect observations and outcomes from medical records, leveraging them for research and education, which ultimately led to the emergence

[5] In 1816 (Bishop, 1980)

of clinical epidemiology (the study of patterns, causes, and effects of health and disease in individuals and populations) (Morabia, 1996).

At around the same time, the medical profession was becoming more organised, with practitioners forming organisations and establishing standards for registered doctors (Irvine, 2006). The 1858 Medical Act introduced legislation which aimed to regulate the medical profession and establish a formal system of professional registration (Waddington, 1990). A central purpose of the Act was to ensure that only qualified practitioners were allowed to practice medicine. Prior to this act, anyone could practice medicine in the UK without any qualifications, which led to concerns about the quality of medical practitioners and the safety of patients.

The General Medical Council (GMC), an organisation established in 1858 through the key provisions of the 1858 Medical Act, produces a document of professional standards entitled 'Good Medical Practice' (General Medical Council, 2013). This document emphasises the need for clear, accurate, and legible medical records. This requirement serves not only research and epidemiological purposes, but also so the GMC can hold medics to account and maintain the reputation of the profession. Hospital staff are often told to remember, 'if it's not written down, it didn't happen' (Maxwell, 2013), underlining the central role of the medical record in demonstrating professional care and accountability.

This brief account of the evolution of the medical record before computerisation begins to demonstrate that as long as there have been patient records, they have been changing. Their role and contents have shifted along with the diversity of people using them. What the 'medical record' is, has never been a fixed or easily identifiable object, and this continues to be the case.

2.1.3 The role of the patient record in medical work

Whilst the medical record is understood to contain information from a diverse range of sources and practitioners and is used across multiple healthcare settings, this thesis will focus predominantly on the use of the medical record on hospital wards. As such, the content of this literature review will be primarily directed towards research which relates to how the record is used in this context (as opposed to the outpatient clinic or primary care).

In modern hospital practice, how the paper medical record has been conceived has developed beyond it being a repository for an individual doctor's use. The paper-based record can be understood as a heterogeneous collection of materials, rather than a singular distinct entity (Fitzpatrick, 2000). This concept was described in detail by Berg (1996) in 'Practices of reading and writing: the constitutive role of the patient record in medical work'. Berg presented findings from ethnographic research in a hospital in the Netherlands to demonstrate how the medical record is an *active* part of medical work.

According to Berg, the medical record actively influences the consultation between a clinician and a patient. Through the conventional order of medical history taking or the direction of pre-printed forms, the record 'co-produces' the problem at hand. Snippets of information are gathered together as notes, affording the clinician a 'highly *selective*, distanced, abstracted representation' (1996, p. 505 original emphasis). The notes are a thinking space for the clinician, and when writing in them with the patient present, they offer what Luff and Heath (1998) describe as 'communicative flexibility'. This can conduct the pace and turn-taking of the consultation by distinguishing between times of speech and silence and marking transitions between the various phases of the consultation (Berg, 1996, p. 508).

Beyond the doctor-patient consultation, the medical record is also central to coordinating activity on the ward. Berg (1996) explains that the medical record functions as a 'semi-public memory', relieving medical personnel of the burden of remembering a multitude of tasks and their outcomes. What is recorded, requested, or ordered in the record become actions applied to the patient, meaning that the 'practices of reading and writing the record, then, are practices of reading and writing the patient's body'. Furthermore, the medical record can also mediate the temporal structure of hospital work through how it collects and distributes tasks via a 'material infrastructure' of charts, tables, and lists.

2.1.4 Practices of reading and writing

In addition, Berg (1996) argues that medical record writing is a 'social event'. Often, the manner in which information is documented is influenced by the possibility that it will be subject to retrospective review. Awareness of this possibility can result in the presentation of a more 'rational' or 'typical' narrative, which may smooth over uncertainty or disagreement voiced outside of the documentation. Berg emphasises how the physical act of reading and writing encourages brevity and conciseness, resulting in sentences which can be the culmination of a lengthy history of repeated constructive work.

Through these examples, Berg introduces how the *production* of the record through the physical practice of its documentation (on paper, through reading and handwriting) contributes to the *content* of the record itself. This view expanded understandings of the medical record, moving it away from being a 'passive information archive' (Fitzpatrick, 2000) towards conceptualising the medical record as a more complex and active artefact.

Berg's focus here was predominantly on the practice of reading and writing in the record and how that relationship could shape clinical work and interactions. However, beyond these practices, there are additional elements of the physicality of paper medical records which have been noted to contribute to how they are used in hospitals.

2.1.5 The physical properties of the paper record

Coiera (2015), a health informatician with a medical background, argued that the physical nature of paper—how it is moved, held, and manipulated— also plays a significant role in its function as a medical record. He explained how flexible physical interaction with paper facilitated an informal working space, encouraging consensus building and mapping of patient care trajectories (Coiera, 2015).

Furthermore, paper's portability and the 'minimal training' required for use provided an added layer of reliability in diverse environments, even when power sources fail or IT systems become unavailable. Accessing data written on paper can also feel direct and enable a form of 'rapid scanning' (Coiera, 2015), or to put it more simply, being able to pick up the record and flick through the pages.

However, the informality that Coiera describes is also criticised as a potential source of inconsistency and inaccuracies, compared with the structure and standardisation that is promised via electronic records (Carpenter et al., 2007). Similarly, while accessing data written on paper can be immediate and direct, this only applies when the record is in your possession, becoming less helpful across distances (as hospital clinics often are).

Returning to the medical ward, there are other properties of the paper medical record which, over time, have added to the role it undertook in supporting medical work. Nygren and Henriksson (1992), who interviewed physicians in Sweden about their day-to-day use of the paper medical record, explored how there were several aspects of the materiality of paper which contributed to how physicians interacted with the record:

- The appearance of the record influenced the strategy with which the notes were approached. For example, the 'thickness of the folder', or the age of the record, acted as an indicator of the case's complexity and how reading it should be approached.

- Seeing the record, even the 'visible edge of the bundle', could trigger a 'memory-picture' of the case, assisting recall.

- Visualising the complete paper record could also highlight what was missing, creating a broader overview and awareness of what might yet need to be done.

Whilst they also acknowledge the fragility of paper notes, this account demonstrates the value that can be derived from seeing and handling the paper record and the information that can be imparted to the experienced eye.

Paper also had other more dynamic utilities. The physical adaptability of paper is often noted in research which has tried to explore why electronic records have not succeeded as it was assumed they would. Studying the digitalisation of medical records on a Norwegian hospital ward, Iverson et al. (2015) asked, 'Why is it that paper-based patient lists are maintained in the ward of a hospital going digital?'. Participant observations and semi-structured interviews revealed that paper supported activities at the bedside in an immediately retrievable way, which was not available through the EPR. The nurses described their paper lists as 'personal, versatile, dynamic tools', which were less disruptive in providing patient-centred care. According to this view, the temporary and personal aspect of the patient list as a memory aid seemed to be particularly important to the nurses, something which the EPR was unable (through function and design) to accommodate. Mount-Campbell et al. (2020) described similar findings from interviews with nurses in the USA, where these sorts of paper lists are sometimes known as 'brain' notes, emphasising their importance as memory devices.

These accounts help to bring alive the practical material aspects of the paper medical record beyond how it has more recently been framed as materially inadequate for use in healthcare (Korpman, 1990). But what is also interesting, and somewhat dismissed by accounts of how paper is a poor material for information management, is how the practices (of reading and writing) and the physicality of paper have been intertwined (Berg, 1996). Paper may not require the same sort of technical training as a comprehensive EPR, but in the literature I have brought together here, it can be seen how the use of paper records in practice, reading and writing in the record as well as other physical aspects of its use, are more complex than might be expected. These elements of paper record use are often tacit and can be easily overlooked as part of what has comprised routine workflows on medical wards (Halford et al., 2010 – see also page 70).

Beyond the information they contain, paper records have had a three-dimensional place interwoven into medical practices for nearly as long as those practices have been in the making. In addition, I have described the significance of the medical record in decision-making, the mediation of medical work, and the 'renderings' of the patient's story through reading and writing (Berg, 1996). These accounts introduce a way of thinking that understands the medical record as a core device in facilitating medical work beyond just being a pile of paper. The materiality of the medical record matters in support of medical practices, and since this is in the process of significant change, it needs careful scrutiny.

2.1.6 Digitalisation

The materiality of the medical record is mostly absent from accounts of how it needs to be transformed. In the narrative surrounding the impetus to digitalise, where the medical record is more closely equated to a container, an 'innocuous storage device' (Berg and Bowker, 1997), the continued use of paper is seen as a failure to improve productivity. This can be demonstrated in this extract from a 2018 Department of Health and Social Care policy paper, 'The future of healthcare: our vision for digital, data and technology in health and care', which associates the use of paper with lost time and efficiency:

> *We need technology that makes life easier for staff […] Many staff are resorting to paper-based processes as workarounds because the technology they use is slow and clunky and others still work in paper-based organisations where mobile working and digital technology could increase efficiency and productivity [...] Digitisation will save health and care providers money and free up staff time – money and time that can be better used to provide great care.*
> *(Department of Health and Social Care, 2018)*

Although this extract attempts to convey that 'great care' will be realised through improvements related to digitalisation, it also highlights something about the adaptability of paper as a 'workaround' to 'slow and clunky' digital technology. This reflects the physical adaptability of paper's materiality, which I have detailed throughout this chapter, and which will continue to be relevant when discussing the EPR in the next part of this literature review.

2.1.7 The materiality of medical records

When discussing paper as a material and understanding that the role of paper in medical work both figures in and configures the practices it supports, this can also be described as 'materiality'. The concept of materiality, while referring to the physical aspects of an object or entity, carries broader connotations. In the context of information systems or organisational studies, for example, materiality does not just refer to the physical existence of an object but also considers how its tangible properties contribute to or influence its function, usage, social interactions, and significance within a system or context. Materiality thus incorporates not just physical properties but also the implications and effects of those properties in a broader context (Leonardi, 2010).

2.1.8 Paying attention to materiality

In the introduction to a collection of papers compiled to make 'mundane material culture' more visible in healthcare, Buse, Martin, and Nettleton (2018) highlight the importance of paying attention to objects which tend to slip unnoticed into the background of care, such as clothing, food, and furnishings. Buse et al. (2018) utilise this quote from Miller (2005; 5) to explain why they believe objects should be analysed:

> *'[O]bjects are important not because they are evident and physically constrain or enable, but often precisely because we do not 'see' them. The less we are aware of them, the more powerfully they can determine our expectations by setting the scene and ensuring normative behaviour, without being open to challenge.'*

The same sentiment could be applied to the medical record. Whilst attention has focused on the content and connectivity of the record, how that digital information is actually moved in a physical environment is also often unnoticed, with little attention paid to the physical embodiment of the data. The physical properties of paper, such as its fragility, lack of accessibility, and sometimes illegible contents, get used as reasons for why it is inadequate as a medical record (Korpman, 1990), but the actual material form of how the EPR will be mobilised is missing from accounts describing digital transformation. As Orlikowski and Iacono (2001) describe, it is *presumed* to be unproblematic:

> *'We find that IS [information system] researchers tend to give central theoretical significance to the context (within which some usually unspecified technology is seen to operate), the discrete processing capabilities of the artifact (as separable from its context or use), or the dependent variable (that which is posited to be affected or changed as technology is developed, implemented, and used). The IT artifact itself tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed.'*
> *(Orlikowski and Iacono, 2001, p. 121)*

Above, I presented research which described the ways in which the materiality of paper has been intertwined with medical practices. However, to take the 'IT artefact' for granted as it becomes mobilised could lead to assumptions about how the EPR will support medical practices on medical wards.

Timmermans and Berg (2003) also emphasise the underrated value of investigating 'seemingly mundane, "infrastructural" technologies – such as records, information systems, standards, small home-care technologies, and clinical research guidelines' (p. 108), which tend to escape scrutiny due to their ordinariness. It is only through a comprehensive examination of how these technologies are applied in the real world that we can comprehend their subtle yet transformative interaction with everyday medical practice.

2.1.9 Conclusions

In this section of the literature review, I have identified how the paper medical record has had an intrinsic material role in ward-based medical practices. Without understanding the practical and material ways in which the physicality of the paper record was involved in supporting medical work, we do not know how the gaps left by the removal of paper will be met by the EPR. This begins to introduce why it is essential to pay attention to the materiality of objects.

In the next section of this literature review, I will outline what is understood by the 'EPR' and how it has been conceptualised across academic disciplines. This will lead to a review of work on medical wards and the intended consequences of EPR implementation on communication and collaboration.

2.2 Part 2: The Electronic patient record

2.2.1 Introduction

In the previous part of this literature review, I set out how the medical record is a heterogeneous and complex device and how its materiality has been an intrinsic part of the practices it supported as a paper document.

The literature concerning electronic patient records (EPRs) is vast and spans multiple disciplines and research traditions. It is known by different names across locations, and these names are applied inconsistently within the literature, both in policy and in practice. But the EPR is not just known by various names, it is also conceptualised differently across academic disciplines. I will explain how the EPR is imagined across research traditions before reviewing and bringing together these ideas to explain where the problems with the transformation of the medical record have been described.

I will then focus on literature which describes how electronic records are not doing what is expected, the 'unintended consequences'. Unintended consequences arising following the movement of records from paper to digital formats have been widely reported. In the wake of my own experiences with both types of records, and in line with the aims of this project, I will elaborate on these consequences with particular attention to communication and collaboration, including a review of the complex collaborative practices used across medical wards.

Whilst there is a wealth of research analysing the medical record, comparatively little considers the materiality of its use in practice. In describing the unintended consequences of EPR implementation, I will illustrate how overlooking materiality could be missing key understandings of the health information technology in use.

2.2.2 Defining the electronic record

The terminology used to describe the computerised replacement for paper medical records has changed and continues to shift over time. Definitions are applied inconsistently across the literature depending on the geographical location and academic discipline. In this section, I will give a brief background to some of the terminologies as it helps clarify, in a more technical sense, the envisaged content of the electronic record where it has been realised and how these things have been shaped through political actions.

The terms electronic patient records (EPR), electronic health record (EHR), and electronic medical record (EMR) are often used interchangeably, but their technical definitions, as recorded by English and US official documents, set out how they have been conceived as different things.

In 1998, the Department of Health impressed the importance of clear definitions in the report, 'An Information Strategy for the Modern NHS':

> *'The phrases "electronic patient record" and "electronic health record" are terms often used to describe similar concepts. It is important to clearly define how these terms are used […] to avoid confusion.'*
> *(Department of Health, 1998)*

The report goes on to explain the differences between EPRs and EHRs, primarily that the EPR is a record of periodic care provided by one institution, whereas the EHR is the lifelong longitudinal record which combines information from all healthcare providers (which was the goal of the Department of Health and the National Programme for Information Technology (NPfIT) at the time).

2.2.3 The Electronic Patient Record (EPR)

By these definitions, the use of EPR in England is similar to that of EMR in the USA. But as US terminology has gained strength from legislation and regulation (the HITECH Act (Blumenthal, 2010)), the use of EHR in place of EPR is seen in NHS documents. Dr Robert Wachter's 2016 report for NHS Digital uses EHR exclusively (Wachter, 2016). Other NHS England and Government papers also use EHR (Bunn and Crane, 2016), but local NHS organisations currently tend to talk about EPRs.

As of 2023, the NHS does not have an extensive, universal, life-long electronic health record (EHR). Most records are institution-based and are not shared electronically between primary and secondary care (although this is slowly changing). The Summary Care Record (SCR) (NHS Digital, 2019), a product of the NPfIT (Table 1 page 7), has provided a centrally shared source of basic information (at a minimum: current medication, allergies, and patient demographics). Although the SCR is in the process of transitioning to become the National Care Record Service (NHS Digital, 2023) is still currently the closest thing that could be called, by the above definitions, an EHR.

To summarise, in academic literature, most US-based research reports on EHRs and EMRs (Payne *et al.*, 2015; Heart *et al.*, 2017) and the NHS literature tends to use the terms EPR and EHR (Wachter, 2016; Topol, 2019; NHS Digital, 2022a). In my experience, most NHS hospital staff talk about the EPR or use the name of the actual product, for example, 'Lorenzo'. As I conducted my fieldwork in the NHS, most of my participants used the term EPR. Accordingly, in this thesis, I will use EPR as the standard way of describing the electronic record.

2.3 Conceptualising the EPR

Discussing the definitions of the EPR in these ways leans towards the concept that the system is a formed and bounded object. Whether an 'EPR' or an 'EHR', it is described as a networked container, which sits within a computer, acts as it is programmed, and accumulates information – a 'digital version of the paper chart' (Garrett and Seidman, 2011). The issue with this interpretation, which starts to become visible even through the difficulties in defining it, is that the EPR is not just one thing.

Earlier, I drew on the work of Berg (1996) to elaborate on how the ways in which the medical record is interacted with multiply its roles and meanings. The same principles can also apply to the record in digital form. The EPR, with its accessibility, connectivity, and capacity to hold and process information, expands further on how the medical record can be conceptualised. This concept is important to this thesis, as understanding how the EPR is conceived affects how research from across different disciplines can be interpreted. As a researcher from a clinical background, it is important to me to synthesise different perspectives to produce outcomes that can potentially be translated as widely as possible.

2.3.1 Tensions across different theoretical approaches

As the literature that I will investigate for this literature review spans multiple discourses, I will first provide an overview of the various conceptualisations of the EPR that are currently in use. This conceptual overview will then assist in bringing together the literatures going forward, looking toward the 'unintended consequences' of EPR implementation and medical work.

Researchers working between disciplines have recognised how differently the EPR is described in the literature, contingent on how it is imagined across theoretical approaches. Greenhalgh et al. (2009) brought together some of these 'tensions and paradoxes' in a meta-narrative summary. Swinglehurst, an author on that paper (and a general practitioner alongside Greenhalgh), recognised the challenge of defining the EPR, emphasising the responsibility of the 'EPR researcher to articulate as clearly as possible the philosophical assumptions that underpin the research endeavour' (Swinglehurst, 2012). My own stance and approach will be detailed in the methodology chapter (see section 3.2).

One of the central tensions revolves around the very nature of EPR. There are two contrasting perspectives: one that views EPR as a tool or container for information, and another that considers it as an 'actor' in the healthcare process. The latter perspective is rooted in research traditions such as Computer Supported Cooperative Work (CSCW) (e.g. Fitzpatrick and Ellingsen (2013)), Science and Technology Studies (STS) (e.g. Bruni (2005)), and Critical Sociology (e.g. Henwood and Marent (2019)). CSCW, for example, examines how computer systems can facilitate collaborative work (Schmidt and Bannon, 1992), whereas STS studies of the medical record tend to view it more as a complex and fluid artefact which has multiple 'bodies' (Berg and Bowker, 1997). In this view, as with the paper medical record, the EPR can be seen not just as a passive repository but as an active participant in healthcare, capable of shaping and being shaped by the healthcare process.

Another tension pertains to the role of the EPR user. The traditional view sees the user as an information processor who makes independent decisions. However, an alternative perspective, aligned with STS, considers the user as part of a dynamic sociotechnical network (Mutch (2002) cited in Greenhalgh et al., (2009)). I n this network, the user and the EPR are mutually influential, reflecting the interconnectedness of social systems and technological artefacts (Orlikowski, 1992).

Moving on to the perception of clinical work, with the tension across two opposing perspectives. The positivist perspective, which is based on the belief that reality can be objectively known, views clinical work as a series of decisions leading to predictable outcomes (Hains *et al.*, 2012; Marques and Ferreira, 2020). In contrast, the opposing view holds that healthcare work is highly personalised, filled with exceptions, and context-dependent (Bate, 2014). This perspective acknowledges the importance of human judgment and the situated nature of clinical practice (Suchman, 1987 – more detail below).

Greenhalgh et al.'s (2009) paper was published at a point when NPfIT implementation was ongoing and tends towards an imagined EPR (in the process of implementation) rather than one that is well-embedded in an organisation and being used in situ. It asks questions about what an EPR might be ('is it a passive vehicle?'), and how the EPR user might act ('as an autonomous practitioner or a part of a network?'), rather than describing how these 'tensions and paradoxes' are being enacted in practice. In attempting to draw together diverse literature from such heterogeneous fields, they recognise that interdisciplinary debate is needed regarding the priorities of EPR research. Notably, one of the areas they identify as needing further attention is the practice of clinical collaboration, stating there is 'much room for a detailed study of the communicative dimensions of collaborative clinical work' (2009, p. 768). This is something that I will return to, but first, I will continue to explore how different research paradigms view the EPR.

2.3.2 Metaphors of medical record change

Greenhalgh et al. (2009) position the issues so that different conceptualisations are polarised in tension against each other. Carboni et al. (2022) suggest a different way of thinking about the difficulties these tensions can produce, again in relation to healthcare digitalisation, but which may helpfully assist in 'conceptual and empirical cross-pollinations between different academic fields' (Carboni *et al.*, 2022). Using metaphors, Carboni et al. (2022) illustrate how different research paradigms conceptualise the digitalisation of healthcare. They broadly divide the literature into three core 'strains' and synthesise how those areas conceive the digital transformation of the medical record.

Carboni et al. (2022) use the metaphor of a slime mould to represent science and technology studies (STS) to illustrate the interconnectedness and adaptability inherent in networks. Slime mould, a single-celled organism, operates like a network, constantly reconfiguring itself for optimal functioning. This metaphor is used to understand the dynamic interplay between human and non-human actors, for example, glucose monitoring systems (Danesi *et al.*, 2020) or inhalers (Prout, 1996), which need to adapt and form stable connections across various locations.

In medical sociology, Carboni et al. (2022) utilise the metaphor of theatrical performances is used to understand the visible and invisible work in technology implementation. Drawing on Goffman's dramaturgical theory (1959), this metaphor portrays visible work as being performed on stage, while behind the scenes, there is a plethora of invisible work necessary to keep the technology functioning (see (Oudshoorn, 2008)). This is particularly relevant in understanding the complexities and behind-the-scenes efforts required in EPR systems, especially in hierarchical organisations (Petrakaki and Kornelakis, 2016).

In clinical medicine and health informatics, the metaphor of river engineering is employed to represent the flow of work and information in healthcare systems (Carboni *et al.*, 2022). This metaphor captures how engineering solutions can be used to steer the flow of information efficiently, much like controlling the flow of a river. This is often associated with the promises of digitalisation in healthcare, where EPR systems are expected to improve efficiency, reduce menial tasks, and ultimately facilitate better patient care (Butcher and Hussain, 2022).

These metaphors from different disciplines - the slime mould from STS, theatrical performances from medical sociology, and river engineering from medicine and health informatics - collectively provide a multifaceted understanding of the complexities, interconnectedness, and flows in the implementation and functioning of the EPR. They also help to establish how the digitalisation of healthcare is a subject of interest across multiple academic disciplines.

Together, Greenhalgh et al. (2009) and Carboni et al. (2022) synthesise conceptualisations of the EPR, which serve as a valuable foundation for approaching EPR research and the unintended consequences of EPR implementation. They provide an overview of the tensions and debates surrounding the EPR and offer multidimensional perspectives which could help illuminate how and why unintended consequences might arise from the digitalisation of medical records.

2.3.3 Using sociotechnical thinking to expand understandings of the EPR

As Greenhalgh et al. (2009) and Carboni et al. (2022) described, there are multiple ways of conceptualising the EPR, of which one approach is through the lens of Science and Technology Studies (STS). Science and Technology Studies scholars consider the social and the technological as inextricably intertwined. STS contributes to the idea that people are not passive users of technology but that they also shape and give meaning to technology, which in return can reconfigure and reorder social interactions.

To explain, I present a couple of examples of where researchers have expanded understandings of sociotechnical systems through this approach. Firstly, the concept that technology may act and be acted on in ways unanticipated by its developers was explored in Lucy Suchman's 'Plans and Situated Actions' (2007). After being released from the factory or laboratory, technologies may not do what is expected, or be used as designed. Through descriptions of a new photocopier and its users, Suchman explained how the meanings and assumptions supposedly embedded into technologies could shift when away from their site of production. As a researcher at Xerox's Palo Alto Research Center (PARC) in the 1980s, Suchman observed the difficulties people had operating newly developed photocopiers. Suchman noted the tension between what the users were supposed to do when they used the photocopier (the 'formal logics' embedded into the technology) and what happened in practice in real-world situations (the logics of 'situated action'). The human-computer interaction was less rational and predictable than expected. Much as a conversation between people can take tangential turns, not following 'the kind of message-passing or exchange model that formal, mathematical theories of communication posit' (2007, p. 10), it was also the case that in interactions between humans and technologies, designed-in scripts were not followed.

These ideas can be transferred to understanding how humans and other technologies, such as the EPR, interact. Understanding that 'plans' cannot be perfectly specified and that actions taken depend on the particularities of any given situation, can lead to new ways of thinking about how the EPR is used when it reaches the healthcare environment. The many fine-grained complexities of problems within healthcare mean that EPR users must undertake further work to make sense of the EPR and adapt it to their working practices.

Secondly, users and developers may be employing different and opposing logics in the construction of the EPR. US-based researcher, Judith Gregory, followed the development of an early EPR from 1993 to 1998 and described the extensive difficulties the developers had in aligning the EPR to 'multiple logics', each possessing their own rationality (Gregory, 2000). All the parties involved imagined that the EPR would become a single comprehensive record, but Gregory describes how this obscured the multiple logics and priorities at play and created tension and difficulty in progressing the project. Drawing on Verran's (1998) work on landownership in Australia, Gregory suggested one way forward could be through the recognition of multiplicity and co-creation of joint imaginaries.

In the context of implementing EPRs on medical wards, this could entail acknowledging the diversity of perspectives and needs among various stakeholders, including physicians, nurses, administrators, and patients, and collaboratively envisioning a shared understanding of what the EPR should accomplish. We do not yet understand what this might look like, but it might suggest a path in the digitalisation of medical records that allows greater flexibility of materials in particular contexts.

2.3.4 Affordances

A further concept I would like to introduce, which connects to the concept of materiality (see section 2.1.7), is that of 'affordances'. Carboni et al. (2022) describe how the movement of the medical record, and medical work, from one material (paper) to another (the various forms of the EPR) is an ongoing and evolving situation:

> *'Materiality has powerful ways of steering the direction of the network's growth. We thus need to attend to technological scripts and affordances to better understand changes in work practices in healthcare.' (Carboni et al., 2022)*

Technological scripts and affordances are important concepts in STS (science and technology studies) and function as useful tools for thinking about how working practices are being reshaped by technology.

The concept of the 'affordances' was introduced initially by ecological psychologist Gibson (1977). Gibson argued that how an object is perceived in a specific environment depends on the possibilities for action it offers. Drawing on Gibson, Hutchby (2001) extended the notion of affordances into science and technology studies, writing that technological artefacts possess *'functional and relational aspects which frame, while not determining, the possibilities for agentic action in relation to an object'*. This perspective is grounded in the understanding that the materiality of technologies is fundamental to their analysis. In accordance with how I described materiality earlier (see section 2.1.7), Hutchby (2001) explains that materiality is not just to be considered in physical terms but also, as I previously explained, is inclusive of the implications and effects of the material in a broader context (Leonardi, 2010).

As well as enabling factors, constraints can emerge from the affordances of artefacts. When this happens, the people interacting with sociotechnical systems will attempt to find ways of managing, which can lead to a range of possible reshuffles of social relations and practices (Petrakaki et al., 2014). To explain, I draw on the following example from Allen (2013).

Sociologist and nurse academic Allen (2013) employed the concept of affordances to explain why improvement initiatives, such as 'Integrated Care Pathways (ICPs)', often seem to lead to an increase, rather than a reduction, in 'paperwork'. An ICP is a structured, multidisciplinary 'pathway' contained in a document, devised to plan and guide care for a specific clinical problem (such as, 'fractured neck of femur' or 'asthma'). ICPs are meant to replace writing in the medical record, improve multidisciplinary communication, and through their structuring, improve (and monitor) adherence to clinical guidelines (Campbell et al., 1998).

Allen (2013) found that while the ICPs were valued by staff for their affordance of directing and prompting care, the staff were also frequently constrained by the structured format of the records. The design of these records often did not accommodate divergences from the expected trajectory of care - an occurrence that is not uncommon in clinical practice. This led to staff resorting to the use of the traditional medical record to document care in tandem with the ICP, resulting in an increase in overall paperwork.

Furthermore, the highly codified structure of ICPs (e.g. tick boxes), originally introduced with the anticipation of affording efficiency, was found to constrain the ability of the staff to provide a thorough account of events. For example, instead of providing personalised and contextual details, like how a patient tolerated a tracheostomy cuff deflation, staff instead were meant to simply tick a box labelled 'weaning continued'. This constrained the provision of a more comprehensive account of events, which had supported broader coordination within the healthcare team.

Allen's (2013) account resonates with literature that describes how in the production of new forms of medical information technology, clinical data is too often viewed as a 'commodity', decoupled from the context of its production (Berg and Goorman, 1999). As such, in the implementation of technologies in healthcare, Allen (2013) argues that consideration of affordances is necessary for 'understanding the potential generative mechanisms of artefacts and their unintended consequences'. As I will now go onto explain, 'unintended consequences' following healthcare technology implementation have been extensively written about. In the following section, I will give an overview of unintended consequences research relating to healthcare technologies with particular attention to where unintended consequences have arisen in the scope of inpatient medical work on wards.

2.4 Unintended Consequences

Unintended consequences can be characterised as outcomes that were not anticipated or intended as a result of an action (Ash *et al.*, 2007a; Coiera *et al.*, 2016). The introduction and proliferation of healthcare information technologies have given rise to numerous unintended consequences. In this section, I will examine the unintended consequences of information technology within the healthcare sector, as they relate to medical work in hospitals. This continues to demonstrate how the transformation of the paper record into a digital format has been complex and fraught with difficulty. The themes that emerge highlight the medical practices involved and offer opportunities to examine more closely the multiple factors that could be at play.

2.4.1 Definition and classification of unintended consequences

> *'Do not just pay attention to what technologies are supposed to do, but also to what they happen to do, even if this is unexpected.' (Mol, 2008)*

If the quote above from Dutch sociologist and philosopher Mol (2008) were applied to what information technology is 'supposed' to do in healthcare, the expected benefits would include what is commonly stated as the reasons for digitalisation: improving care, increasing efficiency, reducing errors, and ultimately saving money. However, as I laid out in the introduction to this thesis with the case of 'NPfIT', the experience of implementing healthcare information technology (HIT[6]) has been fraught with difficulties on many levels.

In the United States, where financial packages accelerated higher uptake of healthcare digitalisation, not only were the initial hopes of productivity improvement not achieved, but researchers investigating the implementation of Computer Physician Order Entry (CPOE)[6] noted numerous reports of HIT producing unintended and adverse consequences. The computer systems intended to make hospitals and healthcare safer appeared to be creating danger and causing harm. Weiner (2007) described the unanticipated and undesirable consequences of healthcare IT, those which cause patient harm, as 'e-iatrogenesis'.

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[6] In line with the papers I am reviewing in this section, I have used 'healthcare information technology' (HIT) to encompass components including the EPR, clinical decision support (CDS), and computer physician order entry (CPOE) (a system that allows a decision-maker to enter medical orders directly via computer) (Ash et al., 2006).

Berg, a central proponent of the active multifaceted role of the medical record (see section 2.1.3), along with Ash, and Coiera, from the Netherlands, United States, and Australia respectively, wrote about this in a viewpoint paper in 2004:

> *'We have each encountered many instances in which PCIS (Patient Care Information System)*[7] *applications seemed to foster errors rather than reduce their likelihood.' (Ash et al., 2004)*

Ash's group, who had previously been investigating CPOE implementation, turned their attention to CPOE-related unintended consequences, looking at five different hospital sites across the USA, where approximately 380 different types of errors had been reported (Campbell *et al.*, 2006; Ash *et al.*, 2007b). Using a grounded theory approach, they categorised the errors into nine themes. The groups of unintended consequences were as follows:

Table 2. Nine types of unintended consequences related to CPOE (Ash *et al.*, 2007b)

	Unintended Consequence	Frequency (%)
1	More/new work for clinicians	19.8
2	Workflow issues	17.6
3	Never-ending system demands	14.8
4	Paper persistence	10.8
5	Changes in communication patterns and practices	10.1
6	Emotions ('intense emotions' often negative)	7.7
7	New kinds of errors	7.1
8	Changes in the power structure	6.8
9	Overdependence on technology	5.2

Table 2 provides a concise list of types of unintended consequences in the implementation of CPOE systems. Of particular interest to the topic of this thesis is the 'changes in communication patterns and practices', which I will return to later in this chapter (see section 2.4.4).

[7] Patient Care Information Systems are 'applications that support the health care process by allowing health care professionals [...] direct access to order entry systems, medical record systems, radiology information systems, patient information systems, and so on.' (Ash *et al.*, 2004)

Since Ash et al.'s work from 2007, medical informatics literature has continued to describe a broad range of unintended consequences relating to the EPR, risks and CPOE (Cowan, 2013), information exchange between organisations (Kuperman and McGowan, 2013), and unintended consequences from a nursing perspective (Gephart *et al.*, 2016) including the development of a validated questionnaire (Carrington *et al.*, 2015) and a self-assessment/HIT implementation guide (Sittig *et al.*, 2014). But the research located within health informatics, which predominantly adopts an engineering-type approach to fixing problems (Carboni *et al.*, 2022), does not seem to capture the complexity of the issues.

Nevertheless, unintended consequences continue to be a problem that health informatics is aware of but struggles to know how to manage. More recently, Coiera et al. (2016) acknowledged this when they revisited unintended consequences in HIT twelve years after their initial paper together (Ash et al., 2004). They reflected that when they first wrote about unintended consequences, the dominant paradigm was that 'technological architecture' was prioritised over human-computer interaction. Lack of attention to the 'communication space' created systems that did not 'fit the real needs of clinical practice'.

> *If we do not fit technology to workflow and to the user, if we do not factor in the competing demands that clinicians must juggle as they use a technology, and if the technology is not fit for purpose, then no one should be surprised if it does little good, and indeed leads to patient harm or increased cost. (Coiera et al., 2016)*

According to this view, an understanding of the distinct and dynamic nature of local contexts and workflows is essential. It acknowledges that unintended consequences can never be completely eradicated, and sociotechnical systems must continuously adapt due to their non-static nature. The issue is important because it directly impacts healthcare staff using the systems, and the unintended consequences can compromise safe care. This impresses the continued need to keep investigating the implementation and use of healthcare technologies, and the value of exploring them through sociotechnical lenses.

2.4.2 Investigating Unintended Consequences

As the dissemination of HIT has increased, there have been multiple attempts to try and pick apart the complex sociotechnical relationships that create the dynamic in which different types of unintended consequences develop.

Within medicine and health informatics, qualitative research methods such as ethnography have historically been underutilised compared with quantitative 'definitive' outcome studies (Loder et al., 2016). As I have just discussed, definitive outcomes can be challenging to achieve in research that interrogates an ever-shifting complex and dynamic sociotechnical system. But to give an example of what ethnography can reveal, Greenhalgh and Swinglehurst (2011) presented a case where the introduction of a Computer-Physician Order Entry (CPOE) system appeared to increase mortality in a paediatric emergency department in the United States (Han *et al.*, 2005). The statistics suggested that post-CPOE, there was an increase in child mortality. In exploring the cause of this increase, it took more than looking at the numbers to really understand what was at the root of the problem. Real-life observations in the department led to the discovery that the CPOE was creating numerous barriers which added small but significant delays to the emergency treatment of critically ill children:

- Pre-CPOE implementation, the ambulance crew could ring ahead, and the onsite staff would prepare for the child's arrival by drawing up drugs. Post-implementation, the drugs could only be ordered or prepared when the child was onsite and registered.
- Once in the intensive care unit, there was a reduction in nurse-to-physician feedback regarding potentially beneficial medication changes. This was thought to be because the physicians were no longer making the medication alterations at the bedside. Instead, they were placed remotely at a computer workstation.

This case further supports the importance of appropriate, timely, and ongoing technology appraisal, importantly using methods which go beyond statistical analysis. Technologies do not always do what they are supposed to do, and the smallest of changes can end up amounting to serious harm further along a chain of events and interactions.

2.4.3 Unintended consequences and hospital staff

The impacts of unintended consequences on hospital staff extend beyond immediately observable metrics such as increased patient mortality, and often subtly affect healthcare practices over time. These effects, although not immediately apparent in patient care, could be significantly modifying staff interactions and communication. For example, pulmonary physician, Stoller (2013), described how EPR implementation inadvertently created ‘locational silos’, where clinicians who used the EPR found that their work became more isolated (see Figure 1).

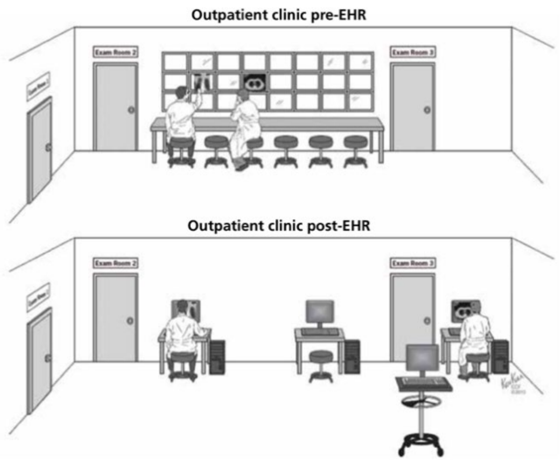

Figure 1: Electronic ‘Siloing’ (Stoller, 2013)

As Stoller explained, the use of larger, wall-mounted display units historically promoted spontaneous collaboration amongst doctors, while the shift to personal computer workstations reduced this open interaction, as these smaller displays limited visibility to other viewers. Similar concerns could also be raised about the digitalisation of other traditional, more openly accessible resources. For instance, A2 or A3 paper observation charts, which were conventionally located at patients’ bedsides allowing shared review. This transition, while technologically advanced, may inadvertently hinder the cooperative exchange of insights, further demonstrating the complex, multifaceted implications of technological evolution in healthcare settings.

Another concern regarding the distance between clinicians, enabled by the EPR, is a sense of blurred responsibilities, where the accessibility of the patient's record and who is taking charge of care is spread more thinly across professionals. Whyte and Kelly (2022), both NHS hospital consultants, described hypothetical scenarios where the EPR could automatically refer patients to specific specialities on the basis of test results, bypassing the consultant who is in charge of their care (or, as they put it, has 'ownership' of the patient).

If this happened across multiple test results, they expressed concern that the patient's care could be dispersed to the extent that there would be 'nobody taking responsibility for the whole person', leading to a confusing situation where the overall management of the patient's care was unclear. They called this a 'collusion of anonymity' and expressed alarm at the potential for a lack of clear accountability for the patient's overall care should problems arise.

Though a hypothetical scenario, this concern does raise questions about how interprofessional relationships may be reshaped through the affordances of the EPR. The EPR could replace instances where a conversation might have previously happened, distancing staff and undermining the formation of professional relationships. I will briefly outline the complexity of communication and collaboration on medical wards before describing the unintended consequences that have been reported in relation to those areas.

2.4.4 Communication and collaboration

2.4.4.1 Introducing the complexity of interprofessional communication and collaboration

The importance of effective interprofessional communication and collaboration in ensuring patient safety in healthcare is well-established (World Health Organisation, 2010). The failure to keep colleagues informed and share appropriate levels of information, including medication changes (Manias, 2018), are among the most frequently reported errors leading to patient harm (Campbell *et al.*, 2018).

The nature of interprofessional communication on medical wards, however, is beset with complexities. Reeves et al. (2004), in their ethnographic study of collaboration between various professional groups across two NHS inpatient medical wards, observed that interactions were often 'fragmented and transient with little evidence of a coherent approach'. This has been supported by research which has observed and counted modes of clinical communication, finding that communication between healthcare staff was synchronous (e.g. face to face, ward rounds, phone calls, MDT meetings, impromptu conversations) up to 70% of the time (Edwards et al., 2009). Often this was achieved through a highly interruptive workflow. As Coiera (2000) put it, when writing about communication behaviours in hospital settings:

> *It is through the multitude of conversations that pepper the clinical day that clinicians examine, present, and interpret clinical data and ultimately decide on clinical actions. (Coiera, 2000)*

The reasons for these interruptions and unplanned conversations are multifaceted (Parker and Coiera, 2000). Reeves et al. (2004) adopted Engestrom's (1999) concept of 'knotworking' to describe interactions among clinicians. This concept illustrates the healthcare environment as a dynamic web of professionals constantly weaving, unravelling, and re-weaving strands of activity during brief interactions. This metaphor was particularly effective in capturing the instability of interprofessional interactions due to the frequent relocation of doctors across different hospital wards.

The movement of staff and patients between wards and spaces is an important factor in understanding the complexity of interprofessional communicative practices. Issues associated with 'temporospatial restriction' (Reeves et al. 2004), where communications are often unplanned and haphazard due to staff being distributed across space and operating in shift-based schedules, have been identified (Coiera and Tombs, 1998). To manage these challenges, medical teams have adopted both synchronous (e.g. face to face, as above) and asynchronous (handover sheets, charts, whiteboards, the medical record) communication strategies (Conn et al., 2009).

Researchers in computer supported cooperative work (CSCW) have paid particular attention to the spatial aspects of collaborative medical work. Luff and Heath (1998) considered the issue of mobility in collaborative healthcare work. Mobility was one of the strengths they attributed to paper as a medium with 'ecological flexibility', supporting medical work through its ability to be 'handlable, manipulable, portable, dismantlable'. In contrast, it has been described how EPRs have had a tendency to 'make work ever more static' as the users are fixed in a location around desktop computers (Bardram and Bossen 2005). But what is not yet clear is how mobile computers could potentially facilitate mobility work and therefore support collaborative work on wards.

2.4.4.2 Unintended consequences and communication

Literature examining the unintended consequences of implementing health information technology, particularly in relation to communication, frequently reports unexpected issues in communication practices. Such alterations are of critical importance, as changes in the workflow and patterns of interaction between clinicians can significantly affect patient safety.

A case presented by Wachter (2015) highlights how information unintentionally concealed within an EPR interface can result in grave outcomes. Wachter narrates the story of a patient who arrived at a Texas emergency department displaying symptoms highly suggestive of Ebola infection. Despite the nurse documenting the patient's recent travel history to Liberia (then amidst an Ebola outbreak) in the EPR, the doctor failed to see this information, did not ask about travel history, and consequently discharged the patient. The patient's condition deteriorated, and he died secondary to complications of Ebola two weeks later.

Initial blame was placed on an alleged 'flaw' in the EPR (provided by EPIC), but it was later clarified that the actual cause was a communication breakdown, not a software issue. Regardless, in response to this incident, EPIC updated its system to make travel history information more prominent in both nurses' and doctors' workflows (Anderson-Fletcher *et al.*, 2015). It is uncertain how this scenario would have unfolded if a traditional paper-based system had been in use or with a different team of healthcare staff. But, repeatedly, changes in how staff communicate are reported in studies that look at the unintended consequences of EPR implementation.

2.4.4.3 The illusion of communication

One of the most commonly reported unintended consequences for communication patterns, which could underlie the reduction in synchronous communication, is the 'illusion of communication' (Ash *et al.*, 2007b). This is a situation where hospital staff falsely assume that information entered into a digital record will be seen and acted upon by the appropriate person:

> *'The clinical information system changes communication patterns among care providers and departments, creating an "illusion of communication", meaning that people think that just because the information went into the computer the right person will see it and act on it appropriately.'*
> *(Ash et al., 2007b).*

The quote encapsulates this phenomenon, where the entry of information into an information system is mistaken for effective communication and underlines an important unintended consequence of health IT implementation on medical work. Further exploring Health Information Technology (HIT) and communication, Dykstra (2002) based their insights on five years of qualitative data (collected via participant observation, focus groups, and interviews) from three different US hospitals. They found a significant shift from immediate interprofessional communication to more impersonal, technologically mediated communication. In addition, the feeling of physical presence, a vital aspect of communication in healthcare, seemed to be lost with the introduction of the CPOE.

> *'Docs picture it going into a black box, that it's a magic process, it's an illusion of communication.'*
> *'With handwriting, you knew it hadn't gone anywhere, so you pick up the phone.' Dykstra (2002)*

Similar issues arose in a focus group and interview-based study by US-based doctors, Embi et al. (2004). They looked at the theme of location: where doctors located themselves to work and how that impacted interprofessional collaboration and workflow. Their grounded theory-based content analysis of interview transcripts revealed that EPR implementation led to improvements in document accessibility but also changes in work practices, communication, document structure, and content. Moreover, it increased errors, concerns, and decreased confidence in data.

Weir (2011) used Clark's 'common ground theory of communication' (Clark and Brennan, (1991)) to further analyse the same data set (Embi *et al.*, 2004). Clark's theory bridges previous concepts of language, the cognitive (psycholinguistics) and the social (ethnomethodological), providing a general communication theory in which common ground is central. Common ground, that is, 'mutual knowledge, mutual beliefs, and mutual assumptions', is required to collaborate and communicate efficiently to create 'joint action' (Clark and Brennan, 1991). Weir found that whilst the EPR aimed to improve communication, it 'fails to support human collaboration in the deepest sense, and that is a source of joint action'. Solely facilitating data exchange was insufficient; users needed a shared understanding or common ground to collaborate effectively. This is the sort of understanding that can be generated more efficiently through synchronous communication and impresses the importance of interprofessional communication as a foundation of collaboration in medical care (Suter *et al.*, 2009; Schot *et al.*, 2020).

2.4.4.4 Co-presence

As described above, it is the haphazard 'multitude of conversations that pepper the clinical day' (Coiera, 2000), which have previously supported the generation of common ground in hospital work. In addition, co-presence, or being located in the same place as another worker, can aid communication and collaboration. Weir et al. (2011) found that the EPR can create a deceptive feeling of co-presence between staff, which can lead to an illusion of collaboration, even if the EPR does not offer functionalities to enhance collaborative work. Additionally, Weir et al. (2011) found that the EPR impacted on interprofessional communication practices in the case of nursing notes. The lengthy nursing notes, and the time commitment to read them, meant other clinicians tended avoided them, reinforcing the need for verbal communication alongside EPR documentation.

2.4.4.5 The role of the EPR in collaboration

In research exploring the unintended consequences of EPR implementation on collaboration, Chase et al. (2014) further conceptualised the collaborative role of the EPR as four different functions – as a monitor, repository, orchestrator, and messenger (see Table 3).

Table 3. Collaborative roles of the EPR (Chase et al., 2004)
Repository - the role of the EPR as a repository was to contain the data needed by healthcare providers.
Messenger – to enable communication and information transfer between the healthcare team.
Orchestrator – the EPR contained templates and standardised order sets which could 'drive workflows'.
Monitor – the systems within the EPR aimed at collecting data for quality analysis.

In this qualitative study, part of the SAFER project (Safety Assurance Factors for EHR Resilience (Sittig *et al.*, 2014)), observations and interviews with US-based physicians and providers were used to investigate the role of the EPR in collaboration. Chase et al. (2014) also described how users struggled with the illusion that by typing something into the EPR, they had communicated it. EPR users also explained what they called 'brain freeze', which described how they would forget to verbally communicate something after they had typed it into the EPR. If they were conceptualising the EPR as a 'messenger', it would help to explain why there was a change in face-to-face communication, with the falsely reassuring illusion of communication that electronic records seemed to create.

The problem with these collaborative roles of the EPR, as Chase et al. (2014) explain, is that supporting collaboration was fully encompassed within the original design of most EPR systems. This picks up on the point made earlier, by Gregory (2000), about the difficulty in aligning the multiple logics of EPR developers with the workflow support needed by the EPR users. It also emphasises how critical it is to understand how medical practices are intertwined with the medical record, so as to support medical work, which is intrinsic to providing safe and efficient care.

2.4.5 The medical record as a site of communication

I have set out how, previously, communicative practices on medical wards have been described as mostly synchronous, and commonly unplanned and haphazard (Coiera and Tombs, 1998; Reeves et al., 2004; Edwards et al., 2009). Weir (2011) described how, post-EPR implementation, it appeared that clinicians were starting to view the EPR 'as a platform for team functioning and patient interaction'. This was in contrast to the hospital administrators who saw the record as a fixed and legally accurate record of events.

It is possible that the clinicians could hold both views of the EPR and move between those views depending on the content of what they were writing. But, as I have described, the medical record can be conceptualised in so many ways that there is no single consensus which captures this. However, other researchers have described alternative developing understandings of the use of the EPR as a space to communicate. Håland (2012) conducted interviews with healthcare professionals and office staff in a regional hospital in Norway, focusing on changes in work practices and professional boundaries. The shifting boundaries of administrative work post-EPR implementation (that is, a perceived increase in administrative work for the medical staff) revealed how the interviewed doctors did not really consider that administrative work was medical work:

> *'The doctors separate work with the EPR from medical work, and in this way construct an important professional boundary where writing and reading the EPR is not defined as medical work' (Håland, 2012)*

Although this study only interviewed four doctors (of a total of 19 interviewees), it reveals how doctors can struggle to encompass the use of the EPR within the boundaries of their professional work. It raises questions about how doctors expect to collaborate with other staff if they are both diverting communication into the EPR and not conceiving interaction with the EPR as part of medical work.

This tension adds further to the 'paradoxes' of the EPR (Greenhalgh *et al.*, 2009), a tension which pulls between Berg's description of the medical record (1996), *as a fundamental, constitutive, element of medical practice'*, and that of the work of the EPR as barely being considered as medical work at all. As a result, Berg's conceptualisation of the medical record starts to fade as the EPR is imagined more as an administrative tool, for administrative work - the emptying of data into a repository.

2.4.6 Paying attention to care

In this chapter, many of the literatures I have discussed resonate with the proposition made by Annemarie Mol, a renowned Dutch sociologist and philosopher known for her work in science and technology studies. Mol (2008) urges that attention is paid not only to 'what technologies are supposed to do, but also to what they happen to do, even if this is unexpected.'.

I have also integrated various perspectives on the medical record, both in its paper and digital forms. This is to underline that the functionality, conceptualisation, and design of the medical record become integral to, or even co-create, the process of medical work.

I have also brought together conceptualisations of the medical record (paper and digital) to emphasise that what the medical record does, how it is imagined and designed, becomes part of, or co-constitutes medical work.

I then directed the literature review towards more specific aspects of medical work, and what is known about how collaborative and communicative practices look to be reshaping around the use of the EPR. But beyond these topics, if the medical record, and consequently medical practices are being altered, then care also needs to be attended to. Again, turning to Mol (with Moser and Pols (2010, p. 7)):

> *'if care practices are not carefully attended to, there is a risk they will be eroded.' (Mol* et al.*, 2010)*

Policy documents are not shy of attending to 'care' when it comes to promising positive outcomes from digitalisation. For example, earlier, I referenced a report from the Department of Health and Social Care (DHSC) (2018) which repeated a claim which is commonly made about the potential of healthcare technology, where improvements in 'care' are assumed to follow successful digitalisation:

> *'Digitisation will save health and care providers money and free up staff time – money and time that can be better used to provide great care.'*

In 2019, the Secretary of State for Health and Social Care commissioned a review into the future of healthcare using digital technologies, entitled, 'The Topol Review: Preparing the healthcare workforce to deliver the digital future' (2019). This report went further with how it expected that care would be improved and was written with the following 'pre-supposition' (2019, p. 7):

> *'A marked improvement in the patient-clinician relationship is possible, owing to the gift of time delivered by the introduction of these technologies. This will bring a new emphasis on the nurturing of the precious inter-human bond, based on trust, clinical presence, empathy and communication.' (Topol, 2019)*

These quotes 'pre-suppose' that technology will afford more time and that the 'gifted' time will be spent on providing 'great care', with the emphasis on 'nurturing of the precious inter-human bond'. How this would happen, what great care means, and the material place that technology might occupy within these interactions is omitted from these accounts. This narrative, and the promise of technology in releasing time to care, continues to be pervasive in NHS policy, as evidenced by the NHS Long Term Workforce Plan (NHS England, 2023). Again, taking advantage of technologies is positioned as a clear priority in meeting the needs of the NHS, and 'free[ing] up clinicians' time to care' (NHS England, 2023, p. 5).

Understanding how these promises translate into clinical practice and examining the notion of time being 'released' for caring through the use of 'technologies' has significant implications for care practices (Mol *et al.*, 2010). This perspective aligns with the views of Buse, Martin, and Nettleton (2018), who highlight the importance of closely scrutinising the objects that often go unnoticed in the background of care. While healthcare reports and policies often focus on the potential of data and technologies, they tend to overlook the work of managing the objects which mobilise healthcare data and the care required to handle them effectively, including the associated data.

I have explored how collaboration between staff members working on hospital wards is complex and how staff rely on methods of communication which are both together (synchronous) and apart (asynchronous) in time and place. Many of these communication channels, which have evolved to channel information both synchronously and asynchronously, have relied on physical artefacts such as charts, lists, and books. Simple, mundane objects, many of which have historically been paper-based.

2.5 Conclusions

Health information technology (HIT) is heralded with possibilities of positive consequences. EPRs have been implemented with the promise of facilitating efficient, safer, and cheaper healthcare systems. By and large, these desirable consequences have yet to materialise to the extent which was hoped for, but what has become apparent is that the introduction of IT, such as EPRs, into healthcare environments can produce new problems. These have been called unintended consequences.

In this literature review, I have presented the medical record as an active and complex object. It orders, combines, and collects diverse knowledges, and the manner in which that happens helps to shape the trajectory of the patient whom it represents (Berg and Bowker, 1997).

Most of the research I have drawn on is qualitative, using field observations and interviews to collect the perceptions of EPR users. Most of this USA-dominated research is published in the medical informatics literature, along with other papers of similar methods (Yu *et al.*, 2013; Park *et al.*, 2013; Noblin *et al.*, 2013), that have found the same recurring themes. Repeatedly it is described that EPR implementation can lead to a reduction in face-to-face communication between healthcare providers who are falsely reassured that just the act of documenting a task in the EPR will lead to it occurring (the illusion of communication) (Dykstra, 2002).

Despite the lessons learnt in the US, there is still relatively little research into the evolving unintended consequences in inter-professional communication practices, and virtually none are based in the NHS. Now that EPRs are starting to mobilise throughout acute NHS hospitals, there is a need to carefully examine, using suitable qualitative methods (Greenhalgh and Swinglehurst, 2011), how they shape care and collaborative practices between clinicians and clinical teams in our local context.

The existing body of research also lacks a thorough exploration of how the EPR, embodied through mobile computers, is reshaping medical practices. Moreover, the absence of paper and the consequential shifts in practice are not well understood in this context. Understanding how the materiality of the record interacts with practice in various forms is key to this research. In the next chapter, I will describe the research methodology underpinning this project.

3 Methodology

3.1 Introduction

This chapter will describe the research methodology and design used in this thesis. I begin by setting out my theoretical and philosophical stance and how this has informed the methods selected in this thesis. I will illustrate how my approach has been influenced by the literature of science and technology studies (STS). Specifically, I will explain how I plan to employ actor-network theory (ANT) as a lens through which to conceptualise my research questions and as a way to think about complex healthcare settings. I will then describe why and how I have chosen to use ethnographic methods.

3.2 Outline of my theoretical/philosophical position

In the introduction to this thesis, I provided an account of my training in clinical medicine, where I predominantly utilised quantitative research methods. How it is possible to understand the nature of reality (ontology), the relationship between the knowledge and the researcher (epistemology), and the ways in which that knowledge was attained (methodology), differ in important ways between qualitative and quantitative studies (Creswell, 2013). Quantitative studies usually align with the positivist tradition, which upholds the belief that there is an objective reality that can be studied, measured, and understood (Denzin and Lincoln, 2018). Researchers employ rigorously controlled experiments to test hypotheses while maintaining impartiality. While this approach may be effective in measuring gravity or calculating the fuel required for space exploration, it is insufficient for understanding the complexity of human life and society.

Alternative approaches and ways of conceptualising issues are necessary in this context so as to capture the multifaceted and nuanced aspects of human experience that quantitative methods may overlook. Qualitative methods have been employed to generate explanations for the associations or relationships that may be found in quantitative work (Pope and Mays, 2006). As such, I lay out the underlying the philosophical position here, which leads to the selection of a qualitative research design, before moving on to further consideration of why I have taken this stance in the setting of this research.

A paradigm is a set of beliefs or worldviews based upon ontological, epistemological, and methodological assumptions (Guba and Lincoln, 1994). In this thesis, my philosophical and theoretical framework is grounded in the constructivist paradigm (Creswell, 2013). Contrary to my previous training, which has been saturated in positivist thinking, this paradigm recognises the complexities of human experiences and the constructed nature of reality.

In line with this perspective, my research adopts an interpretivist ontological position (Schwandt, 1994). According to this position, reality is not an objective entity but is constructed and understood through the interpretations and experiences of individuals. This view asserts that there is not a single, immutable reality, but instead, multiple realities that are shaped and perceived differently by different individuals or groups. This position acknowledges that how the EPR is understood is subjective and varies across individuals, including patients, doctors, politicians, and managers.

To clarify further, within this paradigm, I do not see the EPR as a fixed entity but rather a concept subject to different interpretations based on, for example, profession, employment, or personal experiences. Consequently, epistemologically, I recognise that my understanding of the EPR is shaped by my interaction with the research subjects as well as my own experiences. Methodologically, and based on these positions, I will use qualitative methods to explore the multiplicity of meanings attributed to the EPR. Underlying this is the understanding that social phenomena, such as the concept of EPR, are not fixed or objective entities. Instead, their meanings are constructed and negotiated by the people involved in those social contexts (Bryman, 2012, p. 33).

3.2.1 Ontological considerations

Qualitative enquiry requires the researcher to look thoughtfully at their own position regarding the creation of knowledge, as that will reflect on how the data can be interpreted (Fleetwood, 2004, p. 28). The EPR, which is packaged up and sold by numerous software providers, has a broad technical definition, but what it actually *means* and how it is enacted is another matter. That it can hold multiple meanings to different groups of people, to patients, to politicians, to doctors, to managers, is an illustration of how a 'thing' can be simultaneously known in many different ways.

Greenhalgh (2009) identifies four philosophical positions that are often taken by electronic patient record (EPR) researchers. There is the positivist position as described above. Conversely, the interpretivist position maintains that reality is socially constructed and, thus, cannot be explained objectively, as any observer brings their own values and beliefs to the situation. Researchers taking a critical position argue that social order is unstable and involves a balance of power between groups, with one group becoming dominated by the other. This position seeks to challenge power imbalances. Finally, the recursive or integrative position assumes that subject and object, micro and macro, social structure and human agency are reciprocally related and that 'the purpose of research is to explore the flux between these various dualities over time'.

Believing that users of the EPR can conceive of it differently depending on, for instance, their position and status in society, their employment, and their life experiences is a viewpoint that sets itself apart from the positivist paradigm. Taking the understanding that reality is not out there to be discovered, but is instead constructed socially, is known as constructionism (Crotty, 1998).

3.2.2 Epistemological approaches

In the introduction to this thesis (see section 1.3), I described how, in my own practice using an EPR, I became aware that where staff did their work had shifted. For example, as the desktop computers containing the EPR required work to be done in a fixed place, the healthcare assistants were no longer able to sit with patients as they completed their observation charts. This meant that they were unable to spend as much time with patients as they had been used to, which as hospice staff, they found frustrating and upsetting.

Understanding how the EPR led to these changes in practice would have been difficult to capture using quantitative methods. Quantitative metrics might have demonstrated a count of clinical encounters, uses, referrals, or satisfaction ratings, but they would not have been able to explore the experience of how changes in work were occurring in practice. For example, as I described in the literature review, when the introduction of an EPR seemed to cause an increase in mortality in a paediatric emergency department (Han et al., 2005) (see 2.4.2), qualitative methods were utilised to gain an in-depth understanding of the social and cultural context of the scenario. This ultimately revealed numerous small but significant barriers to the provision of timely care (Greenhalgh and Swinglehurst (2011).

Following on from the ontological and epistemological position I described above, I will now introduce the methodology that has been employed in this research.

3.3 A sociotechnical approach

The healthcare environment is recognised as being a complex research site (Plsek and Greenhalgh, 2001). In acknowledging this complexity, it was important to find a methodological approach that could cope with studying the EPR situated in the messy realities of healthcare. In the examination of such complex sociotechnical systems, Actor-Network Theory (ANT) has been suggested as a valuable lens through which to examine the role of technology in shaping social processes in healthcare (Cresswell et al., 2010; Greenhalgh and Stones, 2010; Goff, 2014).

I will now give a brief introduction to ANT. Firstly, I will discuss what I understand ANT to mean, then I will outline how I intend to use ANT in a pragmatic and specific way within this project, emphasising its relevance and practical application in the study of information systems.

3.3.1 Actor-network theory at a glance

Actor-Network Theory (ANT) is an ongoing project arising out of the field of social sciences, but with research applications across disciplines. Actor-network theory was principally developed by sociologists Bruno Latour (1988), Michel Callon (1984, 1986), and John Law (2001, 2007). It asserts that all entities in a network, both human and non-human, should be of equal significance and agency, making them 'actants' or 'actors' within a network. Further explanation of these terms will follow below, but the essence of ANT, and what made (and still makes) it a radical idea, is the shift from traditional social science perspectives, which often foreground the roles of human actors while relegating non-human entities to the background (Farías *et al.*, 2020). Actor-Network Theory (ANT) gives all actors, be they humans or non-human entities, such technologies, artefacts, animals, and even ideas, the same potential status within networks.

As John Law, one of the key proponents of ANT, encapsulates, the theory offers:

> *'…a disparate family of material-semiotic tools, sensibilities and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations. Its studies explore and characterise the webs and the practices that carry them.' (Law, 2007)*

This description of ANT emphasises the commitment to a relational ontology, highlighting the importance of 'continuously generated' entities, be they human or non-human. According to ANT, these entities are continually creating connections inside complex actor networks, which in turn create social realities. This is supported by the idea that an actor's identity, role, and capabilities are defined by its relations to other actors in the network, suggesting that an actor lacks any inherent attributes independent of these relations (Latour, 2005).

In ‘Actor-network Theory: sensitive terms and enduring tensions’, Mol (2010) offers a concise summary of ANT’s central aspects, which I will now draw on to explain some of the key terms.

3.3.1.1 Actors

Actors, or actants, include not only humans but also objects, ideas, or environmental factors—anything that has an effect or ‘shifts actions’ (Akrich and Latour, 1992). Mol offers that while an ‘actor acts’, ANT refrains from defining ‘actor’ in a rigid manner, instead leaving room for exploration and multiple interpretations. This fluid understanding of the term ‘actor’ opens up ‘layers and possibilities’ (Mol, 2010, p. 257). Latour’s description is in tune with this. He writes that the actor in ANT is ‘something that acts or to which activity is granted by another […] an actant can literally be anything provided it is granted to be the source of action’ (Latour, 1996, p. 373).

For example, McDougall et al. (2016) used ANT to consider ‘fluid’ as an actor in the network of heart failure management when exploring intraprofessional care for patients with advanced heart failure. One of the symptoms of heart failure is breathlessness, predominantly caused by the accumulation of fluid in the lungs. But it is not uncommon for patients with heart failure to also have kidney failure. McDougall explains that this leads to patients being under the care of both cardiologists and nephrologists, who often have divergent views as to the management of this excess and problematic fluid. The cardiologists want to medicate it away by forcing the kidneys to work harder, but the nephrologists want to protect the kidneys from being overstressed. The result is that the fluid forces the professions to become entangled (McDougall et al., 2016). The fluid is experienced and conceived differently depending on where you are in the network. The cardiologists want to ‘dry’ the patient, the nephrologists want to keep the kidneys ‘wet’, whereas the patient wants to be able to breathe more easily. The fluid becomes a site of ‘collaborative entanglement’ (McDougall et al., 2016). The benefit of looking at this through an ANT lens and paying attention to a non-human actor (the fluid) is that it gives the different disciplines an alternative understanding through which to practice and, ideally, a route to improve collaboration.

The emphasis on actors being both human and non-human is what Callon (1984) calls 'generalised symmetry'. It requires that the non-human is not neglected and that inscriptions, technologies and materials, get more equal weighting. 'Conflicting viewpoints' should be examined 'in the same terms', as with the example above, the viewpoints of the cardiologists and nephrologists, the fluid, the heart, the kidney, and the patient's breathlessness.

3.3.1.2 Effects of networks

Continuing with Mol's dissection of the expression 'Actor-Network Theory', we turn to network (Mol, 2010, p. 257). What is a network? Mol sets out to explain the term through the phenomena of its relations. For example, a fish is not 'just a label with an arrow pointing to the swimming creature'. It is recognised by its contrast with 'meat' in the supermarket as well as by its association with 'gills' or 'scales'. A fish is also dependent on other things, such as water, at the correct pH and temperature. It is as such, Mol writes, in a network, that actors are active whilst they are being enacted by what is around them.

In the literature review, I discussed the tensions in EPR research and the various ways the EPR can be conceived, depending on the research tradition from which it is viewed (see section 2.3). With the application of ANT, the EPR cannot be viewed as a singularly defined object; it can be identified as an 'actor' whose relations with other actors in the surrounding network are traceable.

If the network 'falters', the actor may falter too. Mol illustrates this with reference to the documented failures of networks when actors travel, such as the case of gasogene burners in Costa Rica (Akrich, 1993). The gasogene burners, imported from Scandinavia, were adapted to burn corn stalks in Costa Rica (Akrich, 1993), but the stalks, which had never been stored in such a way before, were feasted upon by an opportunistic bug, and the 'network' broke down. The burners stood unused, lacking in fuel. This relates to the statistic that up to 70% of donations of medical equipment to sub-Saharan African hospitals are unused (Perry and Malkin, 2011). A World Health Organisation report (Howie et al., 2008) investigated a case in which 20 oxygen concentrators were donated to a hospital in the Gambia. Within weeks, the concentrators fell out of use. Interviews with hospital staff revealed a combination of social and technical issues that contributed to this outcome: the units were incompatible with the Gambian power supply and could not be retrofitted, there was no technical expertise or supply network available for maintaining the concentrators, staff lacked the necessary skills to operate the concentrators, and there was a sentiment that obsolete equipment was being 'dumped' on them, despite good intentions.

This example highlights the importance of considering both social and technical factors when implementing new technology in healthcare settings, and how the interactions among various actors can significantly impact the success or failure of a network. Mol (2010) refers to 'one of the great classics of actor-network theory', Callon's case of the electric vehicle (Callon, 1986). An electric car cannot rely solely on its design; it must attract interest and create a network of associations. Questions arise about financing, production, usage, regulatory changes, charging and maintenance, and its place in a world with various transportation options. Such is the variety of associations formed that 'associations', Mol writes, 'cannot begin to cover all forms of relatedness'.

As with the example of an electric vehicle, it is possible to imagine how ANT could be used to map the variety of associations needed to support the implementation of an EPR in a hospital. But it becomes more complex as the networks layer and the actors develop fluidity (flow and change). Mol plays with the idea of the multiple, explaining how actors participating in different 'networks, discourses, logics, modes of ordering, practices' become complex and offer alternate realities between sites.

In 'The Body Multiple', Mol demonstrates how a condition such as atherosclerosis can have multiple realities (Mol, 2002). Mol's ethnographic account presents a 'patchwork image' (p151, 2002) of how disease is enacted differently depending on which practices and practitioners are involved. To a physician taking a history of leg pain in a clinic, atherosclerosis is a different thing to that of a histopathologist seeing it under a microscope. The alternate ways of investigating atherosclerosis across medical specialities, through various practices, taking a history or using dye, duplex ultrasound, or the microscope, do not necessarily align, resisting a constant clear definition of what atherosclerosis definitively is. Mol's argument is that these are not different perspectives of a single reality (or disease), but rather that they co-exist in practice as multiple realities. 'The manyfoldedness of objects enacted does not imply their fragmentation', and they manage to hold together whilst simultaneously containing 'gaps and tensions' (p84, 2002).

Mol concludes that ANT should not be classified as a 'theory'. However, if it is taken to be one, it should be used as an 'adaptable, open repository'. This approach captures my usage of ANT as a guide to 'attune to the world' (Mol, 2010). Rowland et al. (2011), reflecting on Latour's Reassembling the Social (2005), describe that though ANT may not be a ready-made toolkit, it is instead a 'workbench on which new tools can be built'. Farías et al. (2020) describe ANT as an 'intellectual project that is always in beta', i.e. not fixed or rigid in its form. I take from this that ANT can be applied in a flexible way, that it can be used as a foundation (workbench) with the spirit of 'making visible actors and articulations that challenge otherwise stabilised conceptualisations of 'the social'' (Farías et al., 2020). ANT provided me with a lens through which to follow the complex and messy interactions among various actors in a network, such as those found in the implementation and use of EPRs in healthcare settings. This is an approach that has been advocated for by other researchers concerned with the implementation of electronic records in healthcare (Cresswell *et al.*, 2010; Cresswell, 2019):

> *'Due to its limitations, the traditional "purist" ANT approach is likely to be too restrictive and too prone to getting lost in detail to be usefully employed in studying health IT implementation … It is therefore often employed in conjunction with other theoretical lenses under the more general sociotechnical umbrella.' (Cresswell, 2019)*

By employing ANT as a lens through which to study the EPR in use, I have been able to trace the relationships and interactions between human and non-human actors, including clinicians and EPR systems, and make visible the more mundane objects and emerging material elements of the network. By embracing the complexities, fluidities, and multiplicities inherent in the networks surrounding the EPRs, I have been able to gain a deeper understanding of the intricate web of relationships and associations that ultimately shaped the use of EPRs in clinical practice.

3.3.2 Challenges and limitations of an ANT approach

There are potential challenges to using an approach informed by ANT. I will summarise some of the main criticisms of ANT below, along with how they might apply to my research and how I plan to answer to them.

3.3.2.1 The problem of generalised symmetry

When ANT was first discussed in the 1980s, the attention it gave to non-human actors caused controversy (Gad and Jensen, 2010). When ANT employs its most ‘radically relational approach’ (Sarker et al., 2006), it does not discriminate between the human and non-human. But, even if ANT sets out to describe actants equally, it does not seek to diminish the importance of people and society (Doolin and Lowe, 2002). My use of ANT aimed to uncover how the mundane objects of the EPR are reshaping medical practices, but the people involved in enacting the practices also constituted a central component of my research.

In their paper, ‘To reveal is to critique: actor-network theory and critical information systems research’, Doolin and Lowe (2002) argue that,

> *‘The very act of tracing the network and the actions of its constituents, combined with a refusal to a priori make distinctions or grant status, enables a critical light to be shone on the assumed, the mundane and the status quo.’ (Doolin and Lowe, 2002)*

This view of ANT accepts that the human and non-human will both be examined, but allows critique to be placed on systems, processes, and hidden relations, which may not have been uncovered without tracing the network. It allows exploration beyond the boundaries of a ward or clinic room, where an alternative EPR project focusing on medical work may potentially be constrained. It encourages the opening of closed doors (into medical records, clinical coding) to 'follow[ing] the actors themselves' (Latour, 2005, p. 5) and the application of scrutiny, concern, and morality to whatever new realities of medical work are being formed.

3.3.2.2 An amoral stance

ANT traditionally views the researcher as detached or agnostic (Cresswell et al., 2010), which leads to the concern that professional and moral issues may be neglected (Greenhalgh and Stones, 2010). But, again, it can be argued that ANT is primarily about description, and the person doing the research has to decide to what extent they will draw out the ethical and moral issues. As Latour (1990) put it, 'in order to make a diagnosis or decision about the […] amorality […] of an innovation, one must first describe the network'. This means that through opening up networks via ANT descriptive analysis, there is an expansion in the possibilities of where the scrutiny of professional and moral issues can be placed.

This concern also highlights the need to be reflexive. As a researcher using ANT, I will be eliciting and constructing accounts of the actors in the network, of which I will also be part. In editing and rendering the data to produce an academic output, I will have to make selections which will co-produce the story. In this way, being reflexive about how the information is shaped by my actions is critical.

3.3.2.3 Problems of description

Walsham (1997) states this last issue is more of a 'mundane' problem. That ANT studies 'produce such a veritable mass of detail'. The mapping of limitless networks can lead to the production of a large amount of description. One way of keeping this under control is to 'examine the networks by tracing how an infinite number of entities grasp one another in a limited number of ways' (Latour 1996b). This could be achieved through the specificity of the research questions and aims, which can help to guide the researcher in setting boundaries in how far to trace the actors across networks. For example, at the site of my study, my research is confined to the hospital trust. Without that boundary, I could extend my fieldwork to the Lorenzo software developers in Chennai, India, or to remote Lorenzo servers scattered across the UK. Keeping a focus on the research aims throughout data collection assisted in producing a more targeted and manageable collection of details and descriptions.

Another problem with disentanglement and the mass of detail that ANT produces is that to deal with the data, a line must be drawn somewhere. Networks are potentially limitless, but at some point, limits to exploration will be reached, and parts of the network will not be examined. To relate back to the previous point, this means taking an ethical stance, as where the accounts stop will lead to one actor being neglected in favour of another. For example, in this project, I have prioritised medical work over the experience of patients, which I will discuss later in this chapter.

Above, I have described ANT and its influence on my thinking and research methodology. However, I am also aware of how it has been criticised, particularly that as good as it is in creating description, it cannot necessarily be relied upon to help make sense of the findings. As such, as I proceed through this project, I will draw on other literatures and theories to help explain and develop meaning in my findings.

I will now move on to explain why I have chosen to use ethnographic methods through which to apply ANT, and how they will enable a sociotechnical approach to this project.

3.4 Ethnographic methods

3.4.1 Ethnography

Ethnography, a practice originating from anthropology, involves understanding and writing about a community or culture, typically after an extended period of fieldwork within the group being studied. While earlier ethnographic studies often focused on remote cultures distinct from the researcher's own, contemporary ethnography encompasses a wider range of research contexts and approaches (Marcus, 1995).

Hammersley and Atkinson (2007) describe that ethnographic work usually contains the following features:

1. The research is conducted 'in the field'. This means the actions and accounts of people are examined in their everyday settings, as opposed to researcher-made environments, such as 'experimental setups' or 'highly structured interview situations'.

2. Participant observation, interviews, and informal conversations are usually the main source of information, but data can be obtained from a variety of sources, including documentation.

3. Data collection is predominantly 'unstructured'. This means that the research design is not 'fixed' at the start. Furthermore, interpretive categories are not built into the data collection process (through, for example, questionnaires). They are 'generated out of the process of data analysis'.

4. The focus is typically on a smaller number of cases, to facilitate 'in-depth study'.

5. The analysis focuses on the interpretation of the 'meanings, functions, and consequences of human action and institutional practices, and how these are implicated in the local, and perhaps wider, contexts'.

Ethnography and participant observation is a 'process of critical engagement with our own being-in-the-world, beyond the taking for granted of what already exists' (Van Loon, 2001). It emphasises the description of the culture of a certain social group or system, seeking to not only observe but also interpret. Through immersion in a chosen place, environment, culture, or practice, the researcher is able to gain an 'emic' perspective (Pike, 1967), or an insider's viewpoint. This emic perspective is instrumental in producing a 'thick description' (Geertz, 1973) and rich data on the cultural phenomena under study. As Geertz (1973) explains, 'thick description' involves discerning not only what is being said or done, but the context-dependent meanings that underlie them. The result is a detailed and layered understanding of the cultural constructs that shape and are shaped by human behaviour.

3.4.2 Ethnography in healthcare

The application of ethnography to hospital settings has gained prominence as a qualitative research approach in examining the organisation and delivery of healthcare (Savage, 2000; Greenhalgh and Swinglehurst, 2011). In healthcare, ethnographic methods have been used widely used to understand the cultural contexts around a variety of quality improvement and safety problems, including EPR implementation (Winthereik et al., 2002; Bruni, 2005; Leslie et al., 2017).

Dixon-Woods (2003, 2010) highlights how ethnographic research can be adept at questioning taken-for-granted practices and describing routine behaviours in their natural environment. Ethnography excels at examining areas where measurement is challenging, where problems are complex and multifaceted, and where it is necessary to uncover the hidden rather than the obvious. It is 'well-suited for identifying conditions of risk', especially when they entail technological and social interactions, organisational and cultural dynamics, and human performance (Dixon-Woods, 2003). Human interactions which will are likely to be missed through quantitative methods:

> *'It can capture the winks, sighs, head shaking, and gossip that may be exceptionally powerful in explaining why mistakes happen, but which more formal methods will miss.' (Dixon-Woods, 2003)*

The observation of the EPR-in-use is particularly relevant to this, as hospital staff can find it difficult to explain, solely through words, how they use the EPR. This view is supported by Halford et al. (2010), who emphasise that there may be tacit relationships between routine work and record-keeping procedures to the extent that those practices cannot be easily articulated by users of the systems:

> *'We must not assume that simply asking people to describe how record-keeping systems are part of everyday work will necessarily elicit explanations.' (Halford et al., 2010)*

This strengthens the argument for using ethnographic methods in the context of my research, and the importance of observing medical work and technology in practice. In this way, ethnography can be valuable in revealing the unintended consequences of technology use (Winthereik et al., 2002). Ethnographic research can bring together insights from across complex networks to help explain what is happening by developing a deep and contextually rich grasp of the social setting in which unintended consequences arise.

3.4.3 Positionality

A key component of ethnography is recognising and reflecting on your, the researcher's, positionality and the influences that shape your views (Davies, 2008). Due to the close proximity that an ethnographer has with participants and the ethical concerns that arise from this relationship, reflexivity—or the relationship a researcher shares with the world they are researching—is a key component of ethnographic study (Reeves et al., 2008). In ethnography, the researcher can be considered the primary instrument of knowing (Guba and Lincoln, 1981). As such, it is crucial for the ethnographer to be sensitive to their own effect on the situation they are observing.

As I have described above, healthcare ethnography often includes participant observation, which places the researcher amidst the community being studied (Angrosino, 2007, p. 2). To what extent researchers can feel immersed or participating in this setting can depend on a number of factors. Wind (2008) considered the extent to which researchers can be true participants in hospital settings. Even as a trained nurse conducting ethnographic research, Wind felt that the dual role of healthcare professional and ethnographer negated full participation. To more accurately describe her experience, she proposed the term 'negotiated interactive observation' to reflect the healthcare professional ethnographer's role.

My own participation as an observer was not only a negotiation with the immediate clinical environment, but also a reflection of what had been permitted in the process of ethical approval. In conducting a 'staff-only' project, I approached the field aware that I had to construct 'invisible barriers' around patients, so that I would not pay attention to their clinical details (as per my ethical approval). In order to do that, I aimed to maintain a distance from the bedside while observing mobile computer use, further altering my level of participation in ward rounds.

Davies (2008) notes that more important than the extent to which an observer is accepted as a participant is the 'circumstances and quality of the observation', along with critical reflexivity as to the nature of their participation. I will go into further detail as to how I considered my role as a researcher in 'participation' during my observations in section 4.4.1.

3.4.4 My role as a researcher

As I have described, this project used ethnographic methods to explore and understand the role of the EPR and mobile computers within the hospital, looking through the lens of actor-network theory as a guide to my approach. An intrinsic part of the epistemological approach I have described, is the consideration of my personal role and where and how my methods may impact the research findings.

As I accompanied and observed medical staff on ward rounds, it was important to reflect on how my presence could have affected the observation environment. My position, the effect of my presence, and my own understanding of the social world influenced the generation of methods, values, prejudices, and decisions, and needed to be under constant consideration (Bryman, 2012). This reflexivity is an important part of the qualitative research process and is part of the constructionist understanding that knowledge is jointly and socially constructed (Finlay, 2002).

As a medically trained doctor, conducting research in a hospital, my research could be considered an 'insider ethnography'. This is a term to describe ethnographic research set in an environment where the researcher is already a member (Dwyer and Buckle, 2009). The advantages of insider ethnography involve having a pre-existing familiarity with the culture, with benefits such as sharing an identity with the participants and having a good understanding of the professional language in use. These familiarities can promote trust and openness among research participants, but this can also lead to the risk of over-familiarity, where the researcher may take certain aspects of the group for granted and thus overlook important details (Mercer, 2007). Therefore, insider ethnography requires careful reflexivity, which involves continuous reflection on positionality, and the impact of the researcher on the research process. The use of reflexivity can help to mitigate some of the challenges of insider research and enhance the credibility of the findings (Arber, 2006).

As well as being concerned with my effect on the participants, there was also the potential effect of the ward environment on me. Being on a hospital ward, but as a researcher rather than a doctor, was a rite of passage (Borbasi *et al.*, 2005). I had to have an awareness of being 'betwixt and between', belonging to the categories of both researcher and doctor, but at the same time belonging to neither (Long et al., 2008). This continual adjustment of my professional identity was in flux with how my observation participants perceived me, what they believed my needs as a researcher and/or doctor were, along with their own beliefs about how they should treat a medically-trained observer on a ward round.

Hospital-based medical professionals are particularly used to being watched, especially in teaching hospitals where observations and interaction with medical students are normal and often (Svensberg *et al.*, 2021). On the other hand, being observed by an unknown ethnographic researcher-doctor is unusual, and had the potential to lead to suspicion (Simmons, 2007).

Angrosino (2005, p. 734) emphasises the importance of the researcher setting out their personal experiences and the context in which they are approaching the research. I have woven my background and experiences throughout the thesis so far and will continue to do so as the thesis proceeds. In the following methods chapter, I will lay out how I experienced some of these considerations when I was on the medical wards.

3.4.5 Photographs and illustrations

As well as observing the use of the EPR and conducting semi-structured interviews, I have also employed photography and illustration as part of my ethnographic methods. Heath et al. (2018) describe how along with observational sketching being a method of creating visual data, drawing in a fieldwork diary can be a tool for thinking. To draw, Heath et al. (2018) say, is to create 'concentrated seeing'. They appreciate the 'sketchiness' of drawing, that it is imprecise and edits away extraneous detail, drawing focus to what is important. A quick sketch with a few words can rapidly capture a scene, especially when you are looking at how teams of moving people (a ward round, for example) are interacting with things (mobile computers).

To complement sketching, I added the camera to my toolbox to assist in the illustrative capture of the hospital and the technologies. This was to take photographs of areas and devices without patients. The combination of the drawing and photography assisted me in being able to look back and see further detail that might have been missed in a quick sketch.

I used the photographs to make visual transcriptions, by which I mean I traced and made representative images of the devices and spaces I saw. This method allowed for any identifying features to be drawn out of the images, anonymising the participants. This sort of tracing of images is advocated by the ethnographer, Causey (2017), who says that the ethnographic application of tracing is in the great care attended to the examination of the images, that 'making outlines' allows you to 'register details that might not appear on first look'. I will describe this process in more detail in section 4.3.4.

In this thesis, I bring together these different techniques; watching and writing, drawing and tracing, asking and listening, to paint a picture of how clinical work is being reconfigured in the presence of (and interwoven with) new technologies.

3.5 Relating sociotechnical methodology and ethnography back to the research questions

The overall aim of this project was to examine how the electronic patient record is shaping working practices on NHS hospital wards in England, paying particular attention to communication, collaboration and care. In exploring medical work, this project has embraced ethnographic methods as a way of investigating how the medical ward round was being shaped by the use of the materialised EPR.

As Orlikowski and Iacono (2001) described (see section 2.1.8), devices, once manufactured and implemented have a tendency '*to disappear from view, be taken for granted*' or can be *'presumed to be unproblematic'*. Actor-network theory was used as a lens through which the ethnographic eye could view how medical work and ward rounds were being enacted within a network undergoing reconfiguration due to the removal of paper records. This provided the opportunity to shine a 'critical light' (Doolin and Lowe, 2002) on the mundane, looking at how the claims and assumptions made about the electronic devices housing the EPR were being realised in clinical practice.

ANT also provided the opportunity to follow the actors beyond the ward, and map associations that configured the EPR, as well as how the EPR was shaping the hospital.

Keeping focus on the research question, this thesis will look at how communication, collaboration, and care are applied across this network. The EPR network, even just within the hospital, is vast and highly connected. Employing the materials housing the EPR as a central point of focus for observation has allowed for the exploration of how the materialising EPR-user (assemblage) is entangled with the ward around it. This project has considered how communication, collaboration, and care are shaped by this assemblage and what this means for medical work.

3.6 Methodology and research design summary

I have explained the research background from which I approached this project and how I have come to understand my ontological and epistemological positions. The EPR is understood in many different ways, depending on whether you are a doctor or a patient, a politician or an organisation. This recognises a relativist world in which there are multiple realities.

After being influenced by the sociotechnical approaches, I explained why I chose to use actor-network theory (ANT) as a lens through which to conceptualise my research questions and as a way to think about the networks and actors of digitalising medical work, be they human (staff) or non-human (the objects of the EPR).

I then introduced ethnography and explained why ethnographic methods were chosen to complement a sociotechnical lens in a healthcare setting. In qualitative research, the researcher's position shapes the research at every stage, and as such, the researcher should be explicit as to what their personal standpoints are. In this chapter, I have discussed how I recognised myself as a researcher on a medical ward, being an almost-participant observer. In addition, I will continue to provide further reflections relating to my role as a researcher in the following methods chapter.

4 Methods

4.1 Introduction

Informed by the principles of actor-network theory, as discussed in the preceding chapter (see section 3.3.1), the data collection process for this research was an application of ethnographic methods across the network of the materialising EPR. This chapter outlines the detailed methods of data collection and analysis used in the research.

I begin by explaining how I selected the research sites and recruited participants. This includes details of how I accessed the sites and how participants were selected for the study. I will then go on to describe the specific methods of data collection. This part will present how observations and interviews were conducted, inclusive of specific details relating to the number of hours spent across locations and interviews recorded. I will also describe how and where photographs were taken and the various documents that were gathered for analysis.

I will then detail the data analysis process, highlighting how the accumulated data from observations, interviews, and documentary analysis were engaged with to create meaningful insights and findings. The chapter will close with reflections on my role as a researcher. This section will include a discussion on considerations pertinent to qualitative research, such as the quality of research findings and the extent to which these findings can be generalised.

4.2 Gaining access to the study site

This PhD project was initially devised as being in collaboration with the 'Chief Clinical Information Officer' (CCIO) of Compass Hospitals NHS Trust (CHNT). He was aware that the trust, through the EPR, was accumulating vast amounts of data and was keen to give researchers access to the 'data warehouses', where data from the EPR was being 'deposited'. Although this did not align with my research aims, he supported my plans to carry out observations of the Lorenzo EPR in use and sponsored my application to do research in the trust. He had previously been a full-time physician, but in the CCIO role had reduced his clinical sessions and no longer participated in inpatient work. Throughout my fieldwork, he was able to provide me with contacts in the IT (infrastructure, training, command and control, helpdesk) and EPR departments, but not the clinical sites (medical wards).

Gaining access to the inpatient wards took a longer period and was a more complicated process. Compass Hospitals NHS Trust was spread over three hospital sites, all of which had the same EPR (Lorenzo) and devices (such as mobile computers, iPods, and electronic whiteboards) across their wards. For reasons of geographical convenience, I chose to base my fieldwork at the medium-sized site, Weston District Hospital (WDH). After some time spent waiting for replies to emails from ward managers and clinicians, it was through a random meeting on a train that I connected with a 'gatekeeper' (Pope and Mays, 2006), a specialist nurse who gave me several points of contact, and this ultimately proved most productive. These contacts led to access to ward A (an acute medical unit) and ward B (a medical ward), where I was invited to attend ward rounds and observe staff.

Overall, and in retrospect, I believe it was beneficial to the project that I found and gained my own access to ward locations. If the CCIO had provided me with contacts, they might have been on 'test site' wards, where the trust IT team regularly took visitors to demonstrate their newest innovations. How the devices and the EPR on these wards were used might not have been reflective of practice across the trust (although not without its own interest).

The difficulty I had in connecting with staff via email could have been related to my fieldwork commencing at the same time as an unplanned Care Quality Commission (CQC) hospital inspection. The inspection would have placed significant extra pressure on the ward managers, so I did not pursue contact with them at that time. I will discuss how the inspection may have impacted my ward-based observations in section 4.4.1.

The overall aim of this project was to explore how practices were evolving around the emerging mobility of the materialised EPR. However, in alignment with Actor-Network Theory (ANT), I extended the network of the EPR beyond the boundaries of the ward. Consequently, my project encompassed a range of sites away from the ward (see Table 4, Table 5, and section 5.2.3).

Gaining access to the non-clinical sites was a straightforward process in comparison to accessing ward areas and was typically coordinated via email. Detail of data gathered from these sites will be presented in the following section (see section 4.3.1).

4.2.1 Sampling and recruitment

Sampling, or selection of cases, in qualitative research, requires a flexible and pragmatic approach (Featherstone *et al.*, 2019) which is guided by purposive or theoretical sampling criteria rather than statistical probability (Curtis *et al.*, 2000).

My approach of tracing the EPR network and 'following the actors' (Latour 2005) required a varied and heterogenous group of participants, both clinical and non-clinical. Along with the selection of staff on the basis of ward round observations, I aimed to recruit a range of personnel from different disciplinary backgrounds, identified as users of the EPR.

The observations were predominantly of the use of mobile computers and interaction with the EPR in ward rounds. I also observed the mobile computers in use in other situations, such as multi-disciplinary meetings and handover meetings. At times when I did not see the mobile computer in use, I observed staff using the desktop computers at the main reception desks.

Once I had gained access to the clinical sites, I used the sampling strategies described below to recruit participants for observations and interviews.

4.2.2 Sampling of sites/participants for observations

The focus of the clinical observations was to observe the use of the EPR and mobile computers in ward rounds. Specifically, I decided to direct my efforts on accessing medical wards. Firstly, having worked on countless medical wards in NHS hospitals across England, this is where I had the most experience. I have also worked on several critical care units (ITU and HDU), and along with my foundation placements in surgery, I gained additional exposure to a variety of surgical wards whilst working in anaesthetics. Through this work, I had an awareness of how medical wards ward rounds and surgical ward rounds are different (Atkinson, 1992). Surgical ward rounds tend to be significantly faster and more procedural, often focusing on post-operative patients and readiness for discharge. Medical ward rounds generally take longer, and they may be more diagnostic, often focusing on interpreting symptoms, managing medications and chronic illness. Through the course of writing the literature review (chapter 2), I also noted that there were several studies which already looked at the use of the EPR in critical care (Morrison et al., 2008; Carayon et al., 2015; Plumb et al., 2017; Leslie et al., 2017). Critical care ward rounds can be lengthy in a similar way to medical ward rounds, but it is a more controlled environment with fewer patients and a greater number of staff. Additionally, high-dependency beds often have a computer in each bed space. Overall, I felt that observing the EPR in use on medical ward rounds would represent its use in an interestingly messy location, especially in terms of the amount of mobilisation needed to move around to patients' bedsides and the complexity of the work involved.

Gaining access to two wards meant that I was able to observe different types of medical work (acute admission and longer-term inpatient). I also was able to see a greater variety of ward round types due to the number of senior doctors working in two wards. At the two ward sites, details about the research were distributed through gatekeepers - a consultant on ward A and a specialist nurse on ward B. The approach taken was to observe multiple ward rounds across both sites, with diverse ward round leaders. For feasibility, participation was limited to consultants who responded to email invitations or agreed to take part when approached in person. Further details about the observations are provided in Table 4, while additional information regarding ward A and ward B can be found in section 5.2.

4.2.3 Sampling of interview participants

Clinical staff interview participants were purposively identified during the process of observation (O'Reilly, 2009). I aimed to interview clinical participants from across a range of selected staff groups. I approached nurses, doctors, physiotherapists, clinical support workers, pharmacists, medical students, ward clerks. This approach had some success, but several of the junior (foundation year) doctors I had observed rotated into new jobs during the interview phase of my project, and I was unable to contact them. Following the interviews, I asked participants to help recruit further staff from their networks. This is known as 'snowball sampling' and is known as a good method of recruiting participants in less accessible fields, such as in a busy clinical environment (Bryman, 2012).

I also employed an opportunistic approach to recruiting participants (O'Reilly, 2009). There were several occasions when the participant I had just interviewed put out an open request to other ward staff to see if they would be interested in talking to me. It should be reiterated that in both ward environments (A and B), my project had been introduced (see Appendix A) in the weeks/months previously. On all occasions, I fully re-explained the participant information leaflet and emphasised that the participants were free to change their minds at any time.

I asked the CCIO to suggest interviewees within the IT department, and he put me in contact with several non-clinical participants. In addition, non-clinical staff members, especially those involved in the deployment and management of the EPR, were often very visible on the trust's social media channels, and I was able to contact them via this route. My local knowledge and contacts also helped in recruiting a small number of interview participants. Via this method, I was able to access a staff group (physiotherapists) who I would not have necessarily been in contact with had I relied on my ward observations.

4.3 Data collection methods

4.3.1 Observations

The use of observation aligns with the principles of an ethnographic approach which emphasises the importance of immersion in the research environment and involvement with the world being studied (Hammersley and Atkinson, 2007; Reeves *et al.*, 2008). Upon obtaining agreement to conduct research on wards A and B, I visited both wards to distribute leaflets and display posters to raise awareness of the project. In addition to this, I enlisted the help of my primary contacts within the wards, requesting that they disseminate relevant information about my research, which they did via email or during departmental meetings (for leaflets and posters, see Appendix A)

On the day of the observations, I approached potential participants, explained the research, and obtained informed consent. I made it clear, as per the leaflets I provided to all participants, that they could withdraw from the research or ask me to leave at any time. It was not possible to speak to all participants in advance of observations, due to the unpredictable nature of medical work. For example, two ward rounds would meet and have a discussion, a pharmacist would cross paths with the ward round, and there would be a conversation about a medication change, or a specialist nurse would join for a short duration. In these circumstances, I did not interrupt the clinical flow, taking the view that I should not disrupt the setting if my research was unlikely to be consequential to those staff members (Murphy and Dingwall, 2007). Where possible, I looked for the opportunity to introduce myself at a later point, or I did not include this data in my analysis.

Table 4. Fieldwork: observations and site visits

	Date/time	Where	What	Record	Hours
1	23/11/18 09:30	Medical Records	Tour of warehouse and chat with the medical records manager	Field notes Photographs	2
2	28/11/18 14:00	WDH	Meeting with the medical matron	Field notes	1
3	29/11/18 10:00	WDH Ward A	Ward round MDT	Field notes Photographs	3
4	04/12/18 12:00	WDH Ward A	MDT	Field notes Photographs	2
5	05/12/18 08:00	WDH Ward A	Ward round	Field notes	4
6	10/12/18 09:00	WDH Ward B	Ward round	Field notes	2
7	13/12/18 09:00	WDH Medical coding	Meeting	Field notes Photographs	2
8	08/01/19 09:00	WDH Ward A	Ward round	Field notes	3
9	05/02/19 09:00	WDH Ward B	Ward round	Field notes Photographs	3.5
10	06/02/19 13:00	REH	Visit to 'command centre.'	Field notes Photographs	1.5
11	07/02/19 09:30	WDH Ward B	Ward round	Field notes	3
12	07/02/19 14:30	WDH IT	Tour of facilities with the head of IT	Field notes Photographs	3
13	11/02/19 09:00	WDH Training room	Lorenzo training	Field notes Photographs	7
14	09/05/19 08:00	WDH Ward B	Ward round	Field notes Photographs	4
15	23/05/19 09:00	WDH Ward B	Ward observation	Field notes	4
16	24/05/19	WDH Ward B	Ward observation	Field notes	3
17	09/07/19 11:00	Medical records	Observation at 'subject access request' office	Field notes Photographs	3
				Total hours	51

Shaded rows indicate ward-based observations.
WDH – Weston District Hospital
REH – Royal Easton Hospital

Between December 2018 and July 2019, I made 17 field visits, spanning approximately 51 hours, and including seven ward rounds (observing 16 different doctors and two advanced nurse practitioners). Alongside this, I spent time in the medical records department, medical coding, and IT infrastructure (including the clinical command centre), observing and speaking to the staff in those departments. These are listed in Table 4 above, and further detail regarding those sites will be presented in section 5.2. These meetings and observations were not audio recorded, but I took detailed notes of the conversations, which I wrote up immediately afterwards (see section 4.3.1.2).

4.3.1.1 Clinical observations

In the clinical areas, my observations focused on the use of mobile computers during ward rounds. I tended to remain close to the mobile computers, and as there were often multiple computers on a ward round, I would move between them depending on the activities at the time. If the computers were at the bedside, I would generally wait outside the curtains, observing how they were arranged around the bedside rather than concentrating on the interactions between the staff and patients. There were a few occasions when I went to the wards to observe the use of computers outside of ward rounds. I positioned myself wherever it looked like I would be least in the way or taking up a seat that was needed. Where possible, I would try and sit near the ward clerk, as this was a good position to get an idea of the 'comings and goings' on the ward. Ward clerks, in my experience, are often highly knowledgeable lynch-pins on hospital wards – holding together the ward with practical and experiential knowledge of how their clinical environment functions (Kennedy, 2016). This means that they can act as key informants to the contextual information of a research setting (O'Reilly, 2009, p. 132)

After observational periods, I would write up my rough handwritten notes, and then type them up as soon as possible (before forgetting details or what any annotations meant) (Emerson *et al.*, 2011).

4.3.1.2 Informal conversations

My project was originally set out as having an observation component and an interview component, but in the field, I found this was not always a clear delineation. The observations I made in non-clinical areas were sometimes accompanied by long unrecorded conversations, or 'naturally occurring oral accounts' (Hammersley and Atkinson, 2007), between myself and the participant. Informal conversations have been recognised as complementary to more formal types of interview (i.e. recorded semi-structured) and can create a 'greater ease of communication producing more naturalistic data' (Swain and King, 2022). I found these conversations to be often rich in detail, and the participants were able to demonstrate their points practically in the environment of their work (Reeves *et al.*, 2008). I did not audio-record these conversations, but as per consent, I made detailed notes in front of the participant. Where I had conversations with ward staff, I attempted to follow up these encounters with a recorded interview in which I would refer back to what we had talked about.

4.3.2 Interviews

Semi-structured interviews were conducted to gather information from a variety of professions and gain insight into participants' experiences and viewpoints (Turner, 2010). Combining observations with interviews can allow for the data from each to 'illuminate the other' (Hammersley and Atkinson, 2007). Between April 2019 and December 2019, I interviewed a variety of staff members across both hospital sites (see Table 5). The majority of the staff were clinical and worked on wards A and B, where I had based my observations. I also spoke to non-clinical staff across the two main hospital sites (WDH and REH), who could provide other insights into the EPR and the mobile computers beyond the ward setting (for example, the health and safety considerations of new devices or EPR training). I conducted 34 recorded interviews with 33 members of staff (one participant spoke to me twice, interviews 1 and 24). These amounted to a total of 1291 minutes of interview recordings (average length of interview 34.2 minutes).

Table 5. Interview participants

	Usual work location of the interviewee				
Occupation of interviewee	Ward A	Ward B	Other clinical areas	Other (non-clinical)	Total
Nurse	1 ANP (trainee) 1 Ward manager 3 Staff nurses	1 ANP 1 Clinical team leader 3 Staff nurses	1 Research nurse		11
Doctor	1 Consultant 2 Associate Specialists	1 Consultant 1 Associate Specialist 1 Trust grade 1 F1			7
Physiotherapist			2 (WDH)		2
Clinical support worker (CSW)	1	1			2
Pharmacist		1	1 (cross-site)		2
Ward clerk	1	1 (see notes)			1
Medical student		1 x 5th year 1 x 3rd year			2
EPR trainer				1	1
Library and knowledge services				1	1
EPR manager			1 (clinical background)		1
EPR/IT helpdesk				1	1
CCIO			1		1
Health and safety advisor			1		1
Total	10	13	7	3	33

Notes on table:
CCIO – chief clinical information officer
ANP – advanced nurse practitioner
CSW – clinical support workers (also known as healthcare assistants)
One of the clinical support workers had a dual role as a ward clerk, and I spoke to her about her experience in both capacities (she is counted in the CSW column).
The EPR manager worked approximately one clinical session per month in outpatients.
The CCIO also split their time between clinical work and CCIO work.
The library and knowledge services manager was the author of the monthly patient safety/improvements newsletter.

Interviews took place in staff rooms, offices, the canteen, waiting areas, the library, and the education centre. 15 of the 34 interviews were conducted during the participant's shift on a ward.

All interviews were digitally recorded, face-to-face, and one-to-one. I used an interview questioning guide drawn from the literature review (chapter 2) and the research questions (see section 1.4). In line with a semi-structured interview approach (O'Reilly, 2009), this guide was continually adapted depending on the participant's job role and in response to prior observations and interviews (Britten, 2006). To minimise disruption, I arranged interviews with clinical participants at quieter times, such as during breaks, after work hours, or on weekends. In line with taking an actor-network theory approach, I allowed space for participants to elaborate on the parts of the network that they found most important, to which I would add prompts from my question guide (Demant and Ravn, 2020). As I gained more experience and confidence in conducting interviews, I found myself relying less on the interview guide. As a result, the interviews generally felt more relaxed and seemed to flow more smoothly. In cases where I had previously observed the participants, I was assisted by having already built rapport with the participant (Hammersley and Atkinson, 2007). The observation was also able to act as a catalyst for further questions, which resulted in a more in-depth exploration during the interview (Higginbottom *et al.*, 2013).

A challenge of employing open questioning was the participants' attempts to decipher what I might want to hear, a phenomenon known as 'social desirability bias' (Fisher, 1993; Bergen and Labonté, 2020). Sometimes time was very limited, and I was especially conscious of the interview length with clinical staff who were mid-shift. These interviews tended to be shorter and more prone to interruption. Although all the participants completed their interviews, there were occasions with the clinical participants where I could not cover all the areas in my questioning guide due to time constraints. In line with my ethical approval for this project, I was continually mindful of the time I was taking from their clinical responsibilities.

4.3.3 Documentary sources

In line with my approach of tracing the EPR network and 'following the actors' (Latour, 2005), the collection of documents was part of my research strategy. Drawing on influences from Atkinson and Coffey (2004), Hammersley and Atkinson (2007), and Prior (2008), documents were collected and analysed to provide an additional representation of the various actor interactions and their sociotechnical associations within the EPR network.

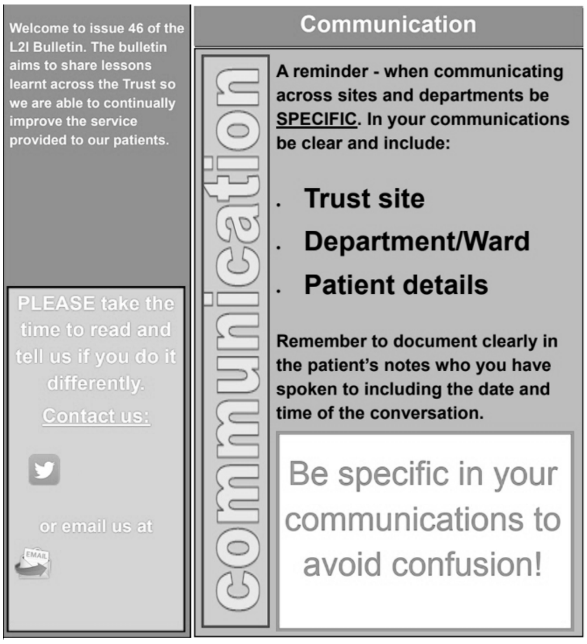

Figure 2: Excerpt from Improvement bulletin

Publicly available documentation such as board meeting minutes and reports (for example, from CQC and internal 'Quality Assurance' ratings) were collected and reviewed for content relating to the research questions.

Compass also published a monthly improvement-based newsletter (see Figure 2). This document was produced by the trust's library and knowledge services department and authored by a staff member who sat on the trust's improvement and patient safety committee. It was publicly available as a pdf document via the library pages on the trust's website. It shared lessons from across Compass Hospitals, with the intention of 'continuously improv[ing] the service provided to patients'. I found 26 of these documents to be relevant to my research questions.

I collected relevant information from the trust's other online resources. Compass and its departments (IT, for example) had multiple social media channels, upon which they published a wealth of information and online resources. These ranged from video clips (introducing new devices) to entire websites devoted to the historical timeline of the EPR implementation at Compass. I also took note of unpublished informal documents (e.g. noticeboards in side rooms), posters, and signs around the ward.

Documents were also a valuable source of triangulation in my analysis and were useful during interviews and observations (Natow, 2020). For example, I could ask a question along the lines of: 'I saw there were posters advising patients that your iPods weren't mobile phones. Can you tell me something about that?'

4.3.4 Photographs and illustrations

As described in my methodology, I took photographs for the purposes of illustration whilst in the field. This was integrated into the research application, participant information leaflets, and consent forms. I took 93 photographs across the hospital site (see Figure 3 for a representation of photograph locations).

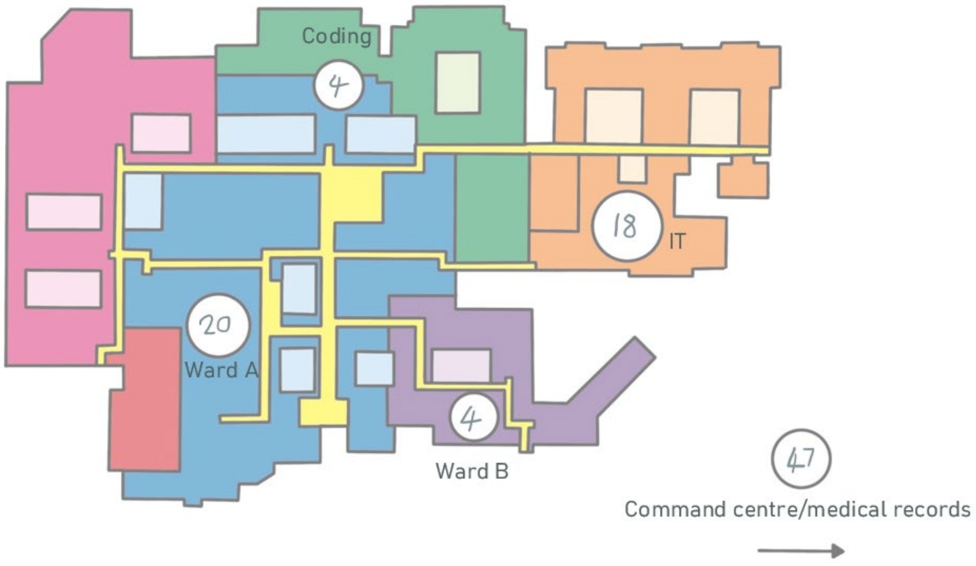

Figure 3: Representation of where photographs were taken (not actual hospital plan)

I did not take as many photographs in clinical areas as I thought I would. At times, I felt awkward asking participants if I could include them in shots, and so many of the photographs I took were of the technologies without their users. Arriving early in the morning allowed me to get good photographs of the ward corridor lined with devices of various sorts, including numerous mobile computers.

The digital traces, or 'transcriptions', of the photographs were made manually via an iPad Pro and Apple Pencil within the 'Procreate' drawing application. There are increasingly sophisticated ways of creating automatic illustrations of photographs, but my process was to hand draw the outlines of the objects, traced upon layers above the uploaded original image.

My method of taking photographs for transcription provided a meaningful way of connecting with the materiality of the EPR at the site, whilst also providing a more visual form of representation of the non-human actors in the thesis. Whilst I do enjoy drawing, the actual process of tracing the photographs did not require artistic skill. Engaging with the objects of the EPR in this way gave me a deeper sense of familiarity with the form of the devices, so that when I saw the same devices in other documents, e.g. product catalogues, I could see how they were different or adapted, and how they often stood alone and uncluttered. Paying this close attention drew my eyes to small details in the constitution of mobile computers, the size, shape, and number of casters, and the smoothing of the desktop edge. These are features which I did not notice until I traced over the images and was made to follow the design with my (digital) pencil. I could also draw over the photographs in layers, adding and removing the 'clutter', thereby noticing how it was there in the first place (see Figure 4).

I found that using these 'transcriptions', rather than photographs, was more an exercise in seeing than presentation. The process of tracing added a filter to photographs rather than letting the reader see and interpret them in their unaltered form. This method does not replace photography; instead, it creates an alternative way of getting to know an object.

A similar method of tracing photographs is described by Causey in 'Drawn to see: Drawing as an ethnographic method' and is a technique he applied to the investigation of ancient Mayan inscriptions, whereby tracing over the markings made 'intricate elements pop' (Causey, 2017).

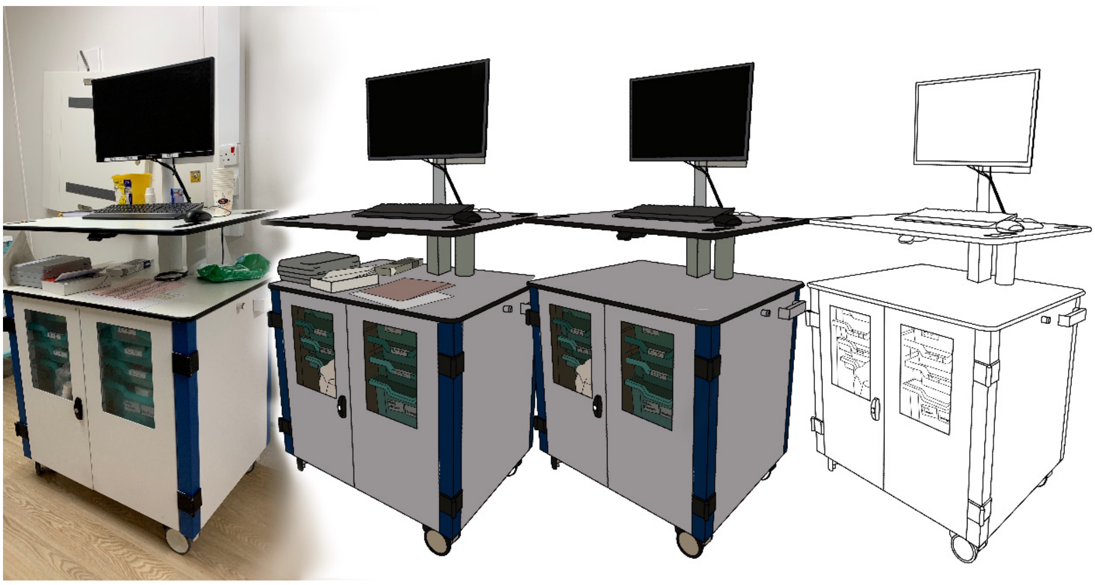

Figure 4: An illustration to demonstrate the layers of photo 'transcriptions'

Causey (2017) draws attention to a limitation of photography in fieldwork, in that through taking many photographs, the observer can almost be 'not-seeing' unless they remember to return to the photograph for careful examination before the details of the context are forgotten. Drawing on the photographs required me to pay that close attention, but textual details of the context also need to be documented. The camera also only captures what is in front of the camera-eye, omitting what is behind the camera or out of frame. For these reasons, it is important to add notes to photographs, as with the writing of field notes, rich detail can quickly be forgotten.

4.4 Reflexivity

In qualitative research, reflexivity is woven through the ontological and epistemological framework of the research as well as 'moment-to-moment interactions between the researchers and others' (Doyle, 2013). Reflexivity, through acknowledging the complexity of social research, helps to provide a valid and reliable account of events. Bryman (2012) defined reflexivity as:

> *'…reflectiveness among social researchers about the implications for the knowledge of the social world they generate of their methods, values, biases, decisions, and mere presence in the very situations they investigate' (Bryman, 2012)*

Reflexivity is fundamental to my methodologies and data analysis, and my own position in the research is inherently biased by my own experience as a healthcare professional. Throughout the findings that will follow, I explain how I interpreted my findings through what I saw as well, along with what I did not see, and through my prior knowledge of practices that had evolved using paper records.

4.4.1 My role as a researcher

An important component of qualitative research is contemplating the unavoidable impact of the researcher on their research environment. There were several significant factors that may have been at play on the wards at the time of my fieldwork. These issues were likely to have affected the field, my interaction with it, and the participants' interaction with me. Significantly, a CQC inspection coincided with the start of my fieldwork. The outcome was disappointing for Compass and came after a number of other critical reports. It seems highly likely that this would have had an impact on staff morale, which was already bruised from previous negative outcome inspections. In addition, the two years leading up to my fieldwork commencing had been a period of intense EPR deployment at Compass. Lorenzo had been in use for many years, but the 'EPR optimisation program', introduced electronic prescribing and electronic clinical notes, effectively removing the day-to-day use of paper records for the first time. Several clinical participants expressed tiredness from working through these system changes, and the CCIO was aware that Compass had 'taken on the pain' of developing Lorenzo, 'rubbing the edges' off a new EPR.

Whilst I do not concentrate on these themes in my findings, they are relevant to how I was able to do my research at the site. Overall, the site had a sense of fragility that I wanted to be sensitive to. If I felt any resistance or hesitancy in the field, I stepped back, and I did not push on. This meant that I did not spend my time focused on observing single teams in detail, instead spreading my observations across different clinicians. One consequence of this was that I saw a greater diversity of ward rounds, which has been significant in informing my analysis and findings.

On the other hand, spreading my observations across multiple teams meant that I did not reach the level of immersion or acceptance into a single team that I had hoped for when I planned this research. I think I naively assumed that as a clinician, i.e., an 'insider' who understands the challenges of working on a medical ward, the participants would view me as a friendly visitor (Fine, 1993). What I had not really thought about was that CQC inspections are carried out by clinicians, enquiries are headed by clinicians, and the EPR implementation programme was led by a prominent clinician, the CCIO. In addition, I was explicitly linked with the

CCIO via participant information leaflets. I emphasised to participants that although the CCIO had authorised my research in the trust, he was not involved in the collection of the data, nor would I be reporting back to him. It is possible that this may have formed part of the reason that some staff members did not reply to my emails.

In conducting a 'staff-only' project, I described in section 3.4.3 how my participation as an observer was at a distance from the bedside (and patients). This distance was challenging on a couple of occasions, particularly when ward round staff expected me to be more interested in listening to the clinical details of the cases they were discussing. Nurse ethnographer Wood (2018) described a similar sort of 'conscious positioning' whilst undertaking participant observation in her own place of work. In my case, I was not in my workplace, nor was I known to any of the participants, but as they were aware of my status as a doctor, they presumed I would want to be included. On these occasions, I would remind the clinicians of the limits of my ethical approval and refer them to the information leaflets which made clear the purpose of the research.

4.4.2 Ethnographic methods

I have described the research procedures used in this project as 'ethnographic methods' rather than an 'ethnography'. The experience described above, and how I did not feel embedded within the social structure of the ward, would suggest that my choice of description is fitting. But I do think it is important to appreciate that this view of the 'essence' of ethnography (Wolcott, 2003) has been changing over time. Lewis and Russell (2011) propose the idea that ethnography is about:

> *'…'being there' sufficient to experience the mundane and sacred, brash and nuanced aspects of socio-cultural life and, through observations, encounters and conversations, to come to an understanding of it.'*

Researchers involved in evaluating quality and safety in healthcare settings have made the argument that ethnography should not necessarily be defined by the length of time spent somewhere and that a richer determinant is the degree to which contextual understanding and immersion are achieved. This involves the asking of questions which 'explicitly seek to expose the nuances of culture and what actually happens in the setting' (Cupit et al., 2018). This is a view which also takes on board the effects of funding constraints and ethical issues, such as burdening participants, who, in medical environments, may already be stretched for time.

My sense that I was not fully participating also reflects how much, as a former 'insider', I was aware of what it truly felt to be a participant. This resonates with the experience of Wind (2008), who, as a nurse observing nurses, acknowledged that her feeling of not doing participant observation 'properly' stemmed from her 'intimate, thorough and embodied knowledge of the work of nurses'. I might not have felt immersed in the process of ward rounds, but through ANT, this project was broader and deeper than that, and I do believe I was able to feel immersed in the EPR as it materialised through networks of practices and devices.

4.4.3 Note-taking

I have described above how approaching the field as an apparent 'insider' clinician was not the advantage I thought it would be in gaining access to the research sites. Moreover, further assumptions I had made about how I would conduct myself in the field also turned out to be not what I expected. Before I started my fieldwork, I purchased a number of small notebooks in which to write my field notes. The specific notebook was meaningful to me[8], as it is what I had always used when I worked on wards (see Figure 5).

Figure 5: My fieldwork notebook

In the quote below, ethnographer Lois Weis explains to Walford (2009) how she made field notes in a school and how easy it was because it was what everyone else in the classroom was doing:

> *'Actually, doing observation in a school is the easiest because, whether kids are engaged in taking notes or not, they should be. So when we're in there as observers, it's easy for us to kind of blend into the background*

[8] The 'Passport Notebook' by Muji, 24 sheets of plain paper, 12.5 x 8.8 x 2.4cm (passport-sized!)

because I just become another person in a classroom taking notes. That I find the easiest form of ethnographic observation' (Walford, 2009)

And so I hoped it would be during my observations of ward rounds. I thought I would be able to join ward rounds and take notes much as I always had, as far back as when I was a medical student. What I had failed to take into account was that I would be one of the only people on the ward round without a mobile computer, making my scribbling in a small notebook stand out in stark contrast to the other participants. Instead, it felt easier to follow the ward rounds with my notebook hidden in my pocket, sneaking it out to make quick notes when there was a lull in activity.

An unintended consequence of this unexpected contrast in note-taking materiality was the opportunity to make the familiar activity of the ward round strange. A researcher working in a familiar environment is at risk of having their findings 'overshadowed by the enclosed, self-contained world of common understanding' (Mannay, 2010). But ethnographic observations require the researcher to be at once an insider through participation, and an outsider through maintaining an analytical distance from the social world of their research site (Spradley, 1980). Through the strangeness of how I experienced mobile computer use on the ward rounds, I was able to gain a more distanced perspective on what I saw, which ultimately contributed significantly to my findings.

4.5 Trustworthiness and credibility

Qualitative research explores personal, subjective experiences situated within contexts that may be difficult or impossible to reproduce identically (Sandelowski, 1993). Therefore, replicability, a core concept in quantitative research, is often not an applicable criterion in the trustworthiness of qualitative studies (Leung, 2015).

Trustworthiness is an essential quality that underlines the integrity of methodological choices, analysis, and interpretation. Reliable and transparent data collection, interpretation, and reporting, when handled with care and reflexivity, result in findings that are believable and can be applied beyond the specific context of the study (Shenton, 2004). The interconnectedness of trustworthiness and quality in qualitative research emphasises its criticality in producing meaningful and transferable insights.

4.5.1 Triangulation

The concept of 'triangulation' supports credibility by collecting data across multiple times, spaces, and people (Korstjens and Moser, 2018). For example, two wards were observed in my research, and a wide variety of staff members were interviewed. Additionally, documentary evidence and patient safety briefings were incorporated into the analysis to further strengthen the comprehensiveness of the findings (Mays and Pope, 2000). For example, versions of the problems with communication that I perceived from my observations were repeated in the patient safety reports, which, as Jowsey (2016) puts it, helped 'to support the meaning-making of the ethnographer about the meaning-making of the people under observation'.

While the findings of this research do not claim to be the only version of truth, which is in line with a constructivist paradigm (Creswell, 2013), as I set out in section 3.2, triangulation contributes to trustworthiness by providing a more comprehensive and well-rounded view of the area under study (Rashid *et al.*, 2019). In addition, this approach allows for greater confidence in the conclusions drawn, which can support the transferability of insights into practice (Smith, 2018).

4.5.2 Saturation

Data saturation is a concept in qualitative research referring to a point at which no new information or insights emerge from data collection (Morse, 1995). It helps researchers to ensure that their study has reached a level of depth necessary for a meaningful understanding of the phenomenon under investigation. Wolcott, quoted in Baker and Edwards (2017)[9], describes how data saturation can be achieved with varying numbers of respondents. It could be as few as one participant, especially when that individual is the 'person of interest', or it could be as many as necessary to capture the full range of responses. Wolcott emphasises the importance of identifying a range of responses rather than focusing on an absolute number, as qualitative research focuses on exploring the depth and complexity of experiences rather than quantifying them.

In healthcare research, it is not simply a matter of collecting data until saturation criteria are met. The time constraints clinical participants face can be particularly challenging, and any additional burden created by research needs to be addressed and kept to a minimum. There is also the limited amount of time a researcher has to do the fieldwork in the context of a PhD study. Accordingly, taking these factors into account, once interviews and observations reached a stage where novel information was becoming scarcer, I stopped recruiting participants and made no further observation visits.

4.5.3 Generalisability

I have chosen to look at a single NHS hospital trust. As has been discussed in the literature review (chapter 2), hospitals across the NHS are approaching EPR implementation in different ways, and as I have described, every ward is different to the next (even within the same hospital). As this is not a positivist account, I am not attempting to make a comparison of groups across different hospital trusts.

With politicians focusing on the urgency of implementing and expanding the interoperability of EPRs, it is important to keep in check how the technical is shaping the social. Qualitative enquiry with actor-network theory is a good way of describing the complexity involved in this, and specific situated stories can be used to speak to general issues. This is a strength of being influenced by ANT and

[9] 'Quoted' as in interviewed by Baker and Edwards for the paper, 'How many qualitative interviews is enough?' Baker and Edwards (2017).

examining science and technology studies (STS) literature such as that from Berg (1996). STS research collects and layers stories; this deepens the web of knowledge and helps to increase understandings and explore meanings. In this way, it is possible to use studies of atherosclerosis (Mol, 2002) and gasogene burners (Akrich, 1993), which link the phenomena of multiplicity and travelling technology to that of EPRs and medical work.

Instead of attempting to match the potential generalisability of quantitative research, qualitative researchers can look for ways in which their work may be transferable. The concept of transferability works on the epistemological assumption that knowledges are constructed and that there are multiple realities (Lincoln and Guba, 1985). Therefore, it is not about matching up conditions between contexts, but 'to what extent are these results transferable to other settings?' (Smith, 2018).

The in-depth understanding that ethnography can achieve, and the questions it can raise, can be further explored through other methodologies (Savage, 2000). Rich data description and a detailed account of the research context can promote transferability by allowing the reader of the research to make their own 'transferability judgement' (Korstjens and Moser, 2018).

4.6 Ethical considerations

This project was approved by the Lancaster University Faculty of Health and Medicine research ethics committee (FHM REC) on the 1st of August 2018. Following this, NHS research ethics approval was applied for through the Integrated Research Access System (IRAS). As an NHS staff-only study, it did not require NHS research ethics committee (NHS REC) approval. The Health Research Authority (HRA) approved the study on the 29th of August 2018 (FHMREC17099). The NHS trust issued a 'Letter of access for research' on the 3rd of September 2018 (Appendix A). The ethical approval allowed for up to 15 observation sessions (where a session was up to four hours of observation) and up to 40 interviews, and I completed the research within these limits.

As per my research application and ethical approval, the hospital site and staff have been anonymised. Informed consent was obtained from hospital staff who were being observed and interviewed. Audio recordings and photographs were only made with the informed consent of participants. Photographs did not include patients or patient information. The consent form included details on data preservation and sharing, and steps were taken to protect the identities of participants. My field notes and transcriptions have been fully anonymised, and I have attempted to conceal any information that might connect to participant identity in write-ups.

A proportionate approach was taken to consent as proposed by Health Research Authority guidance (Health Research Authority, 2017). This guidance suggests that how the consent is sought should be proportionate to the 'nature and complexity of the research', the 'risks, burdens and potential benefits', and the ethical issues at stake. For example, the participant information sheets and consent forms used in this research (Appendix A) were designed to be clear and concise, with a point of contact to seek further information.

As the research was focused on staff, patients were not included in data collection in the project, and consent was not obtained from patients. Within the scope of my research, I had minimal contact with patients, as I directed my focus towards staff and mobile computers. Where I was visible to patients, on a ward round, for example, I was introduced by the senior clinician as a researcher 'looking at computers'. I produced an information sheet for patients and visitors (Appendix A), which was available for further detail of the research, and through which patients or visitors could contact me if they had further questions. Patient privacy and confidentiality were additionally protected in line with my professional organisational guidelines, that being the duties of a doctor registered with the General Medical Council (2018).

4.6.1 Drawing boundaries around the network

Following actors using ANT allows the creation of an unlimited network, but for practical reasons, the collection of data had to stop somewhere, and a line had to be drawn. That line limits the focus of research and allows for some aspects to be placed out of the picture. This means taking an ethical stance, with the prioritisation of one account over another. In this research (and with some sadness), I made the decision not to talk to patients. I believe incorporating patients would have steered me away from my research questions which were focused on medical work and interaction between staff members. Patients will still have a place in the network, and I very much hope that future projects can explore questions concerning the experience of being a patient in a ward with mobile computers (see section 10.5.1 for further information).

4.7 Thematic analysis

Thematic analysis, as described by Braun and Clarke (2006), was used as a guide to analyse the data. It is a well-known and recognised method commonly used in qualitative research and is supported by a wealth of practical guidance (Braun and Clarke, 2022). Given the interdisciplinary potential of this thesis, I felt this type of analysis could increase the trustworthiness of the research across audiences, through providing a clear description of the analysis process (Nowell *et al.*, 2017). This could assist in making the findings more accessible to less qualitatively orientated disciplines such as health informatics or clinical medicine.

Braun and Clarke's (2006) six-phase approach to thematic analysis is not intended as a recipe or linear process. It is an iterative and reflective process, and researchers may circle between the stages as required and in response to the data. The phases comprise of familiarisation with the data, identifying items of potential interest, the generation of codes and initial themes, reviewing potential themes, defining and naming themes, and producing the report (Braun and Clarke, 2006). Each of the phases assisted me in developing themes. Below I will provide further detail to show how I approached the analysis, which is a further step in supporting the quality and rigour of the research (Sharkey and Larsen, 2005).

4.7.1 Familiarisation

The transcription process constituted a significant step in my immersion in the data following the interviews (Lapadat and Lindsay, 1999). I typed a first draft of the transcripts (into Microsoft Word), followed by a thorough re-reading to check for spelling mistakes, remove any identifiable information, and format the presentation. I transcribed verbatim, and while I made a few minor adjustments to emphasise or expand on the tone of the spoken word, my approach to transcription remained faithful to the primary goal of recording and interpreting the spoken word. I transcribed each interview myself, with the transcripts totalling 19000 words, which amounted to 456 A4 pages. In addition to the transcription process, I made notes after each interview, which I supplemented throughout and after the transcription. These notes contained general observations, reflections, standout points, and any ideas generated from the interviews. This represents an early stage in the analytical process (Bailey, 2008), as the transcripts produced are a product of my interpretation.

4.7.2 Generation of codes

I began this process using 'computer-assisted qualitative data analysis software' (CAQDAS), specifically NVivo. I attended several NVivo workshops to gain knowledge of the software's capabilities, and I uploaded all the collected data to begin labelling (creating codes) in the software. Although I could see how CAQDAS did have useful features, such as organising large amounts of qualitative data, I did not continue using it. I felt that for my use of it in the context of this project, the software added an extra layer of complexity and distanced me from engaging with the data. I found it easier to work between a combination of paper, post-it notes, and electronic documents. I divided the transcription manuscript into two parts (to accommodate the size), added the typed field notes and had them printed and bound with plastic ring binders. I also transferred the documents (now anonymised) onto my note-taking app on my iPad Pro. As it was a lengthy document, it felt good to be released from the confined reach of my desktop screen and to be able to work in different locations. I alternated between these materials, making notes and highlighting sections. After this point, I worked from within Microsoft Word, formatting a document to contain themes with navigable headings and coded data copied into different categories. I also integrated the documentary sources of data into the analysis at this point. Throughout this process, it was not lost on me that the materials I used to handle the data – paper and pen, iPad and iPencil, keyboard and screen – struck parallels with the shifting materiality of the EPR.

As Saldana (2015) notes, this initial step is relatively systematic, and initial impressions are often superficial, with more complex and deeper themes emerging through time and reflection. Codes label parts of the data and create a way of clustering themes. Braun and Clarke (2006) suggest the use of longer code names, which can stand alone from the data. Codes can evolve, change, move, break into different codes, or be relabelled. Braun and Clarke (2006) suggest a couple of 'coding sweeps'. For me, the second 'sweep' was particularly important as it became a central part of my re-immersion into the data after a period of intercalation in 2020[10].

4.7.3 Generating, reviewing, and naming themes

This process required an examination of the shared patterns of meaning that were created from the codes, notes, and categories I had generated. Reflexivity was integral to this process as it allowed me to acknowledge and account for my own influence on the choices I made in determining the codes. As I described earlier, approaches using ANT *and* ethnographic methods are prone to creating vast quantities of data. The themes produced are a result of interaction with my research questions, the depth and richness of the data, as well as my own conscious and unconscious biases.

[10] Relating to the Covid-19 pandemic

Determining when coding was complete was a subjective process and largely dependent on my own perception of satisfactory coverage. Once I had established groups of patterned meaning, I revisited the coded data to ensure consistency with the identified themes. I used mind maps to create visual representations of the themes, which helped me examine their relationships and identify 'central organising concepts'. I reviewed the potential themes and began to identify the qualities of each theme, ensuring that there was enough meaningful supporting data. In addition, I gave each theme a name and description, and checked that it aligned to both the coded extracts and the entire dataset.

4.7.4 Producing the report

The last phase of thematic analysis is to write up the report. Within this thesis, this report is presented as three findings chapters, each intertwined with ethnographic data, organised around the research questions, with themes relating to practices and materials. Thematic analysis enables a methodical, inductive approach that is 'bottom-up' in nature. As such, themes are generated from the data itself, in contrast to fixed categories or pre-existing coding frames. As I have reiterated above, my own subjectivity plays a crucial role in this process, meaning that the data analysis can produce a wide range of possible interpretations. Consequently, reflexivity must be integrated throughout thematic analysis to ensure validity and transparency.

4.8 Summary

In this chapter, I have outlined the methods of data collection and analysis I used in this project. I have described the approaches I took to access the research site and how I sampled and recruited participants to observe and interview. The phases of my thematic analysis, which I used to analyse the data were presented. I have reflected on my role as a researcher in the process of collecting this data and the ethical considerations of undertaking this project.

The chapter that follows is a preface to the findings, where I will introduce the study site and the EPR, Lorenzo.

5 Preface to findings

5.1 Introduction to the findings

In this thesis, I argue that the objects which house the EPR are fundamental components of the ecosystem of hospital care. This thesis is concerned with expanding knowledge about these objects and drawing attention to the emerging ways in which the materiality of the digital record is reshaping practices.

There are three findings chapters. The chapters are centred around mobile technologies and their use on hospital wards. Before moving on to the findings, I will introduce the research site in more detail.

5.2 An introduction to the study site

Compass Hospitals NHS Trust ('Compass' or 'the trust') serves approximately 350 000 people across 1000 square miles of mixed urban and rural landscape, employing approximately 5000 members of staff. There are around 750 beds across the three main hospital sites in Weston-by-Sea, Norton, and Easton City, as well as outpatient appointments in two further locations. In 2015/16, there were approximately 35 000 admissions (with half of these being emergency admissions)[11] and 450 000 outpatient appointments.

Weston District Hospital (WDH) in Weston-by-Sea, has around 250 beds. It provides a range of services, including a 24-hour emergency department, surgery, medicine, maternity, critical care, outpatients, diagnostic imaging, children and young people's services, and a special care baby unit. Medicine at WDH encompasses cardiology, gastroenterology, general medicine, medical oncology,

[11] More recent data has not been used due to the fluctuating effect of Covid-19 on admission numbers.

respiratory, elderly medicine and stroke care. These are located across seven wards, with the availability of up to 130 inpatient beds (and 20 day-case beds).

It takes nearly an hour to drive from WDH to the Royal Easton Hospital (REH). It is not uncommon for patients living in Weston-by-Sea to have to travel to the REH for outpatient clinics or for clinic attendance to be spread across the two hospitals.

My fieldwork at Weston District Hospital concentrated on two 'paperlight' medical wards:

Ward A: A 19-bed acute medical unit.

Ward B: A 32-bed medical ward with a focus on gastroenterology and general medicine.

5.2.1 Ward A

Ward A (see Figure 6) was an acute medical unit (AMU). The features of an AMU include the management of acutely unwell patients, transferred from the emergency department (ED) or community (usually via a general practitioner) for early consultant review, rapid multidisciplinary team assessment, and prioritised access to investigative services (e.g. radiology, pathology) (Byrne and Silke, 2011).

If a patient is likely to stay in hospital for only a couple of days, they may remain in the AMU. Otherwise, they will be transferred to a longer-stay inpatient location, like ward B. After being admitted to the AMU, a patient will be reviewed by the on-call consultant on a 'post-take ward round'. A 'post-take' ward round is a review (generally led by a senior doctor) of a patient who has been newly admitted into hospital. It is a critical time as the diagnoses and plans made at this initial point will often steer the course of the whole hospital admission. Post-take ward rounds generally occur twice a day. After this initial review, and presuming the patient remains on the ward or in hospital, they will be seen on a daily basis by a member of the AMU senior team on a morning ward round. My observations focused on this daily morning activity.

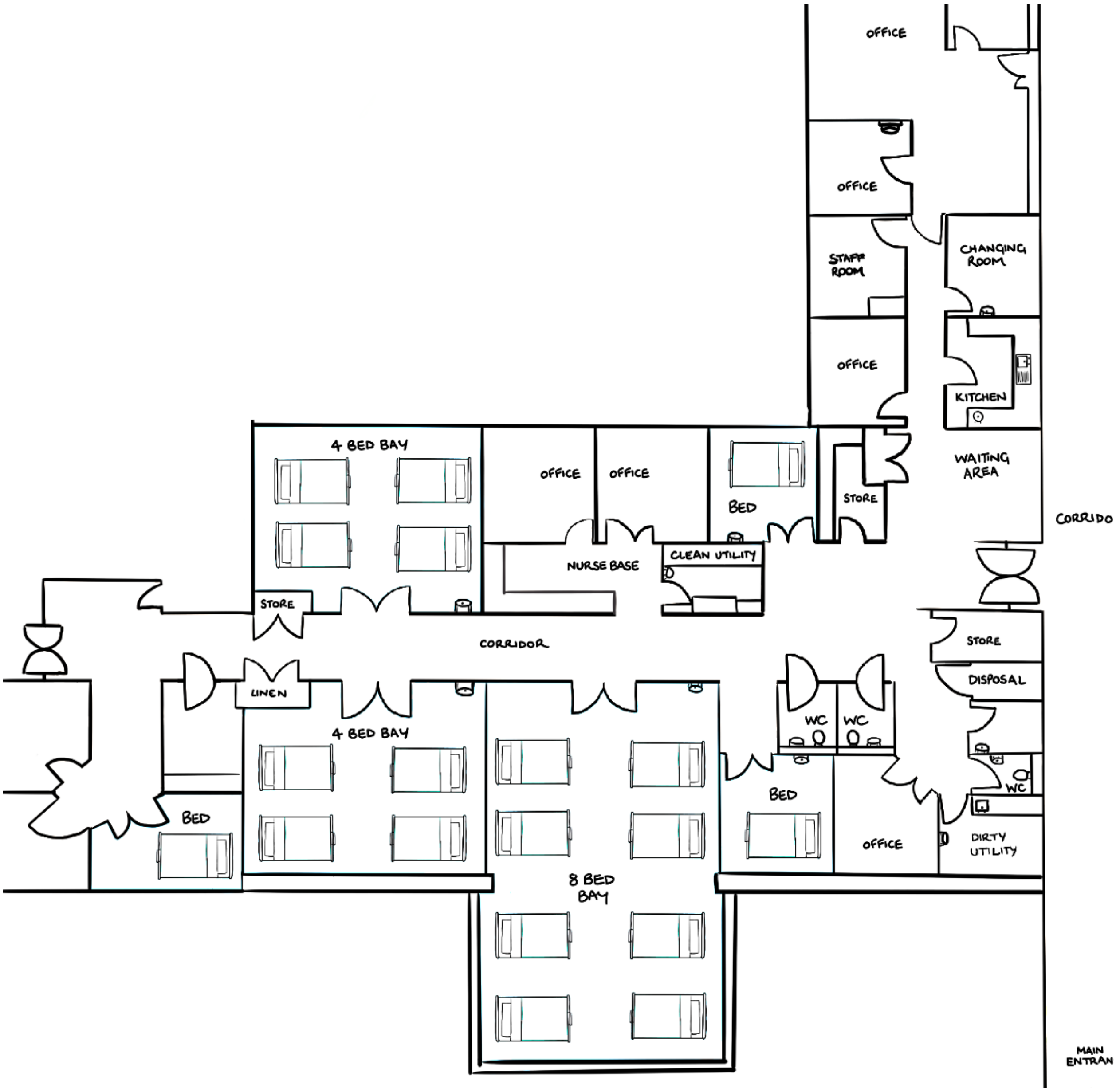

Figure 6: Ward A

5.2.2 Ward B

Ward B (Figure 7) was a general medical and gastroenterology ward. Patients were transferred here from the AMU for further investigation, management, and subsequent discharge planning. The ward also had a small allocation of beds for oncology patients and would often have a couple of cardiology ‘outliers’ (cardiology patients who do not have a bed on the cardiology ward). Separate medical teams see these patients. I observed the gastroenterology/general medical ward rounds.

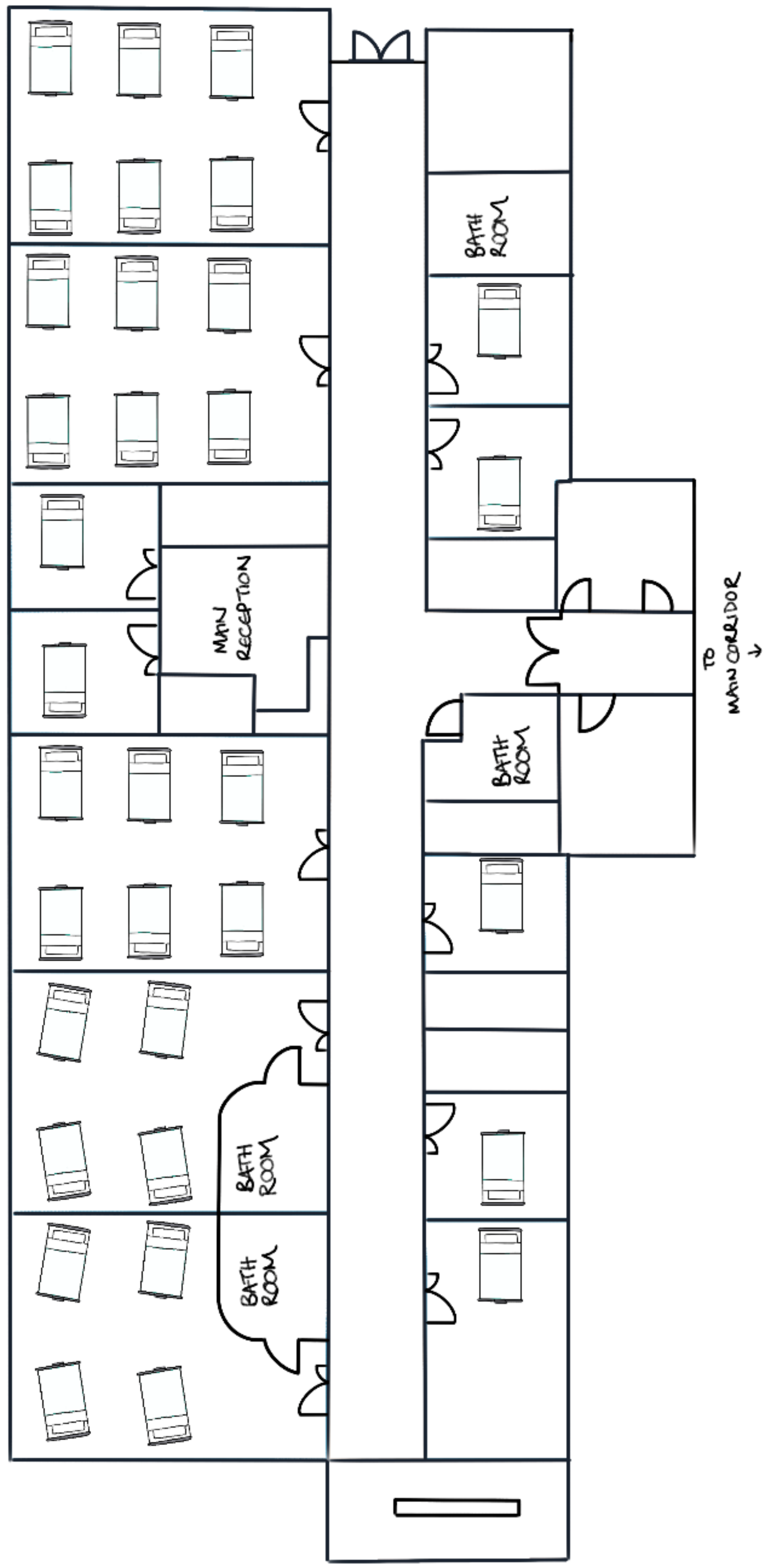

Figure 7: Ward B

5.2.3 Sites outside of the ward

Below (Table 6) is a brief description of other sites in the hospital which I visited, met with staff, and observed practice.

Table 6. Sites outside of the ward

Site	Description
Medical records	A large medical record storage warehouse located on the outskirts of Weston. One of three storage facilities containing the paper medical records for patients from across Compass NHS Hospital Trust.
Medical coding	The medical coding department for Weston District Hospital, located in an office in the Weston District Hospital.
IT training	IT training at Weston District Hospital was located near the education centre and spread across a number of classrooms containing desktop computers for training on the Lorenzo EPR.
IT helpdesk	A 24-hour helpdesk to support IT queries from across the trust, located at Royal Easton Hospital.
IT infrastructure sites	Sites visited across Weston District Hospital, including server rooms, backup tapes (and safety system), fire safety and air-conditioning to the server room, staff and patient Wi-Fi.
Command and control centre	Located at Royal Easton Hospital. Digital updates via large wall-mounted screens and dashboards provide hospital bed status, waiting times, predicted discharges, and ambulance service demand.

5.3 A further introduction to 'Lorenzo'

The Lorenzo Electronic Patient Record (EPR) system is a comprehensive clinical computer system developed with the intent of providing a unified source for all service user information. Compass had a long history with the Lorenzo EPR (and its various owners).

At the time of my fieldwork, Lorenzo was owned by DXC, which was formed in 2017 as a merger between CSC (Computer Sciences Corporation), EDS (Electronic Data Systems), and HPE (the enterprise division of Hewlett Packard). Before that, it was owned by CSC, who bought it from iSOFT in 2011. In March 2022, it was reported that Dedalus, who bought Lorenzo from DXC for £413 million in July 2020 (Hoeksma, 2020), was planning to stop offering the Lorenzo EPR. They would instead offer their customers an alternative EPR, 'Orbis U' (Hoeksma, 2022).

CSC was also a major contract holder in the National Program for Information Technology (NPfIT) program. They were commissioned to provide Lorenzo (via iSOFT at that point) to 3/5 geographical sectors in the NHS in England. During the NPfIT, Compass Hospitals NHS Trust was a Lorenzo 'flagship' site and one of the earliest to 'go live'. At the time of my research, the trust had recently renewed its contract to continue to work with DXC and use Lorenzo EPR software.

The Compass IT department was motivated by the aim of being 'paperlight', as well as believing in the principle of an 'everything in one place' EPR. This type of EPR was achieved through the use of Lorenzo, which was a single programme containing numerous 'modules', including the clinical note, the medication charts and nursing and multidisciplinary care plans, requests and results. This single EPR replaced multiple specialised paper documents, which had been distributed across the ward (and bedside).

Figure 8 is a photograph of an example of what the paper medical record contained. During a hospital admission, components of this record would be used in different locations before being gathered together into the single file when the patient was discharged. In my experience, whilst the patient was on the ward, the location of the various components could vary between hospital trusts and from ward to ward, but in general, the prescription and observation charts would be located separately from the clinical notes, and often at the end of the bed.

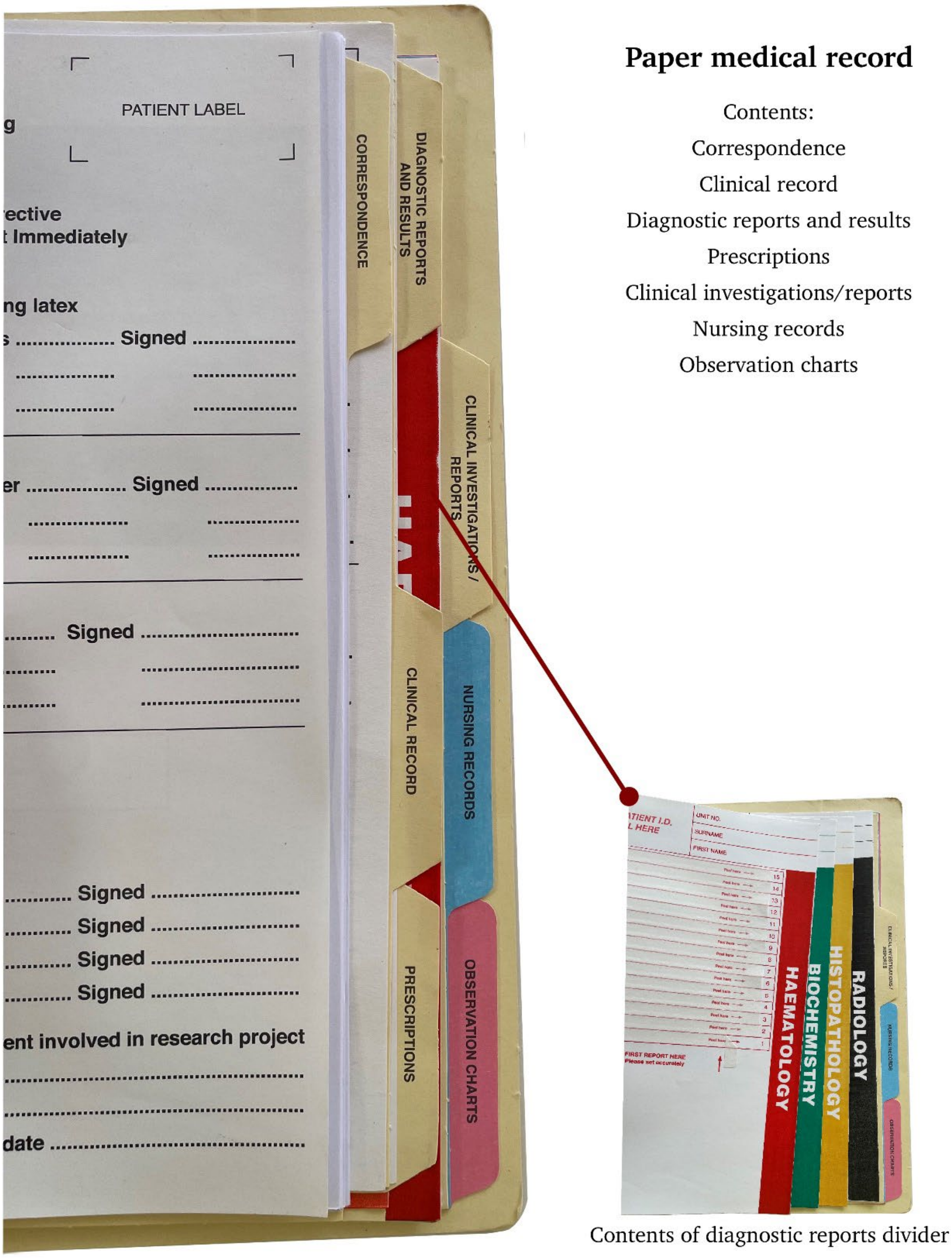

Figure 8: Contents of the paper medical record

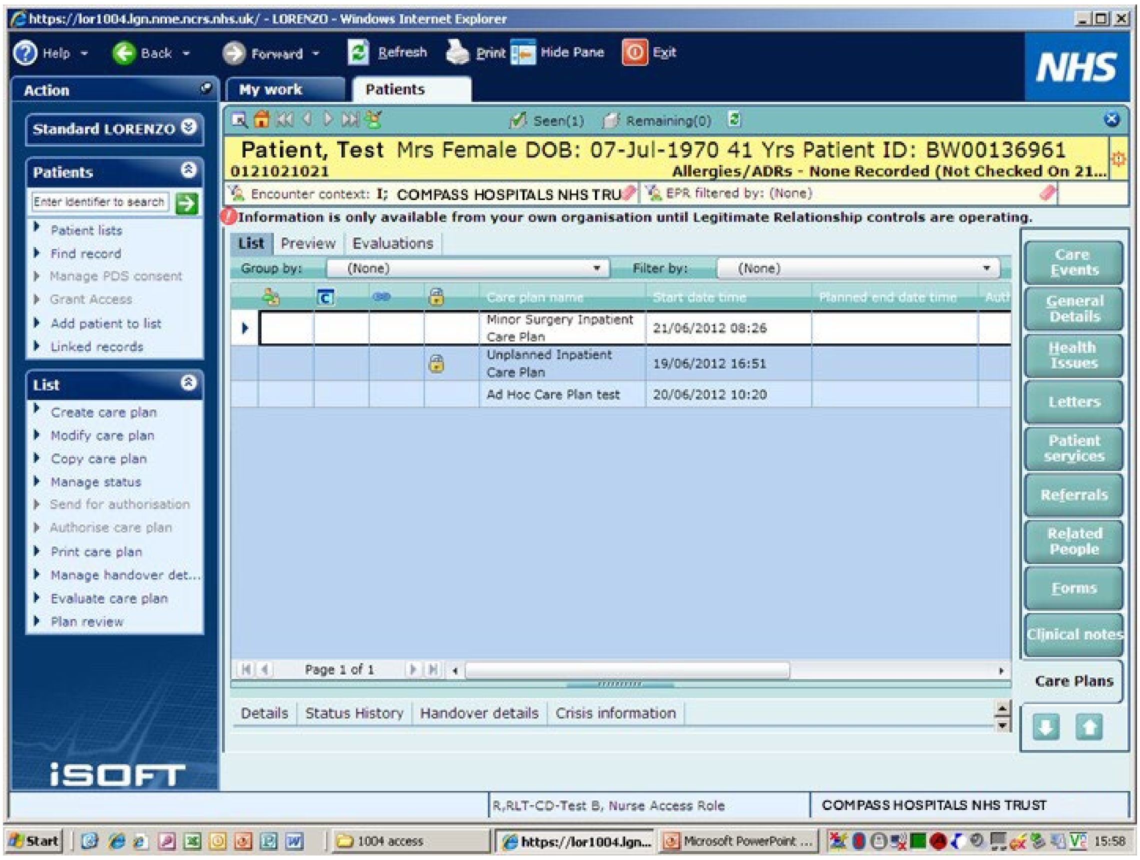

Figure 9: Example of the Lorenzo EPR user interface

Figure 9 is a (low-resolution) screenshot from Lorenzo EPR training and represents a version of how the Lorenzo EPR appeared to staff users. There are tabs and menu buttons located on all four sides of the screen. Along the right-hand side, there are tabs including ‘Letters’, ‘Clinical notes’ and ‘Care plans’, which are roughly equivalent to the paper dividers, ‘Correspondence’, ‘Clinical record’ and ‘Nursing Records’. Within this location, there could be data collected from nursing rounds, including intentional rounding, see Chapter 7. Further explanation of the Lorenzo user interface is beyond the remit of this PhD, but these rough guides to the contents of the paper record and EPR are intended to underline that both material forms of the medical record encompassed a broad collection of multidisciplinary documents.

5.4 An introduction to the IT team

Throughout this thesis, I will refer to the trust IT team. By this, I mean the clinical and non-clinical staff who worked predominantly on the development and implementation of the Lorenzo EPR. During my fieldwork, I did not collect detailed information as to who had worked specifically on the various elements of the 'EPR transformation process', and to give more detail would potentially risk breaching confidentiality. The 'IT team' staff members who participated in this PhD project were:

- Chief Clinical Information Officer (CCIO)
- EPR manager
- EPR trainer
- Head of IT
- IT helpdesk manager

The Informatics, Information and Innovation department consisted of over 150 members of staff. It was led collectively by the CCIO and the Chief Information Officer. The department was responsible for a wide remit of information and technology management, including administration of the data warehouse, EPR development and optimisation, the IT service desk, as well as the day-to-day maintenance of the technology infrastructure.

6 Mobilising the electronic patient record

6.1 Introduction

This chapter examines the transition of medical records from paper-based systems to digital records, focusing on the implications of this shift for doctors on ward rounds. Whilst the medical record and its metamorphosis into new digital formats have been used for decades as a device to explore multiple matters of sociotechnical concern, the material housing of the electronic patient record has been more neglected.

Much time and effort has been directed towards the discussion of what electronic records *do*. However, relatively little has been said about how the disembodied software of electronic records is materialised or how the EPR moving to the bedside is being incorporated into practice. My findings present descriptions of the devices, computers, wheels, trollies, and wards, as well as their users, and I discuss how work is being reshaped in hospitals through these materials made to mobilise electronic records.

Whilst acknowledging the physical technologies, it is important not to divorce the material and physical aspects of the EPR containers from the software, its relations, and its users. The challenge is to try and take these things together, looking at how the materials used may limit or expand possibilities for practice (Fenwick, 2014). One path of exploration is via attention to how the EPR's materiality in practice impacts clinical collaboration.

By drawing on my findings, I will highlight how the materiality of the medical record is critical in its role in facilitating effective collaboration in complex medical practices. I discuss how the affordances of the EPR and the use of mobile computers are reshaping collaborative practices on wards. I will show how the materiality of the medical record has wide-reaching effects on how staff are able to be in the same space, attempting to share information. I also emphasise the challenges posed by the removal of paper, which has long supported collaborative work around and with medical records.

6.2 Electronic patient records on the medical ward

Investigating the consequences of the digital transformation of medical records and understanding the active role that records take in constituting medical practices formed the premise for the aims of this project. The NHS contains a wide variety of sites in which different EPRs in various forms are in use. Often, research looking at EPRs tends to be located in relatively static environments (speaking from the perspective of how much the computers move), such as the outpatient department and the GP surgery (see Waterson et al., (2012) and Winthereik (2007)). My research looked at the EPR on the move, in practice, in a place where the record is probably the most intensely utilised and interacted with – the medical ward [12].

On medical wards, the ward round is the core activity of multidisciplinary collaboration and planning of patient flow. Compared to, for example, a surgical ward, where an early ward round runs swiftly before the commencement of the morning operation list, the daily medical ward round and the plans issued from it are the mainstay of inpatient work for the physician.

6.2.1 The mobile computers

The mobile computers at Compass NHS Hospital Trust were referred to by clinical staff as 'LOWs' (laptops on wheels), 'WOWs' (worktops on wheels), and frequently 'COWs' (computers on wheels). Mobile computers such as these had been in use in Compass since 2013, but their numbers significantly increased when the 'paperlight' ward round module of Lorenzo was released. This was part of the Lorenzo 'optimisation programme', which ran from 2016 – 2018, and according to an IT manager, turned Lorenzo into a 'proper EPR'.

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[12] According to the Royal College of Physicians and the Royal College of Nurses (2021), the definition of a ward is 'a physical space in which a group of patients receive care from a common nursing team. It can sometimes be called a unit. Ideally the other members of the multidisciplinary team will also be common to that ward's patients, but often have responsibilities across a number of wards.'

6.2.2 The laptop cart

The majority of Compass's mobile computers, or 'COWs', were laptops on wheels provided by 'True Medical'[13]. The model most frequently used on the medical wards was the 'ValuLite Laptop Cart', which claimed to be 'Perfect. For every hospital environment' (see Figure 10). The features of the ValuLite included 'easy manoeuvrability' to the bedside (particularly in 'tight spaces and congested areas'), aided by its 'small footprint' and securely enclosed laptop ('up to 19 inches in size'). In addition to a worktop area, it had an 'under work surface' and could be customised with mounts for scanners, sharps bins, keyboards, and sticker printers.

Figure 10: ValuLite Laptop Cart

In the product literature (Appendix C), True Medical highlighted that the ValuLite was small, manoeuvrable, and secure. It was easy to keep clean and could be raised and lowered to 'true seating and standing positions'.

Although, as described in the product literature, the mobile computers were claimed to be designed for easy manoeuvrability, they tended to be presented

[13] Manufacturer name changed

individually. The product website displayed the mobile computers in isolation and showed them in use with a single operator working alone. Larger-screened computers were shown being used on ward rounds but with one mobile computer surrounded by a whole ward round team. What is not shown is a ward round trying to manoeuvre multiple mobile computers and still operate together as a team. This chapter will be an exploration of how I saw the computers in use, in multiples, on ward rounds, and how this use in practice reshaped collaborative activity.

6.2.3 The ward round

The ward round is a long-standing practice integral to hospital inpatient management. In 'Ward rounds in medicine: Principles for best practice', the Royal College of Physicians and the Royal College of Nursing (2012) describe the ward round as a 'complex clinical process during which the clinical care of hospital inpatients is reviewed'. They summarise the main components of this process as follows (see Table 7).

Table 7. Ward rounds in medicine: Principles for best practice

Establishing, refining, or changing the clinical diagnoses
Reviewing the patient's progress against the anticipated trajectory based on history, examination, NEWS2 (national early warning score) and other observations, and results of investigations
Making decisions about future investigations and options for treatment, including DNAR (do not attempt resuscitation) and any ceilings of care
Formulating arrangements for discharge
Communicating all of the above with the multidisciplinary team, patient, relatives and carers
Active safety checking to mitigate against avoidable harm
Training and development of healthcare professionals

(Royal College of Physicians and Royal College of Nursing, 2012)

As the table summarises, the ward round is a time for information gathering, decision-making, and communication (both with the multidisciplinary team and the patient). Whilst the components of a ward round are in general agreement, the structure, scheduling, and staff members may vary significantly from ward to ward and hospital to hospital. In general, most ward rounds comprise one or more doctors, generally with the junior doctor completing the documentation under the supervision of a more senior doctor. Given the known challenges facing collaborative work as described above, the ward round is a critical activity in the daily life of the medical ward, which facilitates a scheduled period of focused and synchronous communication.

6.2.4 The medical record and the ward round

Both conceptually and physically, the medical record has long been a central component of the ward round. As Table 7 summarises, the core components of the ward round are intertwined with the notes in one way or another. For example, a central focus of the ward round is 'establishing, refining or changing the clinical diagnoses'. The clinicians take out key fragments of clinical information (from the record), piecing them together to form a picture of the presumed diagnosis, whilst arranging further testing to support the diagnosis and fill in any gaps.

Figure 11 illustrates a ward round (with paper records). The medical team are gathered around a notes trolley containing paper notes. This drawing reflects how I remember doing ward rounds myself and gives what I feel to be a typical representation of how a ward round might have previously appeared to the on-looker.

Figure 11: Illustration of a ward round centred around a notes trolley containing paper medical notes.

In terms of coordination and collaboration, beyond the ward round, the record of the ward round is a source of ‘what the plan is’ for the tasks delegated to others (e.g. nurses, physiotherapists, discharge coordinators). The doctors and the location of the ward round may change, and the patient may not even be present, but the record persists, representing the patient and providing space to form trajectories and plan care (Strauss et al., 1985; Berg, 1996; Royal College of Physicians and Royal College of Nursing, 2012).

The ward round may spend more time with the record than directly with the patient, especially if the medical team is unfamiliar with the patient’s case. In addition, the introduction of shorter junior doctor shifts with the European Working Time Directive in 2004 (Scavone, 2021) and the demise of the hospital ‘firm’ scheme (whereby patients would generally see the same team of doctors throughout their hospital stay) has led to increased dependence on the record, to hand over the baton of problems and plans from one shift of doctors to the next (The Lancet, 2012; Morrow et al., 2012). These factors emphasise the importance of the medical record to effective intradisciplinary communication and collaboration. I will continue this discussion and what the EPR means to interdisciplinary communication in section 8.2.3.

6.2.5 Collaborative working

Both the Royal College of Physicians and the Royal College of Nursing recommend that the highest standards of communication are achieved through multidisciplinary ward rounds, with the staff who know the patient best (Royal College of Physicians and Royal College of Nursing, 2012).

In reality, this varies with the type of ward, scheduling, and staffing resources. For example, on a rehabilitation ward, there is a more robust tradition of ward rounds encompassing allied health professionals such as occupational therapists and physiotherapists. In contrast, the ward rounds I observed on wards A and B comprised of only doctors and advanced nurse practitioners (ANPs). Ward nurses were not present on any of the ward rounds I attended. Although nursing presence on a ward round is highly recommended (Royal College of Physicians and Royal College of Nursing, 2012; 2021), the results of a recent national survey (Royal College of Physicians and the Royal College of Nursing, 2021) are in keeping with my observations, with only 9.3% of consultants on acute medical units reporting that nurses were routinely present on ward rounds.

6.3 Digitally mobilised collaborative work

Movement is integral to the traditional ward round. With the caveat that there is not one picture of what a ward round looks like or how it moves, my experience, and that of others (Bardram and Bossen, 2005), is that a medical ward round is lengthy (2 hours or more) and mobile. Much of this time is spent standing around notes, computers, corridors, or at bedsides.

Generally, the clinicians move to their patients, at their beds, one after the other. The rhythm and pace of this sequence are set by many factors, including the type of ward, the speciality, the time of day, and the availability of staff and computers. Although a ward round may just be focused upon one ward, often, a number of patients will be 'outlying' across the hospital.

Before the EPR became mobile through computers on wheels, how hospital staff used earlier iterations of the EPR at static desktop computers was an area of interest to researchers in the field of Computer Supported Cooperative Work (CSCW). Luff and Heath (1998) described the challenge of maintaining mobility while accessing fixed resources and information, referring to it as 'local mobility'. They observed that the physicality of the desktop computer limited mobility to its immediate vicinity. As a result, staff had to constantly move back and forth between the computer, patient, and paper records.

It might be assumed that the transition from fixed computer systems to mobile technologies would bring about increased flexibility in mobility within hospital wards. However, based on my observations, I found that the digital mobilisation of collaborative medical work still faced restrictions, albeit in different ways.

I reiterate here that my focus was primarily on inpatient collaborative work, as other forms of medical work may benefit from the enhanced accessibility of the EPR across different sites. For instance, outpatient medicine across multiple hospital locations may be able to take advantage of access to the EPR from one site to another. However, when it came to collaborative practices within wards, where staff gather, engage in discussions, make decisions, and communicate, the materiality of the information systems continued to play a crucial role, just as it did before.

During my observations, I was interested in how the movement of the ward round was being reconfigured by the devices which were housing the record, and it was the stillness that struck me on Dr Burr's ward round.

6.3.1 Dr Burr's ward round

My first observation session at Compass Hospitals was with Dr Burr on ward A (an Acute Medical Unit or AMU). I arrived at his office early on a Thursday morning and introduced myself. Dr Burr told me to take a seat.

I waited for the ward round to start before realising it already had, and I was sitting in it. It was not moving; it was happening there in that room.
(Observation: ward A, 29/11/18)

As I discovered, Dr Burr's ward round was conducted from his office in the 'hub'. The 'hub' was a large office (with a side room) located down a corridor and behind the AMU ward area (see Figure 12, page 127). I later discovered (from the consultant's secretary) that this office and side room had served a variety of purposes over the years. It had been a hairdressing salon in the past, and then a clinical decision unit. At the time of my observations, it was a central area for the ward A clinicians to deal with administrative tasks. It was also where the noon MDT (multidisciplinary team) meeting occurred. Dr Burr, as the lead clinician for the AMU, used the side room as his own office. The main area had five desks with computers (each with two monitors) and two spaces for the AMU secretaries.

Martha (Dr Burr's secretary) told me:

Different doctors do different ward rounds in different ways. Some in here (in the hub), some out there (on the ward itself).
(Observation: ward A, 29/11/18)

On that day and the subsequent days, I observed four ward rounds on the AMU – each with a different senior doctor leading the process. In addition, I was also able to observe (from my position in the hub) the comings and goings of other clinicians, and I took note of how the ward rounds were being conducted, where they were visible to me.

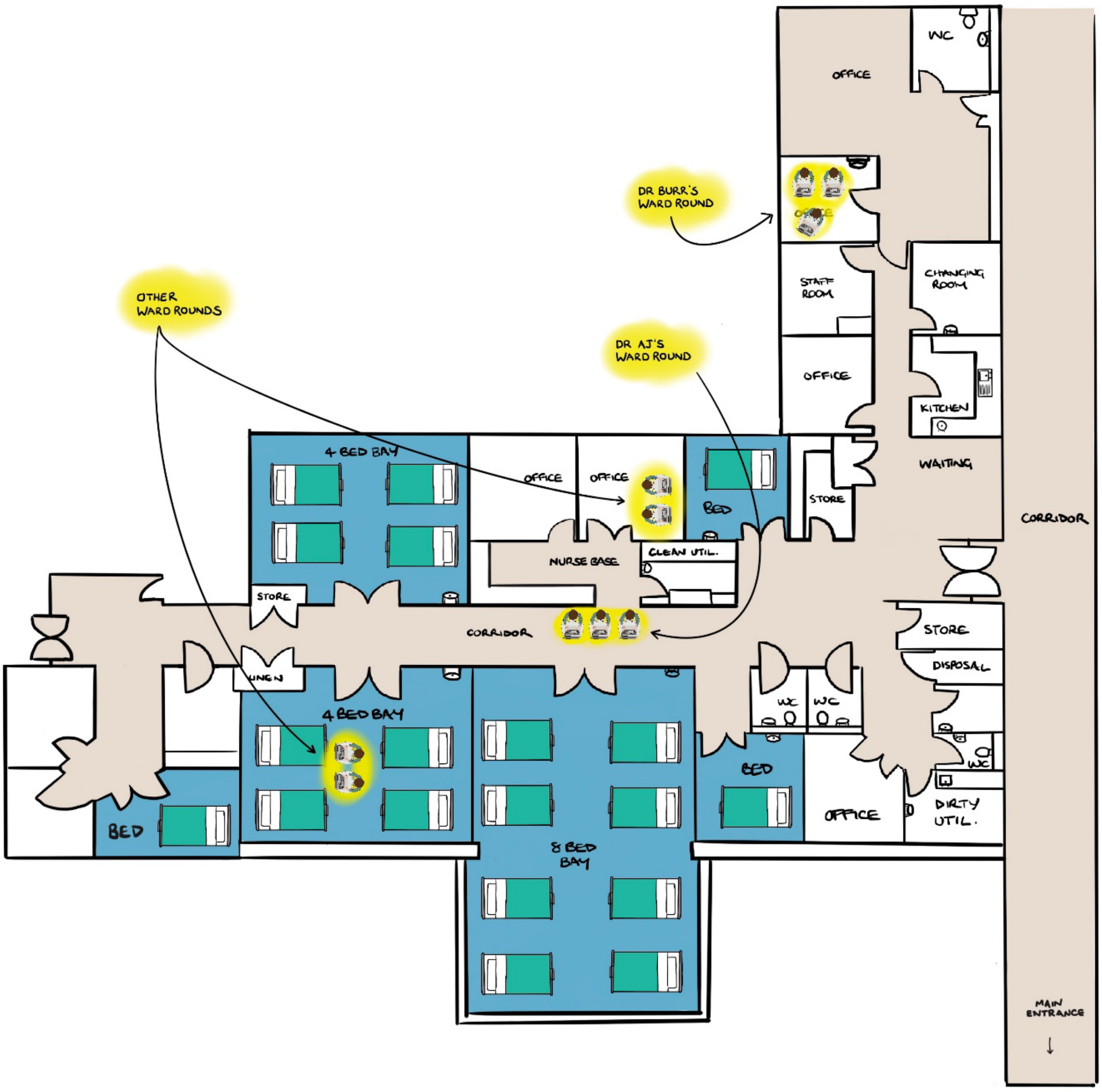

Figure 12: A snapshot of ward round locations. Dr Burr's office based ward round is in the top right corner. Dr AJ's ward round is situated alongside the nurses' base.

Dr Burr's ward round consisted of him and two junior doctors. The junior doctors were relatively new to the trust (weeks to short months) and were in 'locally-employed' non-training grade posts. In their home countries of Singapore and Burma (Myanmar), they had worked with computer records, but not with an EPR system as extensive and 'paperlight' as Lorenzo. I noted:

The ward round is a quiet and largely static affair. Dr Burr reads aloud from the screen and suggests ideas of what might be going on as he goes along. They will eventually reach a point where enough information has been covered, and they will go to see the patient.
(Observation from field notes: ward A, 29/11/18)

Dr Burr sat at his desk, which had dual monitors. The junior doctors sat at mobile computers behind him. Dr Burr had the ward round note open on his computer and typed into it, pausing from time to time to direct questions at the junior doctors. From my position, I could not see the other doctors' screens, so it was unclear whether they were working together on the same patient. Every time Dr Burr spoke, there seemed to be a moment of silent calibration before anyone was able to respond:

Before anyone can reply, he (Dr Burr) tells me that he has become used to pauses. He puts this down to the 'mental hopping' that has to occur as the listener jumps from one 'spinning wheel' to the next. The use of Lorenzo absorbs so much concentration that it takes time to process a new question (especially for a different patient).
(Observation from field notes: ward A, 29/11/18)

I noticed that Dr Burr had a piece of paper beneath his keyboard. He pulled it out to make sure they had not missed anything.

He tells me he has started using a checklist – a reminder of all the things that need to be reviewed (e.g. are they on VTE[14] prophylaxis, are they on antibiotics, what is their resuscitation status?). The sorts of things he has been doing routinely for years, but now he needs a list. He tells me that something about all the changing between screens in Lorenzo is distracting.
(Observation from field notes: ward A, 29/11/18)

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[14] VTE = venous thromboembolism

Before the paperlight EPR, Dr Burr had several forms ('VTE prophylaxis, resuscitation status'), which were all present in a three-dimensional paper format. These artefacts were not necessarily distinct and separate objects, but the AMU paper admission booklet, containing these sections, worked in a way which produced a three-dimensional and tangible memory of where the information would be. Pages have fronts and backs, tops and bottoms, and lefts or rights. Dr Seabury, an associate specialist, described this eloquently:

> *'So, when you picked this thing up, you got an immediate in your hand, if you like, detailed precis of all the salient things about that patient's admission to hospital. And you hold the document in your hand. The admission document is an extremely good example of, if you like, the ultimate paper record – it's light, it's very portable. When you've got a paper document, you've got something you haven't got with a computer document [...] it's actually three-dimensional, it's not two-dimensional. Our brains have evolved to process real things and objects that take up space, and once you've got one more than one side of paper, essentially, you've got a three-dimensional object which you can move around [...] I think there's something missing with the interface between our brains and computers. Computer screens, shall we say, or any screen or any document that's just fixed somewhere, that we can't pick up.'*
> *(Interview: Associate Specialist, Dr Seabury (011) – ward B)*

Both these accounts suggest something is lost in the navigation and use of digital medical records that was afforded through the physical properties of paper. The tangibility of the information and the physical space it occupied aided the memory of the user of the paper document. As Dr Seabury put it, 'our brains have evolved to process real things'. Vitally, the paper record was mobile and portable and could easily be taken to the bedside and shared between the ward round team. The transformation of that collaborative space was one of the factors underlying why Dr Burr had withdrawn his ward round into his office:

'So … instead of gathering around some notes and everyone looking through them together and being able to interact with each other, flick forwards, backwards, maybe do it at the end of the bed perhaps, and everybody would be on the same page. So to speak. But with Lorenzo, that is harder because everybody really needs their own computer to work from otherwise you've just got people sat around watching one person do all the work. But then it means that you will have people buried like teenagers in their devices, and only popping their head above water now and then to interact.'
(Interview: Consultant, Dr Burr (014) – ward A)

Again, Dr Burr makes reference to the material affordances of paper records, being able to move forwards and backwards in the notes through the 'flick' of paper, and what the paper documents allowed in terms of near-instant collaborative awareness – 'being on the same page'. Observing his back-office ward round, I could see that the mental checklist was being ticked for each patient, but the pauses and punctuations to the interactions, augmented by the awkwardness of the seating arrangement without a singular focal point, made the flow of work appear disjointed and lacking in connection.

6.3.2 The 'shop-floor' ward round

Soon after, I arranged to return and watch Dr AJ's ward round. Dr AJ (another ward A consultant) was accompanied by Dr Ash, an FY2 doctor[15] and Dr Ore, a non-training grade junior doctor who had recently arrived from Nigeria.

Dr AJ says he prefers doing ward rounds on the 'shop floor'. He tells me that everyone has different ways of doing things, but this is how he likes it.
(Observation from field notes: ward A, 05/12/18)

[15] Foundation year 2 = a training job in the second year of the foundation programme, typically year two post graduation.

The three doctors each had a mobile computer (otherwise known as a computer on wheels, COW) and lined up to get a handover from the nurse in charge. They then wheeled around to a spot in front of the main reception, which became their base (see Figure 12).

> *'Dr AJ explains how he would like the ward round to run – with one doctor writing the patient's notes and the other doctor getting up results/doing other jobs on Lorenzo.'*
> *(Observation from field notes: ward A, 05/12/18)*

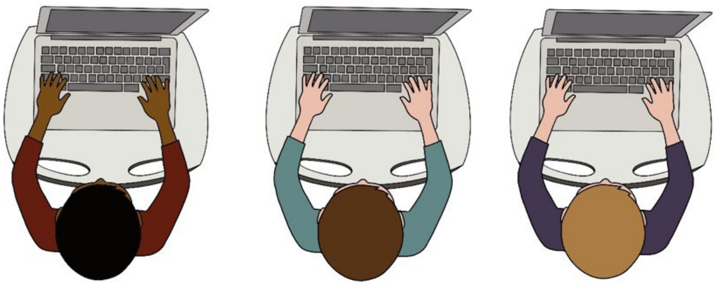
They worked out which patients needed to be seen. They were reviewing the patients who had already been seen on the post-take ward round (on the previous day) and needed further investigation or management before being sent home or to another ward.

Together, they moved to the bedside with their mobile computers, saw the patient, and then returned to their base. This choice of 'base' location was limited. With the space they took up between them (and their mobile computers), they could not easily remain in the ward bay. At this time of the morning, other wheeled devices were competing for space near to patients. A commode needed to be wheeled past; a clinical support worker was wheeling clean folded linen on a larger trolley. A technician was attempting to find the space to manoeuvre an ECG machine to a patient in the corner bed. So, their base at the main reception is a compromise between being in the centre of the ward (near to the next patient), near the nursing staff (as they will periodically report back to the nurse in charge), but also where they will fit.

Figure 13: Wheels everywhere - a sketch of a view down the ward across the three lined-up mobile computers of the ward round (this picture, drawn without people, highlights how busy with wheels the corridor is with the devices alone).

To further explain how the mobile computers were articulated in the ward environment, I will now illustrate some of the ways I saw the ward round members standing with mobile computers. These 'formations' are not exhaustive, but they give an idea of how ward round members made subtle adjustments to their mobile computers to create a space in which they could collaborate. In addition, there were other ways of standing, some of which involved the less-mobile mobile computers – the pharmacy workstations on wheels. These large mobile computers contained the medications for each bay (excluding controlled drugs (e.g. morphine) and some others).

6.3.3 Ways of standing



1.

This linear formation enables the users to see each other's screens. In my observations, Dr AJ used this way of standing on ward A. The consultant took the central position, which would have given him the clearest views of the screens to either side of him. As the consultant leading the ward round, Dr AJ needed a clear overview of the patient information, and this view of the other screens would have facilitated this. It is similar to having screens placed side-by-side on a desktop (as on Dr Burr's desk in his office-based ward round).

Significant space was required to accommodate the alignment of three computers along with their users. The area needed to line up the three computers plus their users is significant. The corridors of the medical wards were not spacious. Any available space had already been occupied by equipment.

At one point, I saw around 14 computers lined up along the side of ward A's main corridor; Figure 13 (above, page 132) gives an impression of this. The corridor served as a busy thoroughfare with near-constant movement of staff and patients, along with various mobile objects, such as bulky hospital beds. This resulted in frequent adjustments to accommodate the passage of people and equipment, as well as the steady detangling of clashing wheels.

One of the challenges of standing in a linear formation is the presence of a physical barrier created by the wall of computers. When it came to interacting with patients using the 'computers on wheels' (COWs), at least one of the doctors expressed a sense of awareness regarding this issue:

> *'We move to the bedside. Dr AJ and Dr Ore go behind the curtain with the COWS, Dr Ash holds back, and stands with the COW on the other side of the curtain. He is conscious that three computers are probably too many; 'you can see the patient's reaction'. The computers in these situations are at a height to be used whilst standing, which looms over a seated patient. The patient cannot see the screen – it being both too high and facing the user, not the patient.'*
> *(Observation from field notes: ward A, 05/12/18)*

In this scenario, the smaller size of the laptop on wheels allowed for greater mobility, enabling the EPR to be brought to the bedside using multiple devices. This flexibility would not have been possible with larger mobile devices, which would not be able to cluster around a small bedspace. But there was a compromise. Dr Ash chose to remain outside the patient's curtains, sensitive to the patient being overwhelmed by so many computers. He was reluctant to go in without his computer, leaving it unattended outside the curtains. If he left it, there was a chance another team would take it for their ward round.

2.

A perpendicular formation, which I frequently observed, involved two doctors standing together. This formation is similar to formation 6, where only one user has an overview of both screens. However, unlike formation 6, in this perpendicular formation, the users can more easily maintain eye contact with each other. I did not specifically note at the time whether there was a tendency for the junior or senior doctor to take the position that allowed them to see both screens (i.e. the one on the right).

3.

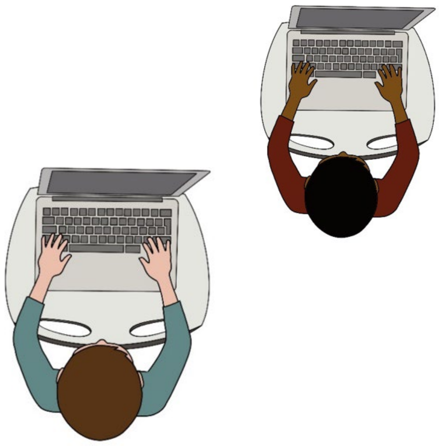
I observed how Dr Kay and Dr Birch (on ward A, 29/11/18) stood beside each other, facing their mobile computers, which were pushed up against the corridor wall. The most notable aspect of this observation was that they were primarily focused on their laptop screens whilst talking. Dr Birch, the consultant, was asking Dr Kay, the junior doctor, questions about the management plan she had suggested. Frequent pauses marked the conversation between them as they simultaneously typed, scrolled, read, and played the roles of teacher and trainee. I did not notice them look at each other during their interaction.

4.

This position, where the users stand facing each other, appears to be the most friendly and interactive. In this configuration, users of the mobile computers can establish eye contact more easily. However, it comes at the cost of losing the ability to directly oversee each other’s work, unless they intentionally turn away from their own screens.

5.

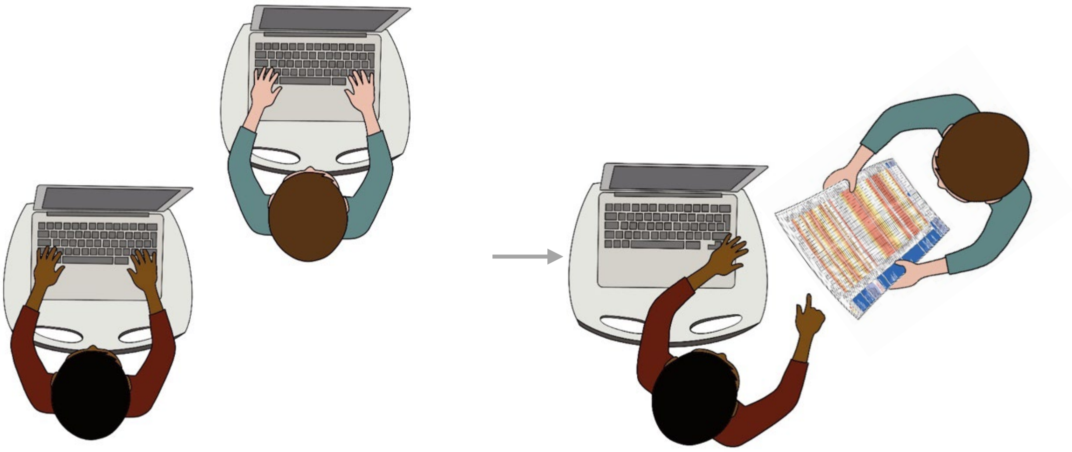
The subtle angulation I observed in this scenario was not so much a collaborative ward round formation but rather two users of mobile computers participating in the same ward round but writing about different patients. They were close enough to be able to communicate verbally, but the divergent positioning of their screens was because they were not actively working together or collaborating on the same tasks.



6.

In this position, the junior doctor (on the right) stood ahead, allowing the senior doctor, the ward round leader, to see both screens more easily. It was interesting to note what happened when a piece of paper (a NEWS2[16] observation chart) was picked up (see below/overleaf). The junior doctor (on the right) picked up the chart, unfolded it, turned around, and held it out so they could look at it together. This interaction highlighted the contrasting ways in which the doctors collaborated (or worked independently) with the mobile computers, compared with how they were able to use paper as an accessible, collaborative device.

[16] NEWS2 – National Early Warning Score (NEWS) 2 (Royal College of Physicians, 2017). A scoring system for physiological measurements that are routinely recorded at the patient's bedside. This paper form was replaced by an eObservation system in 2020, after my data collection was completed.



These diagrams illustrate how the doctors' physical movements were shaped by the utilisation of EPR, the material characteristics of mobile computing devices, and efforts to work collaboratively. The laptop seemed to limit the capacity of the ward round to stand in a way that allowed the alignment of shared visual information.

Pine and Chen (2020) discuss the concept of physical alignment in healthcare settings, particularly in relation to the implementation and use of EPRs. 'Physical misalignment' occurs when workers face challenges in physically bringing together information at the specific times and places it is needed. This can lead to inefficiencies and potential safety risks.

Physical misalignments can be related to patient movement, the inability to co-locate information with the patient, or misalignments related to 'information fissures'. This refers to when clinicians had to work across multiple digital information systems which did not interface with the EPR. My research found that even when the digital information system, Lorenzo, was comprehensive and did not require multiple logins, the physical interface was still misaligned for teams trying to collaborate around the information.

6.3.4 The spatial aspects of collaboration

Mobilisation involves assembling the necessary combination of people, resources, knowledge, and places to carry out tasks (Bardram and Bossen, 2005). This process is also known as articulation work (Strauss et al., 1985) (see also section 9.2.3). Bardram and Bossen (2005) introduce the term 'Standard Operation Configuration' to expand on the spatial aspect of articulation work. A 'standard operation configuration' refers to the creation of spaces that facilitate cooperation based on shared knowledge. For example, a configuration could be the layout of a ward or even an entire hospital, as well as the organisation of surgical instruments on a tray in an operating theatre (Heath et al., 2003).

Bardram and Bossen (2005) describe the trolley used during ward rounds as a 'standard operation configuration' because it fostered cooperation due to 'common knowledge and agreement as to use and navigation'. This physical arrangement included paper medical records, compiled test results, and other materials such as handbooks, tendon hammers, and stethoscopes which created a space and focus for gathering and collaborating. This concept offers an interesting perspective for comparing the mobile computer trolley and its ability, or lack thereof, to generate a similar spatial arrangement.

Firstly, the physical components of mobile laptops do not generate space for group work. As shown in the diagrams above ('Ways of standing'), illustrating different ways of standing around the computers, configuring the laptops for collaboration necessitated the formation of specific spaces and shapes, which limited mobility. The mobile computers occupied space wherever they were moved, which posed a challenge in a busy ward where space was constantly in demand. The users had to adapt to the spatial requirements of the computers, unlike the notes trolley, which naturally generated a space conducive to group tasks, or a single set of notes which could be carried around in hand.

Using the concept of 'standard operating configurations', the EPR does create a space, except that the informational materials of that space are contained behind the screen, within Lorenzo. The EPR provides a recreation of a 'standard operation configuration' within its interface by digitising previously physical objects such as medication and observation charts. The space configured for collaboration moves *within* the EPR and away from the previously external space of configuration. Interactions become intensely focused on the computer screen as users concentrate on the EPR. Dr Burr captured this effect when he said:

> *'it means that you will have people buried like teenagers in their devices, and only popping their head above water now and then to interact'*

The attachment and reliance of junior doctors on their computers and their feeling of being ineffective without them can be further understood through the spatial dynamics of the materiality of the mobile EPR. The paper record (and its accompanying trolley) created a spatial environment that fostered connections with the immediate and present surroundings. In contrast, collaboration through the EPR and the mobile computer directed attention towards digital information and the digital patient.

6.3.5 The laptops in use

The ward staff drove the proliferation of mobile computers. Compass Hospital NHS Trust attempted to provide as many mobile computers to the wards as the ward staff said they needed to do the work. Tanya, a trainee ANP, told me how the nurses and doctors used to have to compete to get access to the computers, so they asked for more:

> *'We've got enough computers now. We don't need to fight over them anymore; in fact, we've got far too many. The more computers you have, the more they'll be used, won't they? I think we've got 11 or 12 now, that's one for every two patients, just about.'*
> *(Interview: Trainee ANP, Tanya (003) – ward A)*

The doctors did not feel there were too many computers. As Dr Burr had described, on Compass Hospital's paperlight wards, 'everybody really needs their own computer'. The junior doctors agreed. They described to me how absolutely necessary it was that they were able to access a mobile computer, especially for ward rounds. Without a laptop, they could not document or retrieve information. Their dependence on mobile computers led to one of the doctors describing himself as feeling like a 'walking computer':

> *'Yeah, definitely [a walking computer], especially on the surgical ward rounds, you'd even steal a laptop from one ward, and you'd even walk down the whole corridor to the next ward, pushing the computer, because you're like, concerned that if you got to that ward they [the laptops] will all be taken, and there's no way to document other than on laptops. And sometimes you would know that certain wards would have faulty laptops, so you'd want to keep a good one with you.'*
> *(Interview: F1 doctor, Dr Louis (006) – ward B)*

Dr Louis' quote gives an insight into the realities of maintaining technologies within the complex environment of the hospital. The scarcity of reliable laptops, and the potential of arriving in a ward without any available, added another layer of burden on the junior doctors, who needed to be connected to the EPR to participate in the workflow of the ward round.

At the time of my visit to ward A, the doctors and nurses were generally satisfied with the number of computers they had, and it was hard not to be aware of how successful their demands for more computers had been. The mobile computers were clustered around the main desk, and first thing in the morning, before ward rounds started, I was struck by the sheer mass of wheels, screens, and tangled drapery of cords:

> *It feels as if there are computers everywhere. There is one drug trolley COW per bay (so there are four). Two phlebotomy trolleys (with laptops). I'm not exactly sure how many mobile laptops - at least six. At one point, I look down the ward corridor, and there are 13 COWs. There is hardly room to squeeze a bed by. It is hard for the ECG technician to get to the*

patient beyond where our ward round is standing. The cleaner has to move each COW away from the wall and back again ('they generate fluff, because they are warm, they're a nightmare really').
(Observation from field notes: ward A. 05/12/18)

And it was not just striking to me. Other staff commented on their numbers, as Tanya put it,

'There are loads when you come on the ward. Did you see them all? If you stand at the bottom of that ward at 10 o'clock in the morning and look up, you could probably count anywhere between 12 and 15 healthcare professionals lined up on them computers. Yeah, and that's without going in the offices.'
(Interview: Trainee ANP, Tanya (003) – ward A)

I found the ward rounds enacted with and through mobile computers immediately stranger than I was expecting. Mobile computers were not new to me, but observing wards where it appeared that most medical staff were standing behind and moving with a computer was strikingly different from my own experience. For the most part, in my practice, computers were on a desk, or we took just one along on the ward round with us.

The movement of the staff/computer couplings seemed to magnify the centrality of the medical record to practice, paper records would go in and out of the trolley, but the attachment to the COW seemed constant and strangely dependent. Some of the more experienced ward staff also expressed a similar view. Dr Miranda, an associate specialist doctor, felt like the ward was an 'alien land'.

'I do think that sometimes it's just strange that you get everybody on the computers […] the nurses were kind of on the computer, the pharmacist on the computer, everybody was on the computer. It's just that it does feel like some alien land now.'
(Interview: Associate Specialist doctor, Dr Miranda (009) – ward A)

And Tanya, an experienced ward nurse who was training to be an advanced nurse practitioner, was particularly struck by how the junior doctors seemed to be dependent on mobile computers:

> *'I really feel like juniors really like a computer. I feel that they feel it's kind of... I think they feel safe with one. It's something for them to do, isn't it? Something to do with their hands and look at, and all the rest of it, and I think when they haven't got one, they kind of go and look for one almost, so if there's three doctors on a ward round in the morning, you'll find sometimes that three of them have all got a computer. It's almost like a thing that they've got to have, it's weird.'*
> *(Interview: Trainee ANP, Tanya (003) - ward A)*

Tanya's observation that junior doctors felt 'safe' with a computer suggests that the computer had become an essential tool in their practice. This relates to Dr Burr's earlier comment, in which he described how juniors had to have a computer each, or they would be sat around watching everyone else do the work. Being with a computer was a necessity in appearing actively involved and professionally equipped.

Other staff members, like Phoebe, a physiotherapist, also commented on how the junior doctors were strongly attached to the computers, which sometimes made them seem detached from their immediate surroundings:

> *'I think it's very easy to spend a lot of time staring at a screen, if you are not careful, and not communicate with a patient. And you see the doctors' rounds, there's several doctors and the consultant probably hasn't got a laptop, he's just instructing whoever to document. But that person is completely detached from the whole communication thing, they're just doing what they are told on the computer.'*
> *(Interview: Physiotherapist, Phoebe (001), Weston District Hospital)*

These quotes describe how the shift towards the EPR during ward rounds appeared to affect not only the nature of interactions but also the personal attachment of the junior doctors to the mobile computer. The junior doctors relied heavily on the mobile computers during ward rounds, feeling that they were rendered useless without them. It seemed that the use of EPRs had become so ingrained in their practice that it was difficult for them to imagine what work they could do without access to the digital records.

When medical records were primarily paper-based, there was an inherent limitation as to how many people could be writing in the record. This meant that the ward round was more centralised around a single patient's notes and a single individual who was writing in or updating the record. At that time, the act of watching someone else write, as described by Dr Burr, was generally accepted as part of the collaborative process. Other participants in the ward round could engage with additional material artefacts like observation charts or medication charts, thereby actively contributing to the overall process.

The shift to the EPR changed this dynamic. With digital records, the possibility of multiple individuals accessing and updating patient records simultaneously became available. Consequently, the sight of multiple doctors 'sat around watching one person do all the work' on a computer could be perceived as inefficient and unproductive.

On ward B, at the start of another ward round, I watched as one of the junior doctors laid out her belongings on the mobile computer worktop (see Figure 14). Water bottle. Mobile phone. Paper and pen. Bleep. She was setting up her workstation as you might do at a desk, getting ready for what would likely be hours attached to the COW. The worktop space was utilised by the doctors to tether themselves to the device. Walking away was not just a security risk for confidential digital (and paper) information, but also for personal belongings, such as a water bottle and mobile phone.

Figure 14: Personal set up on a mobile computer

This attachment was concisely surmised by Dr Ash, a junior doctor, as I noted during an observation on ward A:

The ward round team reach a side room. The patient is immunocompromised. They don't take the computers into these rooms, where there is a risk of infection (e.g. c. diff/MRSA). Dr AJ goes into the room. Dr Ash and Dr Ore wait outside, listening at the door. Dr Ash smiles, "If the computers don't go in, we don't go in".
(Observation: ward A, 05/12/18)

Whilst there was an element of humour in Dr Ash's comment, it reflected a deeper truth. It was likely that even without the presence of computers, the doctors may have avoided going into certain areas to reduce the risk of cross-infection. But the attachment of the junior doctors to the mobile computers was clearly strong. Throughout my observations, the doctors rarely disengaged from their mobile computer devices. They even admitted to having favourite 'COW's, and I was told there was often competition to secure their preferred one at the beginning of the day. Setting out their things on the worktop marked it as theirs, making it more difficult for someone else to start using it (see Figure 14).

The physical setup of mobile computer workstations and the tethering of personal belongings to the computer could reflect not only security concerns, but also the ways in which the use of the materialised EPR had reshaped the professional and personal boundaries of junior doctors. The mobile computer had become more than just a tool for accessing information; it looked as if it was starting to become a symbol of professional identity and the predominant means of interacting with the work environment. This dependence on EPRs and mobile computers raises questions about the potential consequences for collaboration and care.

6.3.6 The illusion of mobility

Neither of the ward rounds I have described here achieved the envisioned flexible mobility that could have been expected using computers on wheels. At first, it seemed that Dr AJ's ward-based ward round operated independently from the desktop PC, giving a sense of adaptability and patient-centredness. However, when reviewing patients at their bedsides, there was limited space to accommodate the mobile computers. This required the team to return to the main reception area where they could stand together with the mobile computers, or for some of the team to not enter into the patient area at all.

On the other hand, Dr Burr's ward round had shifted away from the ward and centred around a desktop computer in a side office. This relocation provided a more secure and quiet environment for handling the complex array of digital information. This created a distance from the real-life patient, in preference for their digital representation, the 'iPatient' (Verghese, 2008). This version of the ward round did not necessarily spend less time with the patient, but concerns have been raised regarding the potential consequences of such a shift in focus. The risk lies in the possibility of inadvertently prioritising the EPR as the primary source of interaction rather than the patient themselves (Ober and Applegate, 2015). A more digitally-centred approach to care has the potential to disconnect from the patient narrative and undermine patient autonomy (Hunt *et al.*, 2017).

6.4 Ward rounds and paper records

The examination of ward rounds with paper records can provide valuable insights into the materiality and affordances of paper, highlighting the role that paper plays in shaping collaborative interactions, information access, and mobility on medical wards.

In the literature review (chapter 2), I described how the medical record plays an 'active, constitutive role' in the work of medicine and becomes involved in 'shaping and maintaining a patient's trajectory' (Berg, 1996). How the medical record is contained is important because, over many preceding years, medical practices have developed around physical things, including paper and reading and writing (Berg, 1996). As Dr Seabury put it, the paper record was 'not just a blank piece of paper, it very much guided you'.

Memories of my experiences with paper records stayed with me in the field; how we had moved with paper and were moved by paper was often on my mind. So, as much as my ethnographically-informed work has been concerned with looking at how clinicians shaped their work around electronic devices, I have also paid attention to the shadows left by paper-related practices. Shadows and contrasts that I was able to see through my own experience of being a doctor. I will now explore some of the specific properties and characteristics of paper records, and how these related to collaborative practice.

6.4.1 The flexibility of paper records

Paper records may have looked messy and challenging to navigate, but as Nygren and Henriksson (1992) put it:

> *'The medical record is very familiar in structure and content to an experienced physician. Like in a supermarket where you shop every day, the physician finds his way swiftly and easily through the record.'*

This is reminiscent of how medical consultant, Dr Burr, described needing a checklist when using the EPR compared to how he had been able to remember what he needed to do with paper records. The relative flexibility of navigating a paper document, and its 'interactional affordances' (Sellen and Harper, 2003), were also described to me by Dr Seabury, an associate specialist on ward B:

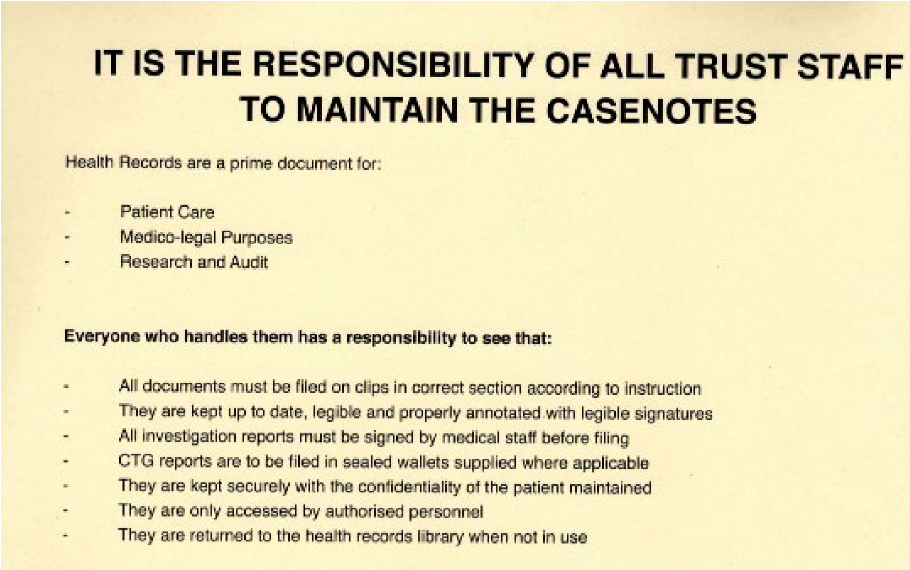
> *'If you've got a paper document with everything in and it's all legible, it's vastly superior, I think, to a computerised document, where you have to remember there's another page you can look at, and then go and look for it ... somehow the information kind of seems easier to get at when you can pick up a document and look at it.'*
> *(Interview: Associate Specialist, Dr Seabury (011) – ward B)*

Dr Seabury suggested that paper records seemed to do more to gather together what needed to be seen, rather than requiring that the user remember to look. This may relate to the idea that there are cognitive advantages to physical interaction, which can aid memory and understanding through embodied cognition (van der Schaaf *et al.*, 2019). The paper record could guide the user, and on a ward round, could also guide the whole team, who would be able to stand together, aware of where they were in the document.

The mobile practice of ward rounds evolved around and has been facilitated by the intrinsic ecological affordances of paper (Luff et al., 1992). Paper allowed flexible, collaborative practice, and with carefully cultured paper technologies (like the admission proforma and the NEWS2[17] chart, for example), clinicians were able to bundle curated packages of information (Gorman et al., 2000) whilst maintaining mobility around the ward environment.

The process of writing notes by hand also encouraged a more economical approach to input. Paper required clinicians 'constantly to create order, to maintain a focus' (Berg, 1996, p. 512). As well as the physical effort of entering information into a paper file, each entry could also be seen as adding actual weight to the record, so curating it and keeping it focused was a collective endeavour which improved its useability and mobility. On the inside cover of paper notes was a reminder to all staff that they were responsible for the maintenance and care of the notes (see Figure 15). During my fieldwork, I was unaware of any similar statement of responsibility or understanding of how to maintain the Lorenzo EPR.

[17] National Early Warning Score (NEWS2) also see NEWS2



IT IS THE RESPONSIBILITY OF ALL TRUST STAFF TO MAINTAIN THE CASENOTES

Health Records are a prime document for:

- Patient Care
- Medico-legal Purposes
- Research and Audit

Everyone who handles them has a responsibility to see that:

- All documents must be filed on clips in correct section according to instruction
- They are kept up to date, legible and properly annotated with legible signatures
- All investigation reports must be signed by medical staff before filing
- CTG reports are to be filed in sealed wallets supplied where applicable
- They are kept securely with the confidentiality of the patient maintained
- They are only accessed by authorised personnel
- They are returned to the health records library when not in use

Figure 15: Photo of the inside cover of a set of Compass medical notes

As medicine has evolved, and the care of patients has moved beyond being the responsibility of an individual physician to a multidisciplinary team of healthcare professionals, paper records have been necessary to transfer information across time and from person to person.

In addition, paper notes were highly portable and easy to transport from bed to bed. Laid open, they could be seen and shared between multiple users. They could be carried and annotated in arms, they could be rested on a bed and shared with a patient, and they could be pulled apart and reassembled. The 'separate mobility of the record's contents exploited for various ways of acting and interacting' (Luff and Heath, 1998) both with the patient and between staff.

6.4.2 The problems with paper

I have described how paper had utility in its physical properties. Unfortunately, some of the material properties of paper were also its limitations. Paper could be easily lost, contain illegible handwriting, and could only be in one place at a time. As such, with these apparent risks, the digital transformation process was not only about the implementation of electronic records but also the removal of paper.

The EPR managers at Compass NHS Hospital Trust described the riskiness of paper and how they believed it had no place in record-keeping in their hospitals. This outlook is supported nationally by guidance and direction from the UK Government and the Department of Health and Social Care ('Paperless 2018' (Department of Health and Social Care, 2013), 'Paperless 2020' (NHS Digital, 2016b)). The EPR manager emphasised to me that they could not allow records to remain on paper. A prominent reason for this was risk. For example, digitalising observation charts was predicted to improve patient safety, as it was expected that the data would be more accurate:

> *'It's just that... we just want to get rid of the paper, and it... we're using NEWS2[18] , and it just takes away any miscalculations that might happen. So, it's a safer way to calculate the NEWS score, by doing it on an iPad.'*
> *(Interview: Head of EPR programmes, Ruth (031)*

And the material properties of paper were described as insufficient and unreliable ('crumbly'):

> *'Paper records … have to be carried around the place. We have drivers whose job it is, because we still have some paper records, and they are ferrying records, so... there's an impact there timewise... what's the word I'm looking for... environment, y'know? … Once we've got them, can we actually read what somebody's written? Really? And having seen some of the records, they are just like big piles of crumbly paper, really, it's a no-brainer quite frankly.'*
> *(Interview: EPR trainer, Lois (021) – Compass Hospitals)*

From Lois' perspective as an EPR trainer, the benefit of a shift towards digital systems was clear. But on the wards, most staff still carried paper and wrote themselves short personal memos to assist in remembering important

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[18] NEWS2 or 'National Early Warning System 2', is a standardised system for recording physiological observations which uses a scoring system to identify the acute deterioration of patients.

information, especially when they needed to take details to places where a computer or the EPR was not immediately accessible. One or two sheets of A4 paper folded to fit into a pocket was enough.

The continued use of paper demonstrates that paper retains certain affordances that are not easily replaced by digital systems. The flexibility and convenience of jotting down notes on a piece of paper, the tactile memory aid it provides, and its portability in places where digital access is not immediate or convenient, underline its enduring relevance. This flexibility is particularly important in acute medical inpatient care, where clinicians often need to rapidly record or recall information in various settings.

This flexible use of paper was described by a consultant who needed to jot down just enough to trigger his memory when he was called about patients at home (when on call). He could have chosen to have the EPR securely accessible in his house, but he had decided against it. He explained that home access to Lorenzo would have included access to other work, and he did not want emails to crossover into his personal time:

> *'If I keep paper on me… like, I saw a patient in clinic yesterday. So, I put a sticker on the paper and this morning I went to radiology to chase an ultrasound scan which has not been done. I don't know why, I've checked on the Lorenzo, it's not done. Just simple things like that. And then when I'm on call, every patient I see, I have to keep a list and I have to keep the diagnosis and the plan and things, because when I'm called, when I'm on call, I need to know that patient that I've just seen, what was wrong with the patient. So, I still need that one. If I've got, especially if I'm at home, I cannot access Lorenzo… I have to have that short information.'*
> *(Interview: Consultant, Dr Madison (020) – ward B)*

Dr Madison described how he took a sticker (containing basic patient demographic information - usually packaged within the residual paper medical records) and transported it to the radiology department to check the status of a request made digitally through the EPR. The sticker allowed him to transport the information he needed (patient ID) to where he needed it (radiology). To aid his memory when on call, his list of notes allowed him to move information outside the hospital without needing a computer. And the way a personal note was handwritten, underlined, or asterisked could have helped to connect his memory to the patient in a way a screen of text may not have.

6.5 Conclusions

This chapter has focused on interactions between staff members and how the materials of the mobile EPR are physically reshaping the way clinicians move and collaborate.

While it has been assumed that the transition from fixed computer systems to mobile technologies would inherently lead to increased flexibility and mobility within hospital wards, my observations indicate that collaborative medical work, when mobilised digitally, still faces spatial restrictions, albeit in different ways. I highlight the continued dependence on the materiality of information systems within ward-based collaborative practices, where staff come together to discuss, make decisions, and communicate.

The ward round is ultimately about the business and flow of the hospital, moving things along and making sure patients are safe. Communication with patients is an element of ward rounds, but it is often brief. Nonetheless, even a concise conversation can have a profound impact on reassuring patients and facilitating their journey through the hospital. Srivastava (2012) emphasises the criticality of conversations with patients as part of bedside care.

> *'Although I often stand during rounds, I make it a point to sit down for these conversations, which has an immediate effect of reassuring the patient that I am there to listen. It's hard to look rushed with your feet planted on the ground… patients seem to respond better when my body is not half-turned towards the door as we talk.' (Srivastava, 2012)*

The act of sitting down for conversations can immediately reassure patients that their concerns are being heard. Srivastava (2012) suggests that this approach sets a positive tone for the patient's inpatient experience.

While this approach can still be applied in the presence of mobile computers, stepping away from the screen required a sort of disconnection that was difficult for some of the EPR users I observed. On some occasions, they would not go behind the curtain. Being at the bedside is still fundamental to the art of medicine. Observation charts can capture physiological parameters, but the importance of 'setting eyes' on someone cannot be understated. Chapter 7 will look in more detail at the use of mobile technologies at the bedside.

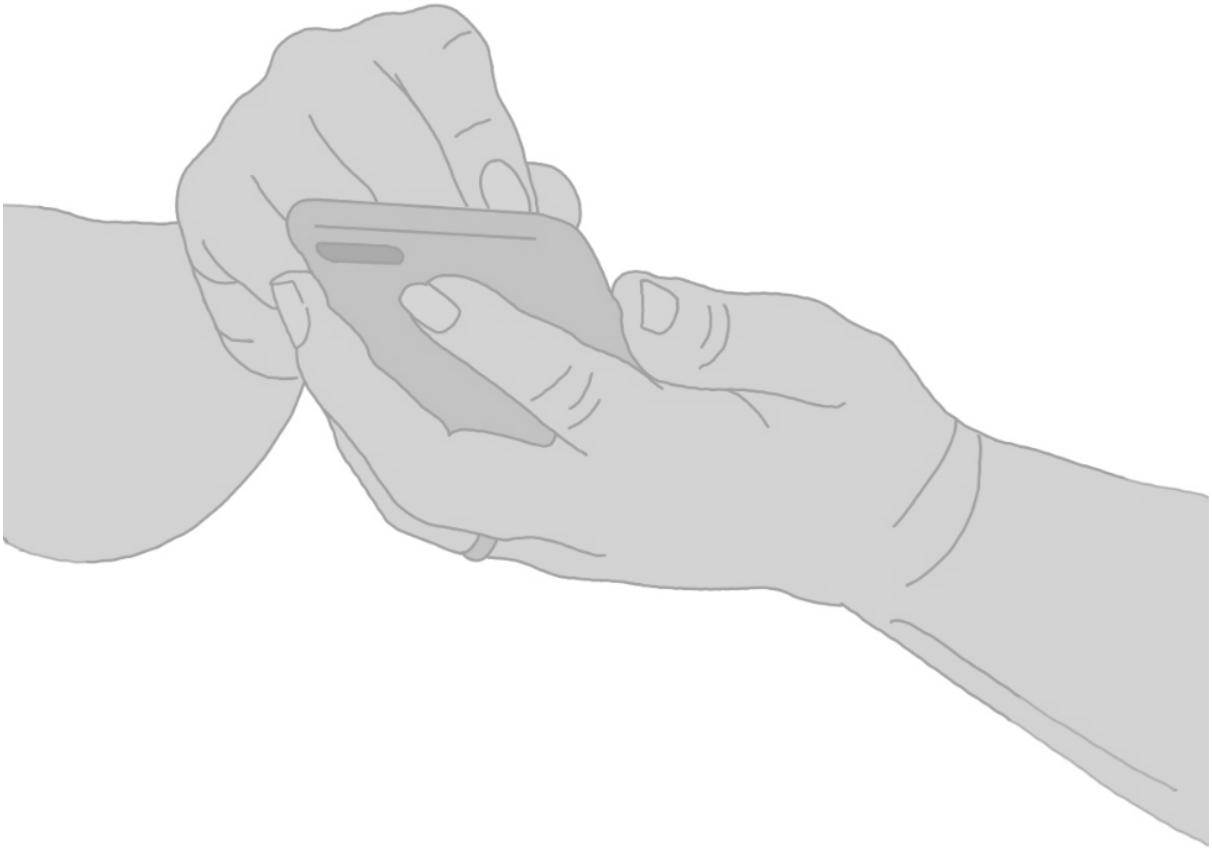
The various ways of standing as a group of COW users contrasted with what I remembered about ward rounds and made ward rounds feel both familiar (ultimately, the same sort of trajectory-forming work was occurring) and strange. Firstly, as an observer without a computer, it was hard to follow what was going on with the patients. Secondly, how the ward round participants were standing with the mobile computers made it hard for me to determine how *they* knew what was going on and whether they were aware of the work of the broader collaborative effort of the ward round.

The attachment and reliance on mobile computers during ward rounds, particularly among junior doctors, revealed how deeply ingrained the use of EPRs had become in their professional identity and workflow. The sense of feeling 'useless' without access to the EPR highlighted the extent to which these digital tools had become intertwined with their sense of competence and effectiveness in patient care.

The examples discussed in this chapter illustrate that the transformation of medical records was not simply a process of transferring information from paper to electronic systems. Lorenzo and the computers used to access the EPR were not just containers or conduits for patient data. The EPR, and the materials used to mobilise it, were part of the broader sociotechnical ecosystem that shaped how medical work was conducted, how professionals interacted with each other and their patients, and how professional roles and identities were enacted.

In the next chapter, I will bring this focus to how technologies introduced for use at the bedside can reshape how care is related to patients.

7 Digital devices and patient care



7.1 Introduction

This chapter is concerned with care. I begin by explaining how care is described and situated as 'compassionate' in the context of current healthcare policy. I then discuss the ways in which compassionate care has been defined, which helps to explain how it is difficult to measure or record. I introduce the idea of 'sentimental work' both as a means of exploring compassion and as a way of explaining the often unseen 'intertwining' work that has to occur when technologies are used around patients (Strauss et al., 1985).

The findings centre around the digitalisation of 'intentional rounding' and what that means to the provision of care, particularly at the bedside. Intentional rounding, a method of regular, systematic care checks made on patients by nursing staff, has been widely adopted across the NHS in England. This approach was driven by the recommendations of the Francis Report (2013b) as a mechanism for hospitals to demonstrate their commitment to regular caring contact with inpatients and to ensure that fundamental standards of care were not being overlooked.

The digitalisation of intentional rounding, specifically its implementation on a mobile device, provides an opportunity to examine the potential impacts of technology on care practices. The iPod, a handheld digital device, was introduced at Compass Hospitals NHS Trust (CHNT) as a tool for documenting intentional rounding, replacing the traditional paper-based process. This shift to digital technology was intended to improve the efficiency and accountability of care. However, it also brought about a series of unintended consequences which I will explore in this chapter.

Speaking to these unintended consequences helps to bring to light material objects of care, or care technologies, that tend to be unseen and forgotten (Buse et al., 2018). Investigating these objects creates opportunities for understanding the practices involved and how care can operate through the materialities of the EPR.

7.2 Compassionate care

Compassionate care is a foundational principle of the NHS, which is emphasised in its Constitution (2012):

> *'We ensure that compassion is central to the care we provide and respond with humanity and kindness to each person's pain, distress, anxiety or need... We do not wait to be asked, because we care.'*
> *(Department of Health and Social Care, 2012)*

The Francis Inquiry (2013b), which scrutinised care failures at Mid Staffordshire NHS Foundation Trust (Mid-Staffs), intensified the emphasis on compassionate care in healthcare quality assessment. This focus is reflected in the Care Quality Commission's (CQC) five criteria (safe, effective, responsive, well-led, and caring), used for the inspection of all organisations delivering healthcare in England. In addition, the Health and Social Care Act 2008 (Regulated Activities) (2014) incorporated compassionate care as a metric in CQC inspections. The CQC ask patients if they feel they are treated with 'compassion, kindness, dignity and respect?' (Care Quality Commission, 2016).

Furthermore, both in response to the Mid-Staffs care scandal, as well as other high-profile care failures (Winterbourne View Hospital (Department of Health, 2012)), the Department of Health ran consultations to develop a shared vision of care values. This resulted in 'Compassion in Practice,' which outlines the '6Cs' of care - care, compassion, competence, communication, courage, and commitment (Cummings and Bennett, 2012).

Figure 16: The '6Cs' from 'Compassion in Practice'

The ‘6Cs’ aimed to be a unifying framework for all care staff across England. It centred care as the ‘core business’, underpinned by the values of the 6Cs: care, compassion, competence, communication, courage, and commitment (Baillie, 2017). These values have subsequently been adopted into nursing policy and standards (NHS England, 2016), as well as into individual NHS hospital trust ‘mission statements’.

The adoption of the 6Cs emphasised the pursuit of high standards of care, but it is important not to overlook that the ‘business of care’ is at the core (see Figure 16). Elective or unplanned, patients attend and are admitted to hospitals, activities occur, are measured, and charged for. On most hospital wards, there is a constant requirement for motion. Nearly always working at capacity, patients arriving at hospital need beds, and patients on wards must move along and out to make space. In a resource-limited system, this need for movement creates a tension between providing compassionate, patient-centred care and the realities of healthcare logistics. Healthcare staff must weigh the safety of keeping a patient in the hospital for an additional day against the risks faced by other patients waiting for beds in the emergency department. Consistently delivering compassionate care in such environments can be challenging.

The added pressures of accountability and candour further complicate this tension. The 290 recommendations of the Francis Report (2013b) demanded greater accountability from hospital leadership. Care needed to be measured against fundamental standards, and staff needed to practice openness and honesty, speaking out if anything went wrong:

> *'We need a patient-centred culture, no tolerance of non-compliance with fundamental standards, openness and transparency, candour to patients, strong cultural leadership and caring, compassionate nursing, and useful and accurate information about services.'*
> *Robert Francis QC: Statement to the press (2013a)*

Francis not only recommended that organisations should be accountable for the care they delivered but that the accountability for the quality of that care (including compassion) did not stop at the 'shop floor', with the people doing the face-to-face caring. Hospital managers needed to know how caring was being done within their organisations and be able to prove it was being done well (to CQC, for example, and their 'key lines of enquiry'). The recommendations of the Francis Report (2013b) have been a key factor behind the drive to 'capture' care activity in hospitals, and this chapter explores how Compass NHS Hospital Trust thought that mobile technologies would assist in this data collection (and how that did not transpire to be the case).

Measuring 'compassionate care' poses challenges because it is a concept that lacks a clear definition. Since 'compassion' has been incorporated into the standards that trusts are required to measure, increasing efforts have been made to develop methods for capturing and monitoring it. In the following sections, I will describe some of these definitions and explore one widely adopted approach for monitoring care known as 'intentional rounding'.

7.2.1 Defining and measuring compassion

The term 'compassion' is rooted in the Latin phrases com- (together with) and pati (to suffer), signifying 'to suffer with' (Dietze and Orb, 2000). It is often characterised by a profound emotional response and the drive to alleviate suffering (Chochinov, 2007; Goetz *et al.*, 2010; Dutton *et al.*, 2014).

However, compassion is more than an emotional response; it has been conceptualised in terms of attitudes (Gelhaus, 2012), moral virtues (Armstrong, 2006; Dietze and Orb, 2000), and interpersonal connections. This is evident in the NHS's '6Cs' definition of compassion:

> *'[H]ow care is given through relationships based on empathy, respect and dignity - it can also be described as intelligent kindness, and is central to how people perceive their care.'*
> *(Compassion in Practice: Nursing, Midwifery, and Care Staff. Our Vision and Strategy. Cummings and Bennett, 2012).*

Following the recommendations of the Francis Report, many NHS trusts have incorporated 'compassion' into their mission statements, pledging to deliver the highest possible standards of compassionate care. However, how this is measured is not clearly articulated, and the measurement of 'compassion' is known to elude definitive capture (Sinclair et al., 2017a). Although the CQC does not require a numerical score for compassion, it does ask that organisations provide varied evidence to indicate the quality of their compassionate care. This is where new programs and technological tools have been introduced to gather such data.

Returning to the research questions and aims posed earlier in this thesis, this project sought to understand how care was being reshaped on hospital wards through the use of mobile computers and the EPR. Understanding how compassionate care can be described was important in speaking to this question, but as I have explained, as a value with a multitude of meanings, it is hard to conceptualise. To further expand on how compassion can be conceptualised in medical work, I will now turn to Strauss et al.'s model of 'sentimental work' (1985) and Allen's 'invisible work' (2014).

7.2.2 Sentimental work

In 'Sentimental work in the technologised hospital', Strauss and co-authors, Fagerhaugh, Suczek, and Wiener give detailed descriptions of what they label 'sentimental work', a necessary 'ingredient' in enabling the interaction between people and medical work (Strauss et al., 1985). The concept came out of fieldwork where the authors were studying the impact of medical technology on hospitals. At that time, this technology encompassed devices such as scanners, monitoring machines, and dialysis equipment.

The authors used 'sentimental work' as a term to encompass the ways in which patients are inducted and orientated into a medical environment. Hospitals can be intimidating environments with unfamiliar rules, routines, and equipment. Along with this, hospital staff need to keep patients moving – admitted, investigated, treated, and discharged in an efficient manner. Sentimental work assists in trying to keep this flow unimpeded by helping patients along the way, both physically and emotionally. This type of work encompasses the many interactions between staff and patients, which aim to smooth and comfort the journey of a patient through a hospital. Strauss et al. described seven different types of sentimental work, which I have summarised below (Table 8).

Table 8. Categories of sentimental work adapted from Strauss et al. (1985, pp. 132–140)
Interactional work and moral rules: This refers to efforts made by healthcare staff to ensure patients feel respected and acknowledged as individuals, not just as medical cases. For example, a doctor might take time to properly introduce themselves, explain their role, and ask for the patient's consent before starting a physical examination. This helps maintain the patient's dignity and can prevent them from feeling dehumanised.

Trust work: This work involves the building of trust between patient and clinician so that treatments or procedures can proceed efficiently, even when they might cause discomfort. For example, a physical therapist might build trust with a patient through clear communication and empathetic care, which would facilitate cooperation during painful physical exercises.
Composure work: This is the work done by staff, often nurses, to help a patient 'keep their composure' during an uncomfortable procedure. An example could be a nurse talking reassuringly to a patient while administering a painful injection, distracting them and thus helping them maintain their composure.
Biographical work: This involves healthcare staff learning about a patient's personal or social history to understand the context of their current medical situation. For example, a nurse might gather information about a patient's home setting, their daily routines, or any potential challenges they may face in adhering to a prescribed treatment plan.
Identity work: This 'complex category of work' involves aligning a patient's identity with their expected medical trajectory. For example, a nurse might spend hours having conversations with a terminally ill patient, helping them reconcile their current situation with their prior expectations of their health and identity.
Awareness context work: This is work done to moderate the information given to a patient in response to their perceived identity position or ability to cope at that point in time. For example, a clinician might break down a complex diagnosis into smaller, digestible pieces of information, shared over multiple sessions according to the patient's ability to comprehend and cope.
Rectification work: This work comes into play when the rules of sentimental work have been broken or misjudged, resulting in trust issues or discomfort. It is

described as ‘picking up the pieces’ in order to restore the therapeutic relationship.

Even though Strauss et al. (1985) do not conflate sentimental work with compassion, there are similarities between them, and there is practical value in how sentimental work is dissected and explored. Compassionate care does not equal sentimental work, and sentimental work is not required to be compassionate, but Strauss et al.’s ‘sentimental work’ helps to describe some of the many ways in which compassion is applied, often unseen, in the clinical environment. Where most discourse around compassionate care is concerned with what it means or how it is measured, the exploration of ‘sentimental’ tasks expands and describes in detail what this work might actually comprise. It does not claim to be comprehensive and all-encompassing, but the categories described help to paint a picture of the diverse, often mundane, frequently invisible, ways in which care is negotiated in hospitals.

In concordance with the recognised difficulties in measuring compassionate care, Strauss et al. (1985, p. 149) describe the ‘relative non-accountability’ of sentimental work. Hospital staff do sentimental work in the hospital in ways which get ‘intertwined’ with other tasks. It is done ‘interstitially, on an individualistic ad hoc basis’, often invisible to others. ‘A great deal of non-sentimental work could not be carried out as easily, efficiently, or at all if the requisite sentimental tasks are not done’.

Although the concept of sentimental work is ‘patient-centred’ and directed towards assisting the patient and advancing their trajectory, it acknowledges the reality that this work also benefits the business of hospitals. Smoothing (and soothing) interstitial tasks can be compassionate towards the patient (and in alignment with the recommendations of the Francis Report (Francis, 2013b)) whilst also being purposed to move work along and to further the core business of care.

Allen (2015) builds on and extends Strauss et al.'s work by specifically focusing on the 'invisible work' of nursing. The concept of 'invisible work' captures the types of activities that nurses perform but which are often overlooked or undervalued because they are not easily observable or measurable. A large part of this work involves the coordination and management done by nurses to ensure patient care is appropriately sequenced, aligned, and completed. This work can involve everything from scheduling tests and procedures, coordinating with other healthcare professionals, and ensuring instructions and medical requests are carried out correctly.

These ideas help conceptualise how 'invisible work' has to be balanced and intertwined with compassionate and 'sentimental work' in order to smoothly progress the treatment of hospital inpatients. I will describe below how, at Compass, I found the balance of this work was disrupted by the implementation of a new technology, an iPod, introduced to digitally record 'intentional rounding' scores at the bedside.

7.2.3 Intentional Rounding

As I have described, if the majority of tasks consistent with compassionate or sentimental care are either unseen or undocumented, it is challenging for healthcare managers, who are under pressure to account for these values, to prove that they know how well they are caring compassionately (Zulueta, 2013). One way in which the Francis Report (2013b) tried to recommend measures which would guard against lapses in care was through regular nursing rounds:

> *'Regular interaction and engagement between nurses and patients and those close to them should be systematised through regular ward rounds' (Francis, 2013b, p. 1610)*

The then Prime Minister of the UK, David Cameron, responded to this by announcing:

> *'We have set this out explicitly in the Mandate to the NHS Commissioning Board, together with a new vision for compassionate nursing. We have introduced a tough new programme for tracking and eliminating falls, pressure sores and hospital infections. And we have demanded nursing rounds every hour, in every ward of every hospital.'*
> *Response to the Report of the Francis Inquiry (Cameron, 2013)*

These extracts provided momentum to the introduction of systems which would measure nursing checks on patients. They did not speak to increasing the quality of the interactions or how increasing nursing rounds might be more compassionate, but they gave hospital trusts a mechanism for proving the standards of their care – and one they could count.

Driven by the recommendations of the Francis Report (2013b), a system of routine checks on patients, known as 'intentional rounding', rapidly spread across the NHS (Sims et al., 2020). Intentional rounding originates from an approach initially developed in the United States (Studer, 2007). It is a method which comprises regular, systematic care checks (see Table 9) made on patients by nursing staff. The intentional routine of the rounding is meant to be comforting to patients who can feel reassured in the knowledge that someone will check in on them at regular intervals. It has also been reported to increase patient satisfaction (Ryan *et al.*, 2019)and reduce harm through reductions in falls (Massimo *et al.*, 2022).

Intentional rounding does not guarantee compassionate care, but it dictates a minimum standard and creates something that is measurable. The tasks within intentional rounding are patient-centred and, once itemised and measured, can be monitored by managers, who can use these metrics as evidence (to inspectors, such as CQC) of their awareness of the standard of care in their wards.

Since 2013[19], intentional rounding has been adopted widely across the NHS, with around 97% of trusts using it in some form (Harris et al., 2019). The original intentional rounding tool checked the '4Ps' (Table 9 (Studer, 2007)), but many trusts (including Compass) have developed their own versions, which have expanded on this.

Table 9. The '4Ps' (Studer, 2007)
The four key elements of intentional rounding: - Positioning - Personal needs (such as toileting) - Pain level and control - Placement of personal items within patient reach

The adoption and spread of intentional rounding gave hospitals a mechanism to prove they were completing basic care and checks on patients. The rounds, and the content of the checks, often recorded on paper, were not new. Nurses have performed 'comfort rounds' or pressure sore focused 'back rounds' for many years (Castledine et al., 2005), with the paper records of this often residing at the end of the bed, until they were filed away into the notes at the end of an admission. Intentional rounding was a repackaging of this but with a greater focus on documentation and accountability.

To summarise, intentional rounding was implemented at a point where care standards had fallen, in at least one location, to a degree that prompted whole system change. The call from the government and Francis for regular nursing rounds was a top-down way of saying, we cannot be confident that you are getting the basics right, so you will have to prove it – get back to the bedsides and care. So, whilst intentional rounding never directly claimed to improve compassionate care, these things arose together, and it would appear that getting ward staff back to the bedside was hoped to improve patient-centred compassionate care.

[19] It was in place in a handful of trusts before this time, but the Francis Report accelerated its spread (Harris et al., 2019).

Strauss et al. (1985) consider these activities at the bedside as fundamental to sentimental work. These points of patient contact within basic tasks of care and the invisible work of nursing (Allen, 2014) are where sentimental work is intertwined. What has not been as well described in the literature, and where this thesis seeks to examine, is how this intertwining functions around the new materials of mobile digital technologies. I will now turn to Compass Hospitals and how they attempted to implement a handheld mobile device, an iPod, in the place of paper, to draw together intentional rounding and digital data capture, for the EPR, at the bedside.

7.3 The promise of the iPod

Intentional rounding was introduced in Compass Hospitals NHS Trust in 2013, along with many other hospital trusts across England. From 2016 – 2017, the documentation process was moved from paper (a form at the end of each patient's bed) to a handheld digital device – small blue iPods. Compass used an intentional rounding system called 'Skin and Safety' (SAS) and collected 'SAS' scores (which they pronounced 'sass'). 'Skin and Safety', which is an acronym, extends the 4Ps (Table 9) to the following checklist (Table 10):

Table 10. Skin and Safety (SAS) checklist	
Skin	Inspection/pressure areas checked
Keep Moving	Position and encourage mobility if possible
Incontinence	Checked and personal hygiene and toileting needs met
Nutrition	Checked and fluid balance and/or food chart maintained. Mouth and lip care checked
Surface	Mattress appropriate/seat cushion appropriate/sheets are smooth
Availability	Of aids. Call bell close to hand/drink is close to hand
Falls risk	Frame/aids close to hand and area decluttered
Footwear	Is appropriate
Evaluation	Variations recorded in nursing notes
Tell	Registered nurse aware of changes
Your signature	Entry signed/countersigned

The documentation and recording of SAS scores were the responsibility of both nurses and clinical support workers (under the supervision of nurses). It is described here by Vanessa, the ward manager on ward A:

> *'It was like a check to check that the patient had had their skin checked, that they had a drink, if they have their walking stick or frame by them, and that the bell was close by - looking at the safety. So, they brought them in on paper, and then the trust decided to go onto an iPod.'*
> *(Interview: Ward manager, Vanessa (010) ward A)*

By March 2017, the ward staff were reported to be entering data for over 70 000 rounds a month[20]. In promotional videos presented by Compass's Executive Chief Nurse and the Deputy Chief Nurse, the senior nurses explained that the iPods were intended to:

> *'release time to care'*
> *'get nurses back at the bedside', and*
> *'enable much more in-depth robust monitoring of quality of care.'*

These aims aligned closely with the recommendations of the Francis Report, both in terms of getting 'nurses back at the bedside' and in hospitals obtaining more detailed information about the quality of their care provision.

7.4 The reality of the iPod

During my early meetings at Compass between 2017 and 2018, the IT managers proudly told me how the iPods were being used successfully on the wards. In a 2018 report, Compass Hospitals NHS Trust's Chief Clinical Information Officer used the 'nursing iPods' as an example of how technology was 'firmly embedded' in their hospitals and how staff were responding positively to their use. However, several months later, when I gained access to the ward environment and commenced my observations (late 2018), the iPods were no longer in use. Instead,

[20] Data drawn from the trust website

both wards I visited had reverted to paper, and the iPods sat unused in a large charging hub. The ward staff joked that they occasionally used the iPods as torches or calculators and that the charging hub helped keep their own phones topped up with power. Even though they were out of use, noticeboards and patient areas still displayed laminated posters that tried to draw attention to the fact that the iPods were for clinical use and were emphatically not mobile phones (see Figure 17).

The nursing staff were keen to talk about the abandonment of the iPods, and I was interested in the reasons behind the iPods' seeming failure, especially because I

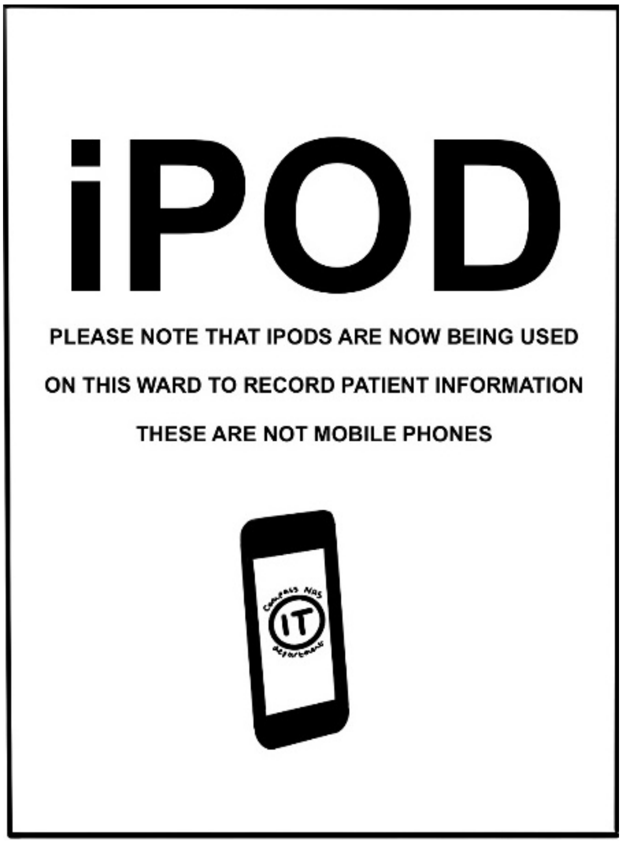


Figure 17: Poster (reproduction) to raise awareness of the nursing iPod

had so recently heard and read about their success. On several occasions, the staff asked me if the iPods had been abandoned on the other wards, 'are they still using them up there?', and sometimes I explained to non-clinical staff that I had not seen them in use because, as far as I knew, the staff had returned to using paper systems. But even though these decisions to stop were made locally, the reasons for the rejection of the iPod were unified across the two wards I visited. The ward staff repeated several reasons for why the iPod failed to live up to the promises that had been made about it.

The iPod did not improve how they were able to record care at the bedside:

- It was confusing for patients as it looked like nurses were on their phones
- It took more time and effort to use
- It required adhering to a rigid schedule of data input

The iPod had technical issues:

- The device was 'fiddly' to use
- There were cases of data loss, particularly in areas where the Wi-Fi signal was patchy

The iPod did provide a channel of digital data from the bedside into the EPR, enabling managers to have an overview of care activities across the hospital wards. This may have seemed to have allowed *'much more in-depth robust monitoring of quality of care',* but as I will describe, how the data was entered may not have been in line with the ethos of intentional rounding. Furthermore, from what I was told, it did not translate into an improvement in compassionate care at the bedside, which was the original impetus for introducing intentional rounding.

I will explain these issues in more detail before discussing what these challenges meant to the nurses. I will also explore how the materiality of paper afforded the nurses additional flexibility in their work, which formed part of their organisational work.

7.4.1 Confusion

There were several areas in which the nurses and clinical support workers described the iPod to be problematic, but the prominent and most frequently mentioned concern was that patients and their visitors confused the iPods with mobile phones and repeatedly thought the staff were ‘on their phones’, as Nina, a staff nurse on ward B explained:

> *‘When I first started, we were using them, and I had staff coming up to me saying, “Nina, could you please go and speak to that relative who's just took a picture of me, saying, 'Look, I've catched… I've caught you on your phone'”, because they're the same size as a mobile phone. So I used to have to go and say, “Please can you delete that photo? The staff are actually working”. You know?’*
> *(Interview: Staff nurse, Nina (026) – ward B)*

Maria, a Staff Nurse on ward A, shared similar sentiments when I asked if patients ever commented or said anything about seeing staff on computers:

> *‘We used to have little iPods, we don’t have them anymore, but I don’t think they looked good because it looked like you were on your phone all the time. Which I don’t think looked very polite.’*
> *(Interview: Staff nurse, Maria (015) – ward A)*

The iPods had been selected for their ease of adaptation, small pocket-sized portability, and relatively low price. Unfortunately, this also gave them an appearance which was too domestic, not professional or clinical enough. Patients and their relatives seemed to default to the assumption that the nurses and clinical support workers were on their mobile phones.

To draw on the categories of sentimental work described earlier (see Table 8), the iPods required rectificational sentimental work (Strauss et al., 1985). Meaning that from the outset, the staff had to apologise and explain what was going on:

> *‘They do look like phones, don’t they? But I think whenever someone has said something to me, like, stop messing around on your phone, I’m like, ah no, I’m filling out this form for you, kind of showing them how I use it.’*
> *(Interview: clinical support worker /5th year Medical Student, Manuel (002) – ward B)*

A further sign of the nursing iPods' incongruence at the bedside was that the patients and their friends/relatives were so struck by what they thought they were seeing that they tried to gather evidence of suspected wrongdoing (by taking their own photographs with their mobile devices).

Intentional rounding was intended to increase the visibility of ward staff at the bedside, which was a shared goal of the introduction of the iPod. In this respect, the iPod was successful. Staff did become more visible, but this did not have a positive impact. Their visibility with the iPod created a scene that they had to continually defend, and without the interactional and rectificational sentimental work to explain its purpose, it only served to confuse.

In videos published by the trust on YouTube[21], the Executive Chief Nurse described the iPod as a technology for nurses 'to enable them to spend more time at patient's bedsides'. In the accompanying video, a nurse (or clinical support worker) is seen moving around a patient's bed whilst appearing to enter information into a small blue-coloured device.

Figure 18 Illustration of nurse using an iPod by the bedside (based on trust publicity images)

[21] YouTube video 2017

Given the device's size (small compared to modern iPhones/mobile phones), she draws the device up to her chest whilst bending her head down, standing by the bedside in a hunched position, glancing up to look at the patient, before her eyes return to the device (see Figure 18). Whilst I did not see these devices in use, this appearance relates to how the staff described it. It also relates to how I observed the ward round doctors, eyes down and concentrating on interacting with mobile computers (see section 6.3.1). It is clear how it could be assumed she is on her phone, with her gaze directed at the screen. It also suggests that although she may end up spending more time at the bedside using the device, it may not be *with* the patient. This activity appears to leave little capacity for the staff member to intertwine compassionate care into their work. Without sentimental work to make the activity acceptable or understandable, the invisible work of data entry becomes visible and raises the potential for confusion.

7.4.2 Technical difficulties

The additional work of explaining the device might have been minimal with each individual, but over a whole ward could add up to a more significant disruption to timing.

Jennifer, a clinical support worker on ward A, expressed how difficult it was to see what you were doing on the iPods:

> *'Well, we were getting complaints off families, saying we were on our phones. So that's why we had to put the posters up, 'cos when we were stood at the end of the bed, like this, tapping away, and then you move on and you are tapping away, you're not actually getting what you do from the paper ones. There's nothing to say there's a pain score box, but it turns out, no, there's a comment box. But no one is going to click on that box to check. They were very fiddly, and people were finding them harder than the paper.'*
> *(Interview: Clinical support worker, Jennifer (019) – ward A)*

As Jennifer describes, the use of the iPods was 'fiddly', and the interface was difficult to use. Certain pieces of information were hidden and required the user to click on specific buttons to reveal them.

The iPods also suffered technical difficulties with patchy connectivity to the network, which meant that the time-consuming data entry could suddenly be lost. This factor contributed to staff moving away from patient areas to central zones with a stronger WiFi signal:

> *'And they didn't use to work all the time, they used to... certain parts of the ward you can't get WiFi. So, you have to then go and move to another part. So, it didn't last very long before we went back to the paper system for that particular one [the iPods].'*
> *(Interview: Staff nurse, Nina (026) – ward B)*

The hope had been that the iPod would enable 'nurses to spend more time at the bedside'. It was presumed that the ward staff would take the iPods to the bedsides and do the data entry next to the patient. However, Claudia, a clinical support worker on ward B explained how that may not have always been the case:

> *'Well, they did [use them], but not for long. The girls didn't like it. [...] It wasn't the same because you could just say, 'Yes, you have done this', 'Yes', tick this, tick that. Don't ya? Whereas with the paper, we work back on paper, we don't... we do our SASs [Skin and Safety] on paper for the patients. Which is better, because you can see what's going on better really within them. Just going through on an iPod, you can just not even bother going around. Can you? Just tick, tick, tick.'*
> *(Interview: clinical support worker, Claudia (027) – ward B)*

Claudia explained that the iPod allowed staff to complete SAS checklists without moving to the bedside. With paper forms, they had to visit each bedside to access the checklist, but the iPod enabled them to enter data for the entire ward from one central location. This saved time and allowed access to a more consistent WiFi signal. Being away from the bedside does not necessarily mean the SAS forms would have been completed inaccurately. The staff member could still have collected the data whilst in the ward area, but it does mean that the iPods were not doing what they were assumed they would do and doing the opposite of what the trust hoped they would achieve.

7.5 The flexibility of paper

The paper system offered the nurses and clinical support workers a number of benefits which suited how they worked at the bedside. Paper was simple to use, particularly when moving about in a busy clinical area. The paper-based approach allowed the nurses and clinical support workers to navigate the ward bays and bed spaces more freely, whereas using the iPod required careful focus and interaction with a small screen. This had the potential to blinker the staff member using the device to what was happening in the ward around them.

With the simplicity of using paper, the user was able to quickly look over the ward and take in details that could add to their understanding of patients in that bay. Although such work was not absent with the introduction of the iPod system, it unintentionally created barriers to interaction, which ran counter to the goals of the device and intentional rounding.

The paper charts also provided staff with a quick and easily visible overview of what had been previously recorded. As in the quote above, Claudia describes how she preferred paper charts because 'you can see what's going on better really within them'. Conversely, when the ward staff entered the information into the iPod, it was less likely that they would see that information again unless it returned to them as a score of their compliance with the system. This was particularly relevant to Claudia, who, as a clinical support worker, rarely had reason to use the full EPR. Getting more information on the paper form gave Claudia an overview of 'what was going on' in a way that could enable her to tailor basic care and sentimental work to the individual patient.

As I have discussed, the use of the iPod was reported to be confusing for patients who thought that the ward staff were 'on their phones'. In contrast to this, when a nurse picked up a paper form from the end of a patient's bed, it was easier for the patient to assume that they were doing work concerning their care. The use of an individual's chart in this way creates shared understanding before any explanation is given. A small phone-sized device was not intuitively understood to be doing the same.

With paper charts, nurses had the flexibility to collect data while performing other duties, jotting down notes later. This enabled the nurses to do intentional rounding in a way that did not necessarily require explanation. It meant that the intentional aspect could remain hidden, and the checks could be integrated into other work. This aligns with how intentional rounding has been described elsewhere in the NHS. Harris et al.'s realist evaluation (2019) found that intentional rounding was not perceived as a discrete activity by patients or observed as such by researchers. But they did find that patients valued the 'relational elements of interactions with staff', the sorts of interactions I have explained in this chapter as sentimental work. These interactions are not in themselves a component of the intentional rounding system. One of the original features of intentional rounding was how it would be explicitly explained to patients so that they would feel comforted in awareness that they would be seen regularly. In practice, intentional rounding has been adapted by nurses and clinical support workers to fit into the tempo of the ward flexibly alongside other activities. When the nurses started using the iPods at the bedside, the system became visible. I will now describe the impact that this had on the nurses and how the iPod added to the complexity of time management on the ward.

7.6 The Impact on nurses

As I have described, transitioning from paper to a digital device for intentional rounding changed the visibility and adaptability of the task it was deployed to support. The response to this included movement away from the bedside and completing the checklists at a single location with better connectivity. This also reduced the chances of it being confused for a mobile phone.

When the use of the iPod decoupled intentional rounding data entry from other clinical activities, it became an extra job for the nursing staff, which meant that it required more time. This is described by staff nurse Helen:

> *'They didn't really work, really, for us [the iPods]. It were, kind of, going round, and you were doing your back round[22], and then it was like another job to do after it, it was like, 'Oh, I'll do this, I'll go on the iPod'. Or like there'd be three of you would go into a room and two of you would do the turns and somebody else would sit on the iPod. So, it was kind of just an extra job. It was just taking up lots of time.'*
> *(Interview: Staff nurse, Helen (029) – ward B)*

In the example given by Helen, she describes how using the iPod almost set the user apart from being involved in other activities. One reason for this may have been the engrained temporality of the work within the iPod and the nature of having timestamped data. This drove the regular use of the iPod, compared to paper which could be retrospectively completed. The EPR manager, Ruth, clarified how this was an important part of moving from paper to digital devices:

> *'The difference is with paper you can't audit as to when someone's completed it, whereas electronically there is a definite timestamp as to when something was or wasn't done.'*
> *(Interview: Head of EPR programmes, Ruth (031) – WDH)*

The 'definite timestamp' of the iPod system, exerted an effect on the timetabling of nursing activities which disrupted the flexibility and control they had over how they delivered care within the ward timetable. This could have had consequences

[22] Doing a 'back round' refers to checking on pressure areas/sores - see section 7.2.3 on 'Intentional Rounding'

for how well nurses were able to provide compassionate care at the bedside, leaving less room for interaction and sentimental work.

7.6.1 The ward tempo

On hospital wards, numerous activities follow routines and timetables. These include mealtimes, medication rounds, personal care rounds, observation rounds, as well as medical ward rounds, visiting times, phlebotomy rounds, and other schedules that the organisation and rhythm of care in the hospital require (Reddy and Dourish, 2002).

La Cour and Højlund (2019) studied care temporalities in Danish nursing homes. They examined different structures of time within nursing homes, focusing on schedules, interactions, and welfare technologies. Technologies, such as fall-alerting 'intelligent floors', created 'event time', which demanded an immediate response, disrupting interactional time. Though the devices differ from the iPod in use at Compass, in a similar way, the iPod had no regard for what the ward staff were doing when it required a new timestamped data entry. La Cour and Højlund (2019) found that across the different nursing home sites of their research, 'interactional time' at the bedside was most susceptible to being cut short in response to the demands of 'event time' from technology.

The temporality of a medical ward has some similarities to a nursing home, but the ward also has the continual drive to move forward the trajectories of the patients within (Strauss et al., 1985, p. 8). Interactions between staff and patients are balanced against the temporality of the ward and how well the schedule is being met. Schedules which contain rigid time points (as can be the case with digital devices) squeeze the availability of interactional time, where sentimental work can be done. Kitson et al. (2014) describe this way of organising work as 'task and time' driven, task-oriented, and 'mechanistic'.

Kitson et al. (2014) also recognise that there is 'inherent systematic tension' in nursing between 'getting the job done' and creating meaningful personalised encounters. Intentional rounding sits within this tension, and according to Harris et al. (2019), the way that intentional rounding has been flexibly adapted into nursing practice has allowed nurses to manage this tension whilst also meeting the expectations of the organisation.

The iPod shifted the ability of the nurses to be able to manage their time flexibly. Events can be unpredictable on acute medical wards, and being able to have the capacity to accommodate unexpected events matters to be able to care compassionately.

7.6.2 Unentwining

As I described earlier, sentimental work (Strauss et al. 1985) is work that is 'intertwined' with other tasks. Another word used to describe it is 'interstitial', which refers to something that is situated or occurring in the spaces or gaps between other things. The use of the iPod was not as permeable to the flow of sentimental work as paper had been; it put up barriers to interaction. These sorts of immeasurable and fleeting interactions are often highly valued by patients (Bramley and Matiti, 2014; Sinclair et al., 2017b).

Although the concept of sentimental work is understood as supportive of patients adapting to hospitals and illness, it also acknowledges that this work benefits the business of hospitals. Smoothing (and soothing) interstitial tasks can be compassionate towards the patient (and in alignment with the recommendations of the Francis Report (2013b)) whilst also being purposed to move work along, to further the core business of care.

From the factors described above, the difficulty of use, the confusing appearance, and the inflexible timestamping, the use of the iPod seemed to cause a sort of unentwining of types of care. The nurses had been used to flexible paper systems, which they adapted into their usual tasks such that they were intertwined with basic routine elements of care. Using the iPod caused an uncoupling and divergence of these ways of caring, so that the 'invisible work' of care became uncomfortably visible.

7.7 Conclusions

This thesis is concerned with how I found the materialisation of the EPR, through a variety of devices, shaped everyday ward-based practices and whether the promises made about digital technologies hold true in everyday work. In this chapter, I have explored the implementation and abandonment of a handheld digital device, an iPod. This technology was introduced as a replacement for a paper system with the promise of 'getting nurses back at the bedside' whilst 'releasing time to care'. But the device did not get the expected reception and was abandoned by the nurses in favour of returning to a paper system. I explored what this says about technologies at the bedside and how they can make visible the differences between doing work *with care* and *for care*.

Intentional rounding, a system of routine checks on patients, is seen as a way to improve patient care and ensure regular interaction between nurses and patients. In Compass, by placing the documentation process for intentional rounding on a handheld digital device – the iPod – the intention was to streamline the process, improve data accuracy, and increase the time nurses spent at the bedside. However, the reality of this implementation revealed the complexity of how nurses combined rounding into their usual routines.

I described Strauss et al.'s (1985) concept of 'sentimental work' to explore the iPods in use. Sentimental work is described as 'intertwined' with other tasks, often invisible to others. It is seen as beneficial to both patients and the business of hospitals, as it helps to smooth interstitial tasks, making the treatment of hospital inpatients progress more smoothly.

The introduction of iPods for intentional rounding presented several challenges. Nurses found the devices difficult to use, and the iPods added an extra layer of complexity to how they managed their work. The iPods also disrupted how the rounding system had been integrated into care, making it more visible to patients and their families, but in a way which led to misunderstandings and confusion.

The iPods were not as permeable to the flow of sentimental work as paper had been, as its materiality held barriers to being integrated into bedside work. This ‘unentwining’ of sentimental work and other tasks due to the introduction of iPods had implications for the delivery of compassionate care by, for example, driving the staff away from the bedside.

In terms of increasing the visibility of nurses and clinical support workers, this aim failed to be realised due to several factors which led to iPod use away from the bedside. The portability of the device was one such factor, as it allowed for usage in various locations, not necessarily near the patient. In addition, the intricate nature of the device demanded concentration, leading to nurses moving away from the patient areas to use them. Lastly, the patchy Wi-Fi signal across patient areas discouraged usage at the bedside, further diminishing the presence of nurses and clinical support workers.

At Compass, intentional rounding had been adapted by nurses and clinical support workers to fit into the tempo of the ward flexibly alongside other activities. This was in keeping with how it has been integrated into care across the NHS (Harris et al. 2019). The introduction of the iPods decoupled intentional rounding data entry from other clinical activities, making it an extra job for the nursing staff, which required more time.

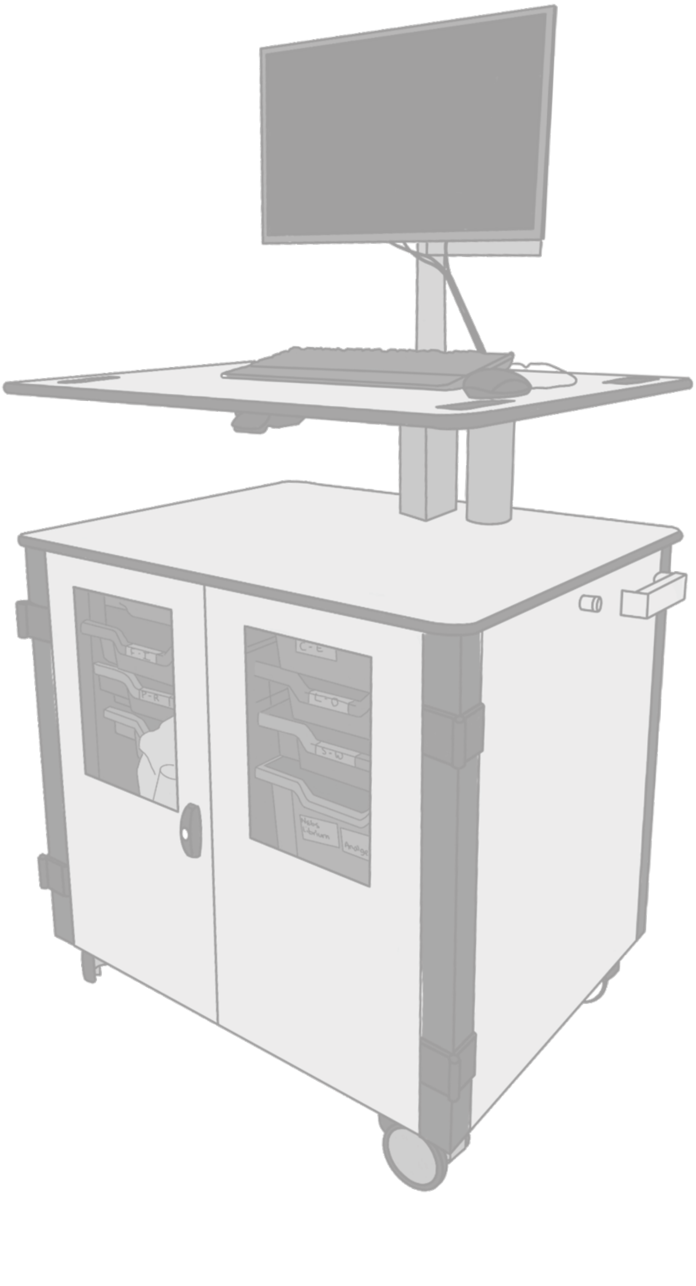
I have centred compassion as the driving quality of care at stake in this chapter because that is where the emphasis was placed by the NHS, government agencies, and by nurses themselves (through reports such as the 6Cs of care (Cummings and Bennett, 2012)). But, as Baillie (2015) describes, compassionate care is too often taken to be an ‘umbrella term for ‘good care’, when good care is more than just compassion. Reflecting on the Francis Report (2013b), Baillie describes that the examples of failures used to illustrate a lack of compassion (patients left without access to fluids) also represented a lack of competence too.

The challenge of trying to emphasise qualities of care separately is also relevant to intentional rounding, which can be seen in two ways. If intentional rounding is not experienced as a discrete activity by patients, then it potentially negates one of the fundamental reasons for its introduction – that patients are aware of it happening and are comforted in the reassurance that they will be seen at regular intervals. However, if intentional rounding is about demonstrating competent care standards, metrics confirming the completion of fundamental activities could help nurses prove they are doing what is required in whichever manner they decide best suits the purpose.

The integration of intentional rounding into nurses' usual care activities reflects the challenges faced by healthcare professionals in balancing competing demands and limited resources. Nurses and clinical support workers adapted intentional rounding to fit within the tempo and constraints of their work environment, prioritising flexibility and practicality. The integration of intentional rounding into routine activities blurred the boundaries between what was considered 'intentional' care and what was part of the standard workflow, potentially diluting the intended impact of intentional rounding on patient experience. How organisations and nurses want different types of care to be balanced continues to be debated (Kitson et al., 2014; Baillie, 2015), but my findings join other research that shows that these differences can become visible through the use of technologies (Halford et al., 2010). My research adds that the materiality of the technologies is an integral part of what drives this, disrupting the usual practices of nurses, leading to workarounds or abandonment.

In summary, the introduction of the iPod for intentional rounding at Compass highlighted the complexities of integrating technology into inpatient healthcare settings, particularly when it interfered with the rhythms of care and the delicate balance of operational and compassionate aspects of nursing work. This suggests that any future technology implementations should be approached with a nuanced understanding of these dynamics, and with careful, ongoing evaluation of their impact on the quality and nature of care delivery.

8 The materiality of communication



8.1 Introduction

In this chapter, I explore how the replacement of paper records with the EPR has led to misalignments in the practices that materially supported interprofessional communication. I examine how the tangible nature of the record, once a physical paper resource, has been transformed in a way that has disrupted established communicative practices and introduced new challenges to providing safe care.

In the literature review (chapter 2), I explored how research has repeatedly shown that the implementation of digital records changes how staff communicate. This chapter will continue to emphasise this, in ways which correlate with previous findings, but I will draw through how the materiality of the record is a fundamental part of the story.

In section 6.3.3, I described how mobile computers on ward rounds introduced a 'physical misalignment' (Pine and Chen, 2020), whereby it became more difficult for ward round team members to share information physically in the same space. In this chapter, I explore the different ways that the materiality of the EPR has misaligned the communicative practices between nurses and doctors. This relates to the role that the paper medical record played in facilitating spaces of communication, as well as a potential divergence in how nurses and doctors understood the EPR as a space to communicate.

Returning to ward rounds, I take a closer look at how the nursing staff experienced being absent from ward rounds and the impact that had on interprofessional communication. The reduction in participation on ward rounds combined with a fracturing in communication between doctors and nurses impeded the nurses' ability to coordinate their work.

As with the previous chapters, the introduction of digital records cannot be weighed up without contemplating how paper is also active in its absence. The changing materiality of the record is still part of the story here, which I will also tell through the example of electronic prescribing, an apparent 'success story', but one which participated in altering the nature of communication and relationship of trust between staff. Furthermore, I show how the introduction of a device to support the administration of medications through the electronic prescription, impeded nurses' abilities to adhere to safe practices, and contributed to the reconfiguration of the spaces of communication that had been formed around the use of paper records.

8.2 Interprofessional communication

In the literature review (chapter 2), I introduced how interprofessional collaboration and communication on hospital wards could be described as complex and interruption-prone (Reeves and Lewin, 2004). I also described how, through the introduction of healthcare information technologies, the role of the medical record as a site of communication was unclear and conceptualised differently across users (Håland, 2012; Chase *et al.*, 2014).

In this section, I introduce findings which help to demonstrate the underappreciated material role that paper records have had in supporting interprofessional communication. In addition, I describe how the materiality of the EPR is not only an absence of those physical paper affordances, but in combination with the unintended consequences it introduces, not supportive of how staff communicated or how nurses were able to coordinate patient care.

8.2.1 Fractured interprofessional communication

As other research has demonstrated, it has been described that the use of EPRs can shift staff from face-to-face communication to asynchronous screen-mediated communication (Dykstra, 2002; Embi *et al.*, 2004; Weir *et al.*, 2011). During my fieldwork, besides what I was told in interviews with clinical staff, there were other signs that communication between staff had been under strain and that interprofessional synchronous communication was an area of concern. Whilst I was in the main office hub on ward A, I noticed a cupboard door with several pages of A4 paper taped up with notes from a series of recent meetings (see Figure 19).

Each included 'communication' as an item, with the emphasis placed on communication between doctors and nurses, seeking ideas and suggestions for improvements that could be made.

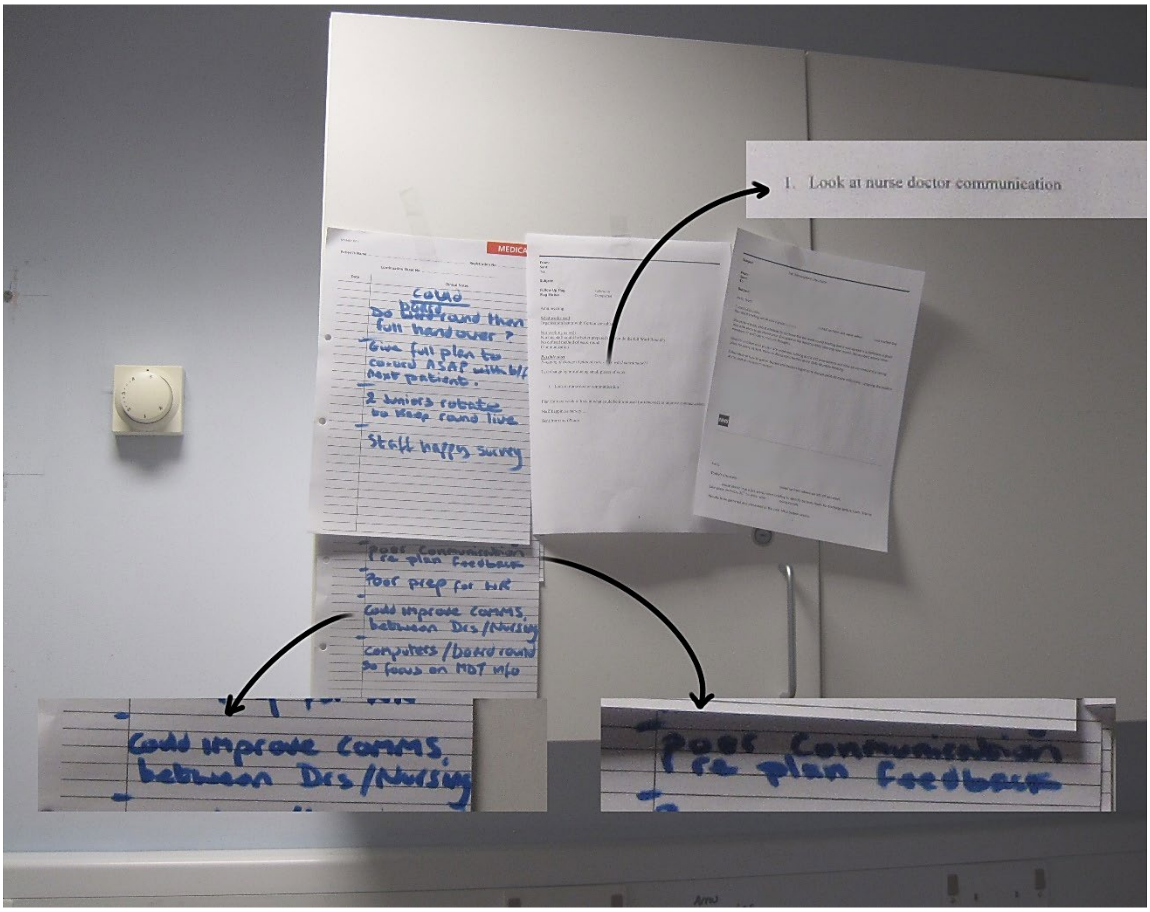


Figure 19: Sheets taped to a cupboard in the ward A office 'hub'. From L-R, the zoomed in sections read, 'could improve comms between Drs/nursing;, 'poor communication re plan feedback', and '1. Look at nurse-doctor communication'.

I asked the staff about this and how communication post-EPR implementation was being experienced. Catherine, a trainee nurse practitioner, explained one of the problems the nurses were facing:

> *'The nurses will probably say there are some barriers because the medical staff will often feel they can put it into the computer and don't have to discuss it with the nurses. That it will be there for them to see because they've written it in.'*

(Interview: Trainee nurse practitioner, Catherine, (003) – ward A)

The above quotation from Catherine highlights how medical staff may assume that once they have entered information into the EPR, their impetus and responsibility to communicate that information to the nursing staff is reduced. This assumption can lead to a lack of direct communication between medical and nursing staff, which can potentially result in important information being overlooked or missed:

> *'Yeah, I think some of the jobs get missed, so it'll be, sort of, say you may put in your plan for the patient to be weighed daily, and then the nursing staff may not pick that up unless you physically go and tell them.'*
> *(Interview: Advanced nurse practitioner, Elizabeth, (005) – ward B)*

Here, Elizabeth, an advanced nurse practitioner, provides an example of how missed communications can impact on patient care. Even though a plan (like a patient needing to be weighed daily) is entered into the EPR, nursing staff may not pick up on it unless it is communicated to them directly.

The quotation below, from staff nurse Julia, describes the implications of not communicating tasks:

> *'There are times when a doctor would have put in the plan they want a flu request but they won't tell anybody, and that has massive implications, because if a patient is in a bay and then comes back positive we have to close the whole bay. Beds are blocked … So, there are issues with communication, definitely'.*
> *(Interview: Staff nurse, Julia (016) – ward A)*

When I asked if this would have been the case when they had paper records, Julia described an important difference in both the materiality of the paper record and the availability of the EPR, which combined to disrupt how the nurses were able to keep track of task changes on the ward:

'I think it's just you have to… obviously it's not just a case of, 'I saw the doctor writing something, I'll just go check', you have to actively find a computer that's free, log on, go onto the care plan, it's not just a case of opening a folder and you can see it there'.
(Interview: Staff nurse, Julia (016) – ward A)

This quotation emphasises both the role that the nurse had in coordinating this sort of task – which would have had immediate and complex logistical consequences for the ward – but also how they were carefully attuned to visual interactions with the paper records, which alerted them independently of the doctor remembering to communicate a task. The EPR, which could be accessed from any computer across the hospital, did not offer the same sort of signals to nurses that their patient's records were being interacted with.

This type of 'peripheral monitoring' has been described by Heath et al. (1994) as intrinsic to locations where staff work together in close proximity, such as stock exchanges. It is communication through observation, supported by physical artefacts and proximity. In the example given by Julia, the doctor may not have consciously placed their interaction with the record in the eye line of the nurse. But the paper records, through their placement on the ward, created a space around them that could be kept under observation by nurses to keep them informed of who was interacting with the records.

Being seen to be working on specific tasks also caused issues for the junior doctors, who on the computers were not as visible to be seen 'physically doing things', as junior doctor Louis describes:

'So, sometimes the nurses don't see us for about 3 hours, so then if things need doing, which had not... they would always just point to the office and be like, 'oh, everyone's in here, everyone's sat at the computer'. I think they meant it in like a harmless way, but I understand that perception of us, sitting down, chatting. No one knows what we're technically doing, because if it's just a laptop screen, they can't see that visibly, like

requesting scans or checking bloods. I could just be doing like, looking at my own emails and things. So probably perceived as that we, we're not, that we're not being proactive, but only because we were doing things on the computer, instead of physically doing things.'
(Interview: Junior doctor (F1), Louis, (006) – ward B)

In this quotation, Louis illustrates the communicative and perceptual challenges in coordinating medical work. There is a disconnection between the physical presence of the junior doctors and the impression of their work efficiency, particularly when seen working on computers. The quotation implies a lack of visibility and transparency in digital tasks. Work that used to be visible, like reviewing physical charts or filling in paper forms, had become obscured behind the computer screens. These findings emphasise the role of visibility of task performance as a form of observational communication between healthcare staff – a factor compromised by the EPR, whether used at a distance or at closer proximity.

8.2.2 Coordinating work and ward rounds

In chapter 6, section 6.2.5, I introduced the absence of nursing staff from ward rounds on wards A and B at Weston District Hospital. Instead of having a nurse present for each patient review during ward rounds, one senior coordinating nurse would move back and forth across various ward rounds to pick up tasks and record changes. This nurse would use an A4 hardback paper notebook, which was portable and easy to handle. As I described in section 6.3, concurrent ward rounds were facilitated by the EPR system providing easier access to patient records. Catherine, a trainee nurse practitioner (and former ward manager), discussed how these EPR-based ward rounds posed additional challenges for the nurses:

'The variability in where the senior doctors conduct ward rounds is absolutely massive, and it's very difficult for us all to get on board and work on the same lines in the morning while shuffling around to find out

> *what each person needs doing. It's difficult, and it's all very much based around Lorenzo.'*
> *(Interview: Trainee nurse practitioner, Catherine, (003) – ward A)*

Catherine's account aligned with my own initial impressions of ward A. With my clinical experience, I expected that I would be able to look down the central ward corridor and identify where the ward rounds were happening. But instead of observing a larger group of staff congregating around a trolley, I saw individuals standing at mobile computers. It wasn't immediately apparent who was working together or which patients they were attending to. I later realised that there were at least three concurrent ward rounds at that time, including Dr Burr's, which was taking place behind several doors in his office, located off the main ward (see section 6.3.1).

It was explained to me that ward A's scheduled midday meeting between the medical teams and the nurse in charge was a way of compensating for the departure of nurses from ward rounds. However, it seemed that this system did not always adequately capture all the information from the doctors that the nurses needed to know. As Vanessa, the ward manager, explained when I asked if the information was handed over verbally:

> *'Not… well, I mean it is, because I might say, 'what's going on with this patient?', because I've not had a chance to go behind the curtains, and they'll just say, 'we want this, this, and this', but when you actually go onto the computer it's not just A, B and C, it's X, Y and Z as well. They haven't told you that bit!'*
> *(Interview: Ward manager, Vanessa, (010) – ward A)*

Vanessa makes the point that what is said verbatim behind the curtains differs from what is distilled and typed into the notes, and different again to what is remembered and handed over to a nurse in the corridor (or MDT meeting room).

The significance of this missing information was emphasised by Adele, a staff nurse on ward B, who would have preferred to have been present on the ward rounds. Her concern was not only relating to receiving a thorough and accurate task list, but that being present would enable nurses to contribute to the development of the plan, thereby influencing the creation of the task list:

> *'I feel like you'd know so much more about your patient. You could have input as well. Because the patients are not always necessarily truthful, or they forget, which is fine. If they're under stress or dementia. I said that the other day, I feel like we should be on the..., you know, they're your... there's a lot of doctors' teams that go around this ward. I know you're not going to get in on everyone, but, you know, the majority of them. I do think it'd be a lot better if we were on the ward round ... I try and be in the bay doing my obs when they're in there, so I can at least listen through the curtains to what they're saying.'*
> *(Interview: Staff nurse, Adele, (028) – ward B)*

Adele stressed the significance of a nurse's presence during exchanges between doctors and patients, especially if the patient later needs help recalling what has been said. This ties in with two important concepts discussed in the last chapter – 'sentimental work' (Strauss *et al.*, 1985) and the invisible work of nurses (Allen, 2014) (see section 7.2.2). Returning to the concept of sentimental work, the nurse being present on a ward round could assist in helping to track the patient's 'identity' and 'awareness context work'. The nurses' presence enabled them to understand the context of explanations, the way a patient spoke about themselves, and how these factors contributed to the patient's understanding of their illness or 'expected trajectory' through the hospital.

In addition, access to this information formed a vital part of the knowledge work that nurses do as part of what Allen (2014) describes as the 'invisible' work of nursing. Drawing on ethnographic research on hospital wards, Allen explains how, through largely unseen processes, nurses are the hub of working knowledge about patients. Keeping track of what was said on and planned following ward rounds, forms a key part of nurses' coordinating work. Consequently, even minor omissions were frustrating to the nurses, who wanted to maintain a complete and up-to-date overview, or 'activity awareness' (Allen 2014) of what was going on.

The challenges presented by a shift towards asynchronous and screen-mediated communication were further complicated when a time-sensitive component was associated with the information. At the time of my fieldwork, Lorenzo had no mechanism to support alerts for time-critical jobs. Some tasks and requests must be done at specific times or at regular intervals. For example, if a blood test needs to be taken at a designated time, but this is only written into the clinical note on the EPR, it can easily be missed. Ward A's Manager, Vanessa, provided an example of how this had been close to potentially causing harm to a patient:

> *'There is a problem, I think, with doctors communicating to nurses. Like last week, there was an incident where the doctors put on the system that the patient needed a troponin[23] repeated. That was in the morning. It was a new junior member of staff, she hadn't noticed, it wasn't picked up until the night staff came on. There was a big gap, but fortunately everything was okay. There was no... but there could've been.'*
> *(Interview: Ward manager, Vanessa, (010) – ward A)*

The incident outlined in this quote highlights the potential for near-miss events in healthcare settings due to communication failures. While in this case, the patient was not adversely affected, it draws attention to the potential risks presented by unreliable systems of interprofessional communication.

8.2.3 The role of the medical record

Research on the medical record has previously positioned the record at the boundary between medical and nursing staff (Håland, 2012). Doctors and nurses

[23] A 'troponin' is a blood test that needs to be taken within a specific time window to measure suspected damage to heart muscle. The result could be integral to prompting urgent further treatment, or, if negative, reassurance and discharge from hospital.

have been categorised and separated by how they *use* medical records. For example, with the medical record as the mediator and focus of care, Introna et al. (2019) describe how doctors 'are there to diagnose and prescribe and nurses are there to enact such prescription, promptly and correctly', with the medical record (or the CPOE[24] in this case) being an important site of action 'where the negotiations (which constitute the intra-actional negotiated order) seem[s] to be taking place'. Through my fieldwork, I also found there was a shift of communication into the electronic record. However, the insufficient interaction between staff groups to support this virtual space led to problems, as described above.

Another potential factor complicating the EPR as a mediator of communication was that the Lorenzo EPR system allowed staff to filter the record content to view only the notes of those professional groups they wanted to see. Consequently, doctors were able to 'hide' nursing notes. Here, Catherine, a nurse on ward A, explains how the notes that nurses wrote were often not seen, even by other nurses:

> *'They get nursing handover in the morning. So, the doctors will go in and sit with the nurses, and the nurses will tell them anything that they feel they need to know about that patient [...] They would NEVER click onto a patient care plan. Never ever, never. So many of the other MDT don't either. It's just the nurses that access the care plans, and then obviously there's all these assessments on now [...] The nurses do all of that, and in my experience, once that's done, it's very rarely looked at again by another member of nursing staff.'*
> *(Interview: Trainee advanced nurse practitioner, Catherine (003), ward A)*

Catherine's account underlines the integral role of face-to-face communication in supporting medical work on hospital wards, while downplaying the EPR's role as a

[24] CPOE – Computerised provider/physician order entry - the process of sending requests and orders (e.g. laboratory, radiology, etc.) via computer rather than paper.

mediator of medical plans and action (Berg, 1996). The use of the EPR, as described by Catherine, sounds more in keeping with a repository (Chase et al., 2014).

In section 6.2.4, I discussed how the EPR could become increasingly critical to facilitating intraprofessional communication and collaboration in the context of the European Working Time Directive and the demise of the hospital 'firm' scheme, whereby information has to be 'handed over' from shift to shift via asynchronous communication channels. This current chapter introduces findings suggesting that there are challenges associated with using the EPR as a mediator of communication. I highlight the lack of interaction and filtering of information within the EPR system, which undermines its effectiveness in transferring medical plans and facilitating communication. The EPR may have provided a place to share information between shifts of doctors, but as a working document to share information interprofessionally, it was insufficient. This also aligns with Allen's (2014) view that the medical record is increasingly becoming orientated towards archival functions, rather than 'a record at work in the practical delivery of healthcare' (Fitzpatrick, 2004). The Lorenzo EPR was not considered to be a suitable location to share evolving and dynamic information relating to patients on acute medical wards, and the nurses preferred to have information shared in a more immediate way so that the consequent coordination work could be planned.

The rhetoric surrounding the EPR and the digitalisation of medical records has given the impression that improving digital systems of record-keeping would facilitate communication. Although that may be the case across distances, within outpatient clinics, for example, on medical wards, not only was the EPR an inappropriate location for sharing important tasks, but it also appeared that communication between staff was even more reliant on a decreasing number of opportunities to transfer information face-to-face.

In the next section, I will describe how the new materiality of electronic prescribing also reconfigured interprofessional communication. To begin with, I will introduce the electronic medication cart and explain how it had additional unintended consequences for nurses dispensing medications at the bedside, with important patient safety implications. The physicality of the Electronic Prescribing and Medicines Administration (EPMA) cart also altered the physical dynamics between staff and patients and shifted the location of nurses in ways which impeded communication.

8.3 Electronic prescribing

Electronic prescribing or ePrescribing (ePx) was introduced into Compass Hospital Trust between 2017-2018. The trust spent hundreds of thousands of pounds on new hardware to host the ePx system. Tablet devices, specifically iPads, were placed in each drug preparation room, and specially designed computer trolleys featuring large, secure medication cabinets, were installed on the wards. Officially named 'Electronic Prescribing and Medicines Administration' (EPMA) carts, they became known among the ward staff as the 'great big computer thing', 'the big one', or simply 'the drug trolley'. On ward A and ward B, these trolleys sat out on the corridor, and there was one for each bay, which amounted to three or four on each ward I visited.

The EPMA carts were introduced onto the wards in 2018 as part of the implementation of ePrescribing. They contained medicines in a locked cabinet below a computer monitor and desktop, and were set up in over 50 inpatient areas over a period of two months. The devices were manufactured by Movec[25], a British company specialising in 'innovative healthcare carts designed to help improve efficiency and accuracy of prescribing, phlebotomy, observations, and other bedside tasks'. The trust IT department (see section 5.4) worked with Movec to customise the EPMA carts to their own specifications, with the primary objective being 'to source carts with ergonomic and mobile working at the forefront of their design to help improve staff well-being, whilst also providing an effective base for electronic prescribing'.

[25] This name has been changed

According to Compass documents, the main aim of the new system was to support 'the safer management of medicine prescribing and care for patients'. Additionally, in aims echoing those stated at the time of the iPod implementation (as documented in section 7.3), the trust hoped that electronic prescribing would 'cut down on time clinical staff spend on paper notes so they have more time to spend caring for patients'[26].

In contrast to the widespread dissatisfaction and abandonment of the iPods, the nursing staff across wards A and B were positive about ePrescribing, as expressed here by staff nurse Adele on ward B:

> *'Oh, I love that so much more than the paper ones. It's brilliant ePrescribing. I prefer that 100%.'*
> *(Interview: Staff nurse, Adele (028) – ward B)*

The nurses explained how they found the electronic charts an improvement on paper charts because they were reliably accessible and easy to read. This allowed the nurses to focus on dispensing the prescribed medications to patients rather than searching for paper documents and occasionally deciphering illegible handwritten prescriptions.

Even though the nurses voiced a preference for the digital version of the medication chart, their experiences of the medication trolleys were not as clearly positive. I will now describe how the EPMA cart had unintended consequences introduced through its physicality. Reductions in mobility and proximity produced through the use of the EPMA cart had ripple effects on opportunities for verbal, nonverbal, staff-patient and interprofessional communication essential to safe and effective care delivery. These accounts emphasise how the material realities of healthcare technology, even when intended to increase efficiency, can inadvertently introduce physical misalignments (Pine and Chen, 2020) that disrupt

[26]Quotes from publicly accessible Compass Hospital Trust communications (the original source may be from the trust website/YouTube/Twitter)

established work patterns, complicate communication, and introduce new potential for risk.

8.3.1 The medication trolleys

Compass purchased two versions of the medication trolleys (or EPMA carts) from Movec, which were configured to their specifications (such as the size of the computer monitor, the hydraulics which raised and lowered the desktop, and the battery status indicator button).

Figure 20: The EPMA carts – on the left is the smaller (90kg) single door version and, on the right, the heavier (120kg) double door version.

The larger of the two carts weighed approximately 120kg and took up a footprint of approximately 90x80cm. The smaller trolley was nearly 90kg (see Figure 20). After interviewing Rebecca, a staff nurse on ward A, she took me to the 120kg two-door trolley, giving me a 'tour' of the equipment and joking with me, 'Well, you try and move it then'. I made a gesture of giving it a significant budge, but it barely moved. The relative immobility of the EPMA carts restricted the mobility of the nursing staff, as described to me by Julia, a staff nurse on ward A:

'Our computer stations are large… that is our computer on there and our medication trolley [...] they have to be plugged in and secured to the wall and locked to the wall because of the medications … So, you're almost maybe not in and out of your bay as much as you would be, 'cos they are quite cumbersome and need charging, they have to be plugged in, kind of the logistics of it sometimes take it out of the bay more'.
(Interview: Staff nurse, Julia, (016) – ward A)

As Julia suggests, moving the medication carts into patient areas was not easy, and other nursing staff admitted that they had stopped trying, tending instead to leave the trolley outside of the bays, meaning they were physically further from patients and opportunities for in-person communication. Some nurses struggled to move the EPMA carts at all. For example, staff nurse Adele was pregnant and worried about the personal risk of moving the carts:

'I am not moving things around when I'm pregnant. They are staying there, and I'm just locking it when I'm going to and from. Those trolleys are very heavy.'
(Interview: Staff nurse, Adele, (028) – ward B)

'Because the computers are so heavy to push around, we don't tend to push them around as much as we should, so we do our paperwork at the computer and then go into the patient.'
(Interview: Staff nurse, Rebecca, (017) – ward A)

The quotations demonstrate that although the staff expressed awareness of how they should be moving the carts, some avoided doing so, limited by physical ability and concern over injuries.

Working with the EPMA carts outside the bays reduced opportunities for face-to-face communication with patients, as well as nurse visibility and availability. This had consequences for safety. The EPMA trolleys were meant to make the electronic prescription, itself a site of asynchronous communication, mobile so that it could be taken to the bedside in a similar way to the old paper chart (Figure 21).

Figure 21: Old and new medication trolleys. Left: old style medication trolley with paper medication charts. Right: the larger style of the EPMA carts.

Figure 21 displays the old-style medication cart next to the EPMA cart. On the left is the paper-based medication cart. On this style of cart, paper medication charts were laid out on the flipped-up interior of the lockable lid, which enclosed the medication containment area. This trolley could be wheeled into bays, like the EPMA cart, but the paper chart could then be picked up and moved closer to the patient to check the details against the wristband. This was an important safety check, to ensure the right drug was being given to the right patient, following and confirming the asynchronous communication of a prescription. It also facilitated confirmation of allergy status with the patient, which could have been achieved by directly double-checking the chart against the patient's wristband identification, as well as seeking verbal confirmation. In addition, having the paper medication chart visible at the bedside facilitated patient education and communication about medications.

When the nurses were able to move the carts into the bays, they had to negotiate further issues. Nurse Julia described how the bulkiness of the trolley and the size of the screen created other difficulties in communicating with patients:

> *'I don't like the fact that it puts a physical barrier between you and your patients. When you had the prescription chart, you could almost hold that at your side, and now you are looking at a screen, you're not necessarily even looking at your patients some of the time, you know, and even when you are dispensing your medications, I will quite often turn the trolley around because otherwise you physically can't see your patient, you've got a screen in front of you, and then there's also the fact of people walking behind you when you've got this screen open with people's medications on, so as well as angling myself somehow so that I can see the patient, I always try and angle myself somewhere where if someone needs to walk into the bay behind me they then can't see what is on my screen.' (Interview: Staff nurse, Julia, (016) – ward A)*

As Julia describes, there was no ideal way to use the EPMA cart within a multi-patient bay. Adapting positioning to improve communication was accompanied by the trade-off of potentially displaying confidential information to the rest of the bay. Julia had to be aware of multiple dynamic factors in her environment and respond with appropriate shifts in the computer's orientation.

Safety was one of the driving forces behind the implementation of electronic prescriptions. The removal of the paper chart reduced certain risks (e.g. illegibility or loss), but the medication cart's new materiality introduced new risks. Not carrying the medication chart (or cart) to the patient deviated from a procedure that had been practised over years as a step in maintaining the safety of medication dispensing.

In addition to the practical considerations, relational aspects of being physically present in the bay during medication dispensing were also impacted. By bringing the cart into the bay, nurses could remain visible and engage more directly with their patients while administering medications. They could observe patients taking their medications and identify any problems they might have. This observation process formed an integral part of the nurses' sentimental work (see section 7.2.2), which added to the nurses' knowledge of how patients were coping with treatments. Being present in the bay, partaking in routine and uneventful activities, also forms part of nurses' 'organising work' (Allen, 2014), where maintaining an overview of patients and communicating this to relevant others forms a core part of nursing activities. So, whilst the medication carts may not immediately seem to be a part of how interprofessional communication was supported, the mobility of staff is a component, and in small ways, the decreased mobility of the nurses with the EPMA carts fed into bigger differences in how and what they could communicate to the multidisciplinary team.

Despite a general preference for digital charts, it was evident that their materialisation shifted the location of nurses' work. Though not by a large distance, it was enough to interfere with practices of communication and the drawing together of information sources (the chart, the wrist band, the patient) which promoted patient safety.

To summarise, the EPMA carts, the merger of a computer and medication storage, was intended to increase efficiency, safety, and mobility but paradoxically resulted in decreased mobility and introduced new risks. The physical size and weight of the EPMA trolleys deterred the nursing staff from mobilising the devices as intended. Consequently, established practices of communication and directly verifying patient identification against medication charts at the bedside - a critical safety measure - were disrupted. Furthermore, the carts' obtrusive presence created a physical barrier between nurses and patients, disrupting patient-nurse communication and potentially compromising the integrity of patient confidentiality.

This is also another example of what Pine and Chen (2020) termed a 'physical misalignment'. Pine and Chen describe how the alignment of practices and information sources can be unexpectedly fragile and that changes even of a few feet, or moments in time, can create 'unneeded complexity, frustration, ineffectiveness, and potential for safety risks'. This can result in a negative impact on the efficiency and safety of healthcare work through obstacles to the co-location of information and work.

These findings also underline the detrimental effects of physical misalignment on the social and spatial dimensions of healthcare work. By deterring nurses from moving into patient bays, the EPMA carts impeded 'organising work', where maintaining an overview of patients and communicating this to relevant others formed a core part of nursing activities (Allen, 2014). These subtle shifts in the mobility and visibility of nursing staff disrupted established patterns of interprofessional communication, leading to potentially significant changes in care delivery. This reinforces Pine and Chen's (2020) assertion that careful attention must be paid to how new technologies align - or misalign - within the sociotechnical realities of healthcare work.

8.3.2 Medication charts

I began this chapter by describing how the paper medical record, as a visible and physical space of interaction, could help to support nurses in maintaining an awareness of when medical records had been updated. I then discussed how the materiality of the EPMA cart made the medication chart less mobile at the bedside and introduced unintended medication administration risks.

I now want to discuss how the new sociotechnical arrangements altered interprofessional communication, with reference to paper medication charts, and how the tendency for movement away from face-to-face communication ruptured meaningful and situated interconnectedness between ward staff.

Echoing the opening to this chapter, Maria, a staff nurse on ward A, described how the transition to the EPR system created an expectation of information and task transfer that lacked verbal communicative backup. She noted the reduced role of verbal communication, suggesting that it was traditionally anchored by a tangible, physical object — the paper medication chart:

> *'I do think that [communication] has got worse, definitely. Because if they [doctors] prescribe something, they would've come to you with a form saying, I've prescribed this, can you give it? But now they put it online, they sort of expect us to see it, which doesn't happen all the time because I'm not always on a computer. So that can be quite frustrating if they've made changes to somebody's care and they don't tell us because they just expect us to see it online. Which is quite frustrating, […] but I think that's just the lack of communication with the doctors, I don't think that's an actual problem with the computer coming in place, I think it's just more of a problem with the doctors really.'*
> *(Interview: Staff nurse, Maria, (015) – ward A)*

Although Maria frames the issue as a communication problem on the doctors' part, what she says reveals a lot about how transportable material objects (paper charts) used to have power and utility in advancing ward-based interdisciplinary communication. As she says, 'they would've come to you with a form'. The EPR is known to create a false sense of effectively communicating (Dykstra, 2002; Ash et al., 2007c; Weir et al., 2011), but in addition, the physical artefact, paper, seemed to create opportunities for interruptive connection, as articulated by Rebecca, another ward A nurse:

> *'If the doctors have made a mistake, you have to wait until they finish what they are doing on the computer to relog onto the patient that you need for them to change it. Whereas before, you could just shove a prescription chart under their nose, and they could change it there and then.'*
> *(Interview: Staff nurse, Rebecca, (017) – ward A)*

Rebecca's account highlights the 'interruptive' nature of ward communication. The word 'shove' portrays a sort of immediacy and forceful interruption, but outside of formal multidisciplinary meetings, communication on busy wards is often interruptive (Rivera-Rodriguez and Karsh, 2010).

As Coiera (2000) put it, it is the 'multiple conversations that pepper the clinical day' that drive 'clinical actions'. The traditionally spontaneous, opportunistic, and interruptive nature of these exchanges (Coiera and Tombs, 1998) aligns with Nicolini's (2007) depiction of hospital wards as dynamic, busy environments where staff often interact in an ad-hoc and unplanned manner. Nicolini (2007) described how, on hospital wards, 'people run and bump into each other all the time, get in each other's way, hold each other up', and these frequent coming togethers create a space for the shared and collective knowledge of patients, which exists outside the record. Paper charts were a way to facilitate these moments, and when they were removed, there was no equivalent object or route within or with the EPR to take their place.

8.3.3 Nurses and junior doctors

The professional identities of the staff groups involved in these communication scenarios are also significant. Nurses frequently expressed frustration over doctors' communication practices, which often involved tasks typically completed by junior doctors, such as prescribing and handing over tasks from ward rounds. This observation may be a key factor, as it suggests that the specific interprofessional relationships between junior doctors and ward nurses benefited from material aids to both disrupt and facilitate communication.

Milne et al. (2015) described how the 'fractured nature of junior doctors' work' can constrain their ability to be effective interprofessional practitioners. It appeared that at Compass, paper could have previously played an underappreciated role in facilitating verbal and non-verbal communication between junior doctors and nurses. Paper charts were able to act as tangible communication tools, supporting interprofessional dialogue. This is described here by junior doctor Louis:

'Yeah. Well, they [the nurses] still shout all the time like, 'who's actually doing this and who is actually doing that?'. I suppose if we are all sat on laptops, then nobody can really tell what anyone's doing. I suppose if we were all sat with the nurses and filling something out, and they could take the piece of paper right away, they would know more instantly what people were up to.'
(Interview: Junior doctor (F1), Louis, (006) – ward B)

Louis compared the visibility of work when done on laptops versus paper, highlighting how the digitalisation of tasks can obscure immediate understanding of who is doing what, in comparison to paper based-work, which provided visual feedback to nearby colleagues. This contrasts with the findings of Heath et al. (1994), who, when describing the work of securities dealers at individual computer terminals, detailed how the dealers overcame the limitations of their computers by forming a 'visual ecology' through the proximal locations of various desks. This, though, did require the dealers to be within a 'glance' of each other. The hospital staff were dispersed throughout various locations. Nurses preferred to use EPMA cart computers to access the EPR, which, as I described above, moved them to ward bay entrances. Junior doctors tended to use mobile computers, which could be wheeled away into office areas (and out of sight from nurses). This dispersion and lack of shared, visible workspaces hindered the establishment of a 'visual ecology' (Heath et al. 1994). This had negative implications for effective communication and collaborative work among hospital staff.

8.3.4 Contextual knowledge transfer in face-to-face communication

Interprofessional communication within hospital settings involves more than the transfer of tasks and requests. Verbal requests are interpreted with a range of contextual knowledges (of the patient, the requester, the environment, the time of day etc.). The physical artefacts, such as paper charts, that once facilitated these exchanges not only helped transmit information but also provided context.

As Berg et al. (2003) describe, ‘orders’ in real-life hospital ward work are rarely straightforward transactions. They are usually the products of interactive and collective discussions involving different doctors, nurses, patients, and other healthcare professionals like pharmacists (Gorman et al., 2003). Taking this into account reveals a much more complex relationship between staff and how action is mobilised on a medical ward, as well as the importance of maintaining formal and informal opportunities for verbal communication. The way in which patient information is documented in medical records, and the contributions made by different staff groups, do not accurately reflect the knowledge-sharing and decision-making processes that occur in a ward environment; rather, they serve as a representation (Berg, 1996). As ward manager Vanessa described above (section 8.2.2, page 191), ‘when you actually go onto the computer, it’s not just A, B and C, it’s X, Y and Z as well.’ This quote highlights that more mundane tasks, such as recording daily weights, can get lost when instructed solely through notes. The extra value that can be added through verbal handover would have helped package the task into action when it was wrapped in context and meaning. For example, ‘please do daily weights’ can be augmented in conversation with why it matters and why the person given the task should care. It can also be an opportunity for the person being tasked to contemporaneously explain why, for example, daily weights might be physically challenging to achieve, denied by the patient, or impossible whilst specific equipment is broken.

Direct, face-to-face communication explaining clinical decisions can provide crucial context and reasoning, particularly as there is little opportunity for nuance or highlighting in the digital notes. Hunches, frustrations, and uncertainties are rarely reflected in medical records – be they electronic or paper. These knowledges circulate privately in conversation and verbal handovers (Tillack and Breiman, 2012). Medication changes may also benefit from verbal handovers, as these open up the chance for immediate feedback from nursing staff (or pharmacists) who may have knowledge of the patient or medication, and why an alternative may be more appropriate.

To return to prescribing, the value of face-to-face interaction is illustrated by Borrott et al. (2017), who drew on ethnographic research to detail communication between doctors and nurses regarding the management of medications on paediatric wards. They described how nurses would proactively engage on behalf of their patients, especially when they possessed greater familiarity with prescribing in a paediatric context than many of the junior doctors. For example, in the prescription of analgesia, less experienced doctors would cautiously prescribe low doses of painkillers. The nurses, who knew the amounts would be inadequate, had to push back in dialogue with the doctors to achieve an effective dose. There had to be effective, active, and respectful communication between the nurses and doctors to achieve the best prescription for the patient. This negotiation might not necessarily have been evident in the subsequent documentation.

Borrott et al. (2017) described this joint decision-making process as a sort of symbiotic relationship. The paper medication chart served to keep this relationship present in a shared physical space, which enriched the interaction between the staff and helped to build trust.

It is harder for this communication to take place if the doctor does not physically come to the nurse with a prescription chart in the first place. The loss of the physical impetus, in addition to the idea of the electronic record as the primary location of communication, reduces the chances that valuable interprofessional conversations will occur. Again, this matters because it is critical that communication happens clearly and effectively on hospital wards to deliver the highest standards of patient care (Campbell *et al.*, 2018).

8.4 Trust

The preceding discussion has outlined how the introduction of the EPR and the concurrent phasing out of paper charts precipitated a shift in communicative practices which had been supported by a ‘web of coordinative artefacts’ (Bardram and Bossen, 2005).

Nicolini (2007) describes telemedicine as a 'stretching out' of practices in both space and time, leading practitioners to reframe how they make their work accountable, as well as reconfiguring their relationships with their co-workers. As I have presented above, this spatial expansion of work practices is not limited to telemedicine alone; it also permeates the conventional hospital ward environment. The affordances offered by digital records substantially disrupt the potential for regular, spontaneous co-presence, possibly engendering a sense of confinement within a clinician's unique 'electronic silo' (Stoller, 2013).

EPR systems are designed to allow network access to digital information. Nevertheless, under time pressure, when users were required to physically access data like electronic prescriptions, I found that the advantages of an extensive information network diminished. The cumbersome EPMA carts and slow-to-access digital systems sometimes compelled users to resort to verbal communication, particularly in urgent situations where timely action could be lifesaving.

Transferring information between staff members outside of the digital record, such as verbal medication orders during emergencies, can put nurses at risk until these orders are documented or input into the system. In these instances, manually writing a prescription is often faster than typing one into a computer. Staff involved in these situations had to rapidly assess these risks to provide safe and timely care.

I will describe how staff experienced difficulties in urgent situations below, but to begin with, I will set the scene for how relationships between nurses and junior doctors have the potential to become more distant through the EPR's affordance of remote prescribing, and how this may compromise the establishment of trust, which underpins actions in emergencies.

8.4.1 Remote prescribing

The implementation of ePrescribing altered how changes or additions could be made to a patient's medication chart. With ePrescribing, when a change was needed, and the medical team responsible for the patient was not on the ward, members of the patient's team or the on-call doctor could be 'bleeped' by nursing staff to request an alteration was made. Maria, a staff nurse on ward A, described how electronic prescribing was convenient in these situations and meant the doctor would not have to attend the ward:

> *'So, if you phone them overnight and say, so-and-so has got this, please can you prescribe some more fluids, they can do it from any computer, which is handy. Normally they'd have to come down to the ward to get the chart off you and prescribe it.'*
> *(Interview: Staff nurse, Maria, (015) – ward A)*

In such scenarios, the doctor and nurse may not know each other, and it is likely that the doctor, being on-call, has little familiarity with the patient. The request may sound simple, such as 'please prescribe a bag of fluids', but the doctor needs to gather more information before fulfilling the request. If the doctor knows the nurse, they may prescribe without further questions, relying on their trust in the nurse's experience. It is possible that the patient required the fluids as documented in their notes and that their regular medical or surgical team had overlooked the prescription. However, the situation may not be as straightforward, as described by Dr Louis, and 'things can go wrong':

> *'On surgery, you had ward C and ward D and day surgery, all in different parts ... all the things that I'd get asked to do from day surgery, like prescribe fluids, or do the VTE[27], I would just do it online and not go there physically. So, they probably don't even know my name, and I've not seen the patient. I just do whatever is on the computer, and it's done. Which has its pros and cons, because it means I don't have to walk there and back to do something, but then I suppose it could be seen that I'm not there as much, I don't physically see the people, and there's some*

[27] Complete the venous thromboembolism (VTE) assessment and prescribe prophylaxis as needed.

> *safeguard... there's some, like, things that can go wrong if you're doing stuff without seeing them.'*
> *(Interview: Junior doctor (F1), Louis, (006) – ward B)*

As Louis highlights, prescribing without physically seeing the patient or visiting the ward carries additional risks. It is possible that the patient's blood pressure has dropped and they are unwell. Other questions could arise: Has something gone wrong post-operatively? What is the patient's cardiovascular status? How well does their heart normally function? Can this patient tolerate additional fluid in their system? What is their electrolyte balance like? Do they require additional potassium? So, a simple request potentially elicits a barrage of questions, especially if the doctor does not travel to the ward and clinically assess the patient.

With the Lorenzo EPR system, doctors were able to review the patient's notes from afar and get a sense of whether the requested fluids were reasonable and necessary. The doctor could also cross-reference blood results to check for any electrolyte imbalances. However, these tasks required time, particularly if there were multiple requests coming from staff members in various locations. Completing these tasks also had to be balanced against more urgent and time-sensitive responsibilities, such as attending to critically ill patients and admitting new ones.

When time was limited, the thoroughness of checking had to be weighed against a balance of risks and trust. The doctor had to trust the nurse's knowledge, the nurse's understanding of the patient, and trust that the nurse was making the right request. The same applied in reverse. Risks arise from what is not requested or checked, particularly when 'all' the information is accessible in the EPR, and the patient is nearby enough to visit. Trust is integral to effective interprofessional working (Calnan and Rowe, 2008; Gregory and Austin, 2016) but can be fragile over distances or when there is a lack of face-to-face communication (Jarvenpaa and Leidner, 1999). Sutherland et al. (2022) studied how proximity influences interprofessional trust in the context of a distributed diabetic foot ulcer team in the United States. They found that trust was established over time, and was supported by 'introductions, communications, and working together'. Workers who were closer together were able to build trust more easily.

Electronic prescribing afforded the introduction of prescribing over a distance, and communication between staff members who may not have met in person. Prior to ePrescribing, the doctor would have needed to physically go to the ward to prescribe the fluids, and they also might have had to go to the patient's bedside to access the chart and visually assess the patient. Alternatively, the charts might have been lined up on the front desk with post-it note requests attached to the covers. Either way, there was a higher likelihood of face-to-face interaction occurring.

The reduction in face-to-face interactions and direct patient assessments can introduce a level of uncertainty and potential for oversight, 'things that can go wrong if you're doing stuff without seeing them' (Louis, junior doctor, see quote above). This distancing can also undermine the formation of interprofessional trust (Sutherland *et al.*, 2022). I found this to be an area of emergent uncertainty, where systems of accountability had not caught up with the shifts in practices.

8.4.2 The challenges of electronic medication charts in emergencies

Catherine, a senior nurse with decades of experience, highlighted the difficulties posed by access to electronic medication charts in emergencies. I had been trying to establish whether gaining a rapid overview of a patient from the EPR in an emergency was difficult. However, Catherine stated that there was generally 'somebody around that kind of knows what's going on.' Instead, her concern lay in accessing and using the electronic medication chart itself. She explained:

> *'You used to be able to get that piece of paper, look, and go and get it straight away. Now you have to put your card in, you log on, click buttons millions of times before you get to the prescription chart. So, it's not just a case of going to get it. It can be a minute or two, two or three minutes to*

log on and get the patient's prescription chart. And that could... that, in my view, could be challenging.'
(Interview: Trainee Advanced Nurse Practitioner, Catherine (003) – ward A)

The quotation from Catherine offers insight into the additional burden faced by healthcare professionals at the bedside when dealing with acutely ill patients and the electronic prescription chart. The time and attention required to log onto computers and wait for the software to load became significant obstacles in a time-sensitive situation. In urgent care situations, described as 'hectic environments' by Dykstra (2002), the focus of attention shifts towards making decisions and taking action, rather than accessing the digital chart.

Workarounds can be thought of as 'strategies to bypass or avoid an undesirable feature in a system' (Carrington and Effken, 2011). As a workaround to the digital chart in this situation, the nursing staff (staff nurses on ward A, Julia and Maria) described to me how they would accept a verbal order from a doctor. A 'verbal order' refers to drug administration without prescription (Evans and Mullen, 2009) and are only permitted in emergencies. They are recognised as being prone to error through the potential for misunderstandings or misheard prescriptions (Shastay, 2019). Below, staff nurse Maria explains the predicament the nurses faced:

'I think when it was an emergency, if a patient has been unwell, the doctor would prescribe it in front of you, and then you'd give it. Whereas now it's a bit like you've got to trust that the doctor's going to prescribe what they are going to prescribe. For instance, I had a little bit of an emergency this morning, and one of the patients needed medication. Normally they'd quickly write it and give me it. Whereas they've got to go back to the computer, so I had to quickly get their medication ready, and then as soon as it was prescribed, I had to give it. So, it does delay things, but it's just that trust that you've got with that doctor. So, like, he told me what he wanted to give, and I made sure another nurse heard that, so then if he

was to turn around and say, "I didn't say that I've documented a different thing", I've got a witness. But it is just dependent on how much trust you've got with the doctor really. 'Cos if it's not prescribed, we're not supposed to give it.'
(Interview: Staff nurse, Maria, (015) – ward A)

Staff nurse Julia also emphasised how verbal prescriptions made her feel uneasy, both in terms of hearing the request correctly and with concerns about whether it would be completed by the doctor at a later stage:

'In that situation [an emergency], we would probably get two nurses to hear something, and then you're almost sometimes doubtful that it will get prescribed, and you double-check, and you double-check, and then you will give it…'
(Interview: Staff nurse, Julia (016) – ward A)

The nurses expressed how the gap in documentation put them in a vulnerable and challenging position. Maria explained the measures she took to protect herself, refraining from administering the medication until it was prescribed or having another nurse witness the order. Julia also expressed a lack of trust in the doctors' reliability in completing prescriptions retrospectively. Both nurses emphasised the importance of having a witness for the request. The doubts and uneasy trust in their medical colleagues, evident in these interview responses, highlighted how this scenario pushed the boundaries of safe prescribing and documentation while striving to prioritise the best outcome for the patient in an emergency.

Doctors also struggled with the barriers to accessing the electronic prescribing system during emergencies. Sebastian, one of the doctors, stated that waiting to access the electronic chart on Lorenzo felt like it could be a matter of life or death:

'Generally speaking, my philosophy would be that if a patient is in an emergent situation, then it is in that patient's best interest to have those medications be given to them first and then retrospectively prescribed

later. Because if you are waiting to fire up a computer application like Lorenzo and trying to access those applications to prescribe medication, and then the nurses have to access the Lorenzo to prescribe the medication, that potentially could be a time for life or death.'
(Interview: Associate Specialist Doctor, Sebastian, (004) – ward A)

Recognising the nurses' discomfort with verbal orders, Sebastian explained how he would retrospectively sign for medications, assuming full responsibility for their prescription and administration, thus alleviating some of the risk burden faced by the nurses.

The distinction between prescriber and dispenser serves as an additional layer of safety and checking, with exceptions made only in special circumstances, such as emergencies (Royal College of Nursing and Royal Pharmaceutical Society, 2020). The decision to take on this responsibility could depend on the experience of the doctor involved, as well as their confidence in accepting broader accountability. Sebastian, as an Associate Specialist, held a permanent position at the level of a consultant. Considering the risks and benefits, he would personally sign for all the drugs. However, a junior doctor is unlikely to feel comfortable taking on the same level of responsibility.

Furthermore, the EPR's ability to create a timeline of events introduced further concerns, particularly when there was awareness of how the system could record individuals as being 'in the wrong'. Staff nurse Rebecca explained how the 'time issue' could misrepresent what had happened:

'So, if it's something like an emergency, you've got to make sure they've prescribed it because you've got to sign for it. Cos it's got a time issue on it, it's got a time of when you've given it. So, if I give it at 10:10, but they don't prescribe it until 11:30, I'm in the wrong because I've given it before they've prescribed it.'
(Interview: Staff nurse, Rebecca, (017) – ward A)

This quote illustrates a further dilemma faced by the nursing staff, which added pressure to the situation. Pine and Mazmanian (2014) describe this as the problem of '"perfect" but inaccurate accounts', where the work of creating a 'perfect' record both directs and disrupts the coordination of the work (as was also demonstrated by the use of the iPods in intentional rounding data collection, see section 7.6).

The issues I have described in this chapter, the distancing of communication between nurses and doctors and the materialisation of the electronic prescribing system all fed into the uncertainty of how to proceed in these situations.

8.5 Conclusions

In this chapter, I have used the implementation of EPR to illustrate how the changes in the material and social balance of the ward have reconfigured communicative practices. The EPR has offered affordances and constraints which have fundamentally altered the balance of the ward in such a way that the materially driven synergistic processes staff used to negotiate and share knowledges have been put under strain.

In Chapter 6, I focused on this physicality with particular attention on the ward round and movement with mobile laptops. This chapter looked at how doctors and nurses communicated beyond the scope of the ward round and how that had been supported by the materiality of the paper record. The physicality of the paper record made it a working document, which gave it uses beyond being an archive. Paper records functioned in supporting practices by being a physical object which could be used tangibly or visibly as a device in communication. For better or for worse, it was intertwined within interruptive communicative processes, and its removal left a hole in how interprofessional practices had been supported.

Paper records brought staff together in direct and indirect ways, which supported communication. Mobility and drawing together the right combination of information and artefacts also supported the safe administration of medications at the bedside. The physicality of the EPMA carts disrupted the movement of nurses on the ward and altered the process of medication administration. For many of the nurses I talked to, safety checks which were traditionally performed at the bedside had been relocated to the corridor due to the physical constraints of the carts. The EPMA carts also had other unintended consequences. The nurses did not spend as much time in the patient bays, which reduced the amount of time they were able to make informal observations of patients. In addition, when the nurses did mobilise the carts, they had to remember to adjust their screens to protect patients' information from being inadvertently visible to others.

The affordances of ePrescribing introduced a new dynamic in the trust between healthcare professionals. Despite its convenience, it also induced a level of uncertainty due to the lack of face-to-face interaction and direct patient assessment. Additionally, trust was a key factor in the use of ePrescribing in emergencies. Through highlighting the challenges of accessing the electronic chart in time-sensitive situations, I described how verbal orders were seen to be pushing the boundaries of safe prescribing and documentation. These scenarios placed nurses in vulnerable positions, requiring them to make decisions on the basis of their trust in doctors.

These findings continue to highlight the diverse manifestations of unintended consequences relating to the material transformation of medical records. While the technologies of the EPR are designed to improve efficiency and accuracy, they also reshape social interactions and work practices in ways that can introduce new challenges and risks.

I will now move on to the discussion chapter, where I will draw together the findings of the last three chapters, explore them in more detail, and situate them within the existing literature.

9 Discussion

9.1 Introduction

In this thesis, I used ethnographic methods to reveal how the materialisation of the EPR was reconfiguring work on NHS medical wards. Taking inspiration from actor-network theory, I followed the medical record through medical wards, clinical coding, storage facilities, IT training and support, and into server rooms. I made notes, drew sketches, and took photographs. I interviewed staff members from across the hospital, both those I had observed and those who had non-clinical connections to the EPR. Furthermore, I read documents relating to the use of technology in the hospital, both produced as hospital communications and in other media (such as policy documents with case studies).

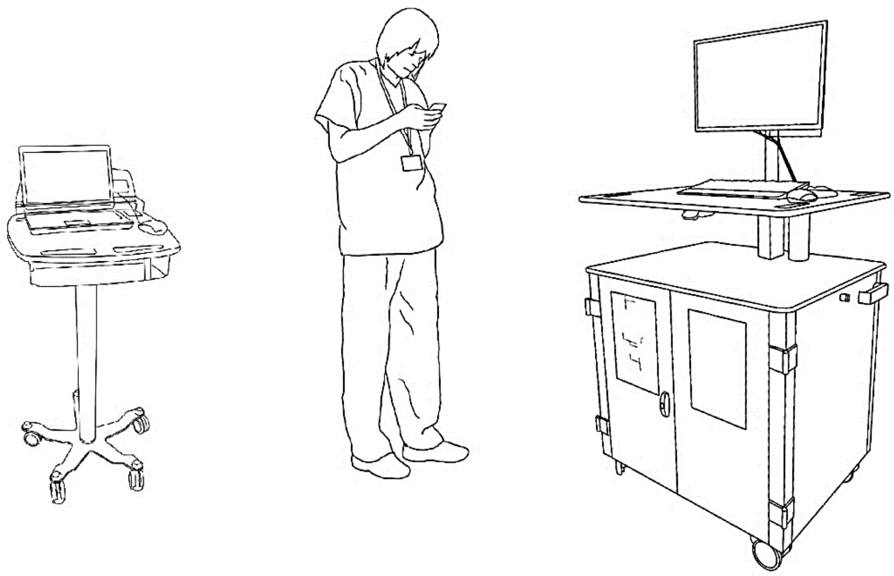


Figure 22: From L-R: Laptops on wheels (otherwise referred to as COWs), a handheld device (an iPod), an electronic prescribing and medicines administration (EPMA) cart.

I studied the EPR through several electronic devices which had been implemented to make it mobile, all with the aim of getting the digital medical record to the bedside, as had been the case with paper records. These were either objects I identified in use on ward rounds during my observations or artefacts which were discussed in the interviews (see Figure 22).

I will now summarise and discuss the main findings of my research in the context of the current literature.

9.2 Mobilising the electronic patient record

The materiality of the EPR contributed to the shape of collaborative medical practices through the affordances of the EPR, through mobile computers, and through the removal of paper. Below I reflect on the main findings of this chapter with how I found collaborative practices were reshaping on wards before moving to a discussion of what this means for medical work.

9.2.1 The changing shape of the ward round

The ward round, known to be a 'complex clinical process during which the clinical care of hospital inpatients is reviewed' (Royal College of Physicians and Royal College of Nursing, 2012), was reconfigured by the EPR. Traditionally, the ward round moved from patient to patient and centred around information held within paper medical records. With paper records, the coordinated focus of the ward round was restricted, but united, around the one available set of notes per patient. Removing the paper records scattered attention and eyes across multiple EPR screens. It altered the mobility of the record so that the information could be accessed from greater distances, even out of sight of the bedside.

9.2.2 Unsettled practices

The ward staff felt unclear about how to do the 'modern ward round', and each consultant was developing their own strategies to conduct the movement of the devices around the space of the ward. The diversification of ward round location impacted the organising work of the nurses, who found it harder to keep track of clinical activity and decision-making on the ward. In addition, several ward rounds were more able to coincide because there was no competition for access to the digital records, as there would have been with the paper notes trolley. Although difficulties relating to the scheduling of ward rounds predate the paperlight ward (Royal College of Physicians and Royal College of Nursing, 2012), the availability of electronic patient notes added to the problem of coordinating care on the ward.

Ward rounds, when uncoupled from a paper notes trolley, were less visible to ward-based nursing staff – as was the case with Dr Burr's ward round, which was based in an office out of sight of the main ward (see section 6.3.1). The dispersion of ward rounds had repercussions for the nursing staff, who had to remember the ward round style preferences of individual doctors and attempt to maintain engagement with them across multiple locations. It made it harder for the nurse in charge to coordinate care on the ward, leaving the nurses feeling they were not always receiving adequate handovers from doctors. Although the nurses had withdrawn from the ward rounds in the locations that I observed, the lack of visibility of the ward round created a further obstacle for the nurses to be able to participate, even temporarily. As I found in Chapter 8 and will discuss later, this could have been a factor in the fracturing of communication between staff groups.

9.2.3 The paperlight clinical environment

Building on the work of others in the fields of medical sociology and computer-supported cooperative work (CSCW) (Strauss et al., 1988; Bardram and Bossen, 2005), my research adds to what is known about supporting articulation work on a hospital ward. Articulation work, as proposed by Strauss (1988), refers to the work needed to align different practices, tasks, and projects. It is 'the work that supports the work' (Allen, 2014, p. 55). The EPR on ward rounds, materialised via multiple mobile computers, altered the spatiality and temporality of the articulation work. In other words, it changed how staff and information came together in particular spaces and across time.

On ward rounds, the laying out of different documents onto the physical space of the notes trolley allowed the arrangement of paper into 'standard operating configurations' to create a 'web of coordinative artefacts' (Bardram and Bossen, 2005). Gathering information sources together in one place (the EPR) diminished the opportunity to be able to create a web of artefacts to support collaboration. The materialised EPR provided the content but did not replicate the way that paper documents were active in how they could direct users through their physicality. For instance, the acute medical admission booklet transported users across the hospital to the time of a patient's admission. Staff holding the booklet would be able to flick to the part where they knew the initial blood results would be placed and where the senior doctor's first impressions and plan were recorded.

Østerlund (2008) has described the importance of 'place' in demarcating spaces for collaboration and communication in healthcare settings. Documents form part of this demarcation. They can be used to 'bridge time and space', as well as directing participants towards the places they need to be for collaboration, for example, the routine of meeting around the notes trolley at a specific time for a ward round (Greenhalgh, 2008). The EPR is able to create extensive connections through time and space, but the mobilised EPR travelling across clinical areas did not function to assist users in remembering what they needed to look at in the place they were in (as a purposively placed paper document would have done). This finding underlines the importance of considering not only the overt functions of artefacts such as paper records, but also the broader materiality of objects in mediating collaborative work in the healthcare environment.

In paperlight sites using mobile computers, there was, as predicted by Mort and Smith (2009) when contemplating informatised healthcare, a 'reductive informational terrain'. The EPR replaced distributed paper-based information across the environment of the ward, which also altered the need to be on the ward or near the patient. Information spread across the environment of the ward was able to assist the team in remembering to bring the data together, and the reduction in this distribution seemed to disrupt how staff were working. During my observations of ward A, consultant Dr Burr described how he had produced a checklist to help him remember specific components which needed review on a ward round. These were things which he had previously been able to do without needing a specific memory aid. The checklist formed a sort of replacement for being able to physically see, amongst other things, the paper medication chart in the proximity of the patient's bed.

How memories and knowledge can become intertwined with different objects in the doing of everyday practices has been described as 'material knowing' (Orlikowski, 2006). The paper-based ward, with a plethora of objects, reinforced knowing and created a sort of 'memory palace', where items in specific places triggered the need to remember to do certain things, especially in experienced clinicians who had built up layers of experience in such places. This aligns with research by (Varpio *et al.*, 2015), who found that 'clinicians think and act through the tools they use, including paper charts and EHRs', and that use of the EPR led to clinicians feeling a sense of disconnection from the patient narrative.

Being able to access more information via a computer was meant to be an improvement to efficiency, with less need to seek out the various pieces of paper needed to review a patient. One potential cost of this was that the patient was viewed predominantly through the screen of the EPR. In their ethnography of hospitalised people living with dementia, Featherstone and Northcott (2020) described how labels attached to patients in medical records can have 'significant consequences at the bedside', where diagnoses such as dementia can overshadow other pathologies, needs, and experiences from being sought when with the patient. If the patient is viewed increasingly through the EPR, these diagnoses have increasing potential to dominate decisions before seeing the patient.

American physician, Verghese (2008), characterises the 'traditional' bedside approach of history-taking and examination as an art which gains an understanding of the patient as well as their reported problems. These interactions provide psychosocial, cultural, and emotional insights into understanding a patient's symptoms, health status, and goals (Sulmasy *et al.*, 2017). Such knowledge is critical not just for gathering information, but for communication and relationship-building (Snyder, 2012). Caring for and learning from the actual patient, rather than electronic representation, the 'iPatient' (Verghese, 2008), is vital in respecting patient autonomy, as well as prioritising 'person-centred care', which is in keeping with the NHS Long Term Plan (NHS England, 2019).

9.2.4 Ward round collaboration through the visual and physical sharing of objects

Numerous layers of contextual information were previously provided by paper records (Nygren and Henriksson, 1992). For example, the location of the notes on the ward, the bed they were retrieved from, the annotations in the margins, and the colour and size of the paper – these visual and physical cues were lost in the transition to the EPR and became difficult to share visually in a team. Mort and Smith (2009), looking ahead to the predicted digital transformation of healthcare, expressed concern that medicine was being envisioned as 'storable and deliverable' rather than 'generative, dynamic and intimate'. My findings support and extend this view through the materialisation of the EPR. The idea that medicine would become 'storable and deliverable' was embodied in mobile computers, which prioritised the movement and accessibility of the EPR rather than interactiveness with and around the record.

The multi-sensory and haptic experience of using paper records, as described by Berg (1996) and Coiera (2015), was dampened when channelled through the EPR and its materials. It became a flatter interaction via the computer screen when the information could be picked up and held between people. This transition from tangible and tactile paper records to the EPR diminished not only the sensory dimension of medical work but also the human connection between staff that arose from physically sharing and examining information.

Xiao (2005) draws on examples from the restaurant industry (the 'spindle wheel' in a kitchen which holds order checks) and air traffic control (paper 'flight strips' which contain flight plan data) to demonstrate how in complex and dynamic environments, such as healthcare, collaborative work is often mediated through physical objects which can be accessed quickly and simply. In this way, paper records had a three-dimensional physicality, which, when familiar, led users through their contents. For instance, flicking back and forth between the results and medications or the examination findings and initial impressions, could be done quickly and intuitively, which assisted the complex synthesis of multiple information sources. Memories of my experiences with paper records (as explored in section 6.4) resonated with the interview response of one senior doctor, who described that the ward A admission booklet was 'not just a blank piece of paper, it very much guided you'.

In this way, the paper record acted as an 'embodied artefact', which participated tangibly in the activities of clinical staff organising medical care (Dourish, 2004). The information, as held and mobilised by mobile computers, could not physically embody the information in the way that paper records could. The information on a mobile laptop could not be physically held between people in the same way. Holding or placing a piece of paper together enabled users to check they were on the same page, literally as well as figuratively. The additional richness of information that was annotated onto a piece of paper could also be absorbed and interpreted collectively by a group.

Furthermore, the limited way the mobile laptops allowed the users to share a screen exacerbated the difficulties resulting from the reduction in paper objects. The small screen size of the laptop on wheels had been selected to aid movement around the ward, but it was prohibitive to shared use. The size of the mobile computers resulted in each ward round member using and becoming firmly attached to their own laptop on wheels for the duration of the ward round. Consequently, I observed that two or more users struggled to stand together with laptops in a way that supported collaboration, using either one or multiple screens (see section 6.3.3).

The limitation of the small screens also helps to explain why some doctors leading ward rounds preferred to base themselves at a static desktop computer with a larger screen (or two screens). The medical teams valued being able to look at things together, as a group. It assisted in forming a consensus and constructing a story of what was going on (Stoller, 2013). In addition, the senior doctors could model a system of how to read, interpret, and write patient notes whilst being observed by the junior doctors and medical students (Bowker *et al.*, 2023). The ward round is a practice which does not just organise work to be done but also supports the experiential learning of junior doctors (Claridge, 2011; Royal College of Physicians and the Royal College of Nursing, 2021). Part of that education is how to read medical records and synthesise the information within them. Using paper records, and bringing together information from different physical places, presented this very visibly. The facility to demonstrate systems of information gathering and synthesis was not easily achievable through using the EPR, especially on the mobile computers.

9.2.5 Mobilising multiple computers

The design of the laptop on wheels, the physical housing of the EPR chosen for activities such as ward rounds, seemed to be based on providing the most secure and manoeuvrable device with the smallest possible footprint. The laptop devices lacked features which suggested that facilitating collaborative working was part of the design brief. The focus was on moving the EPR, not the work that happened outside of the EPR to produce the information which formed the record.

Staff struggled to manoeuvre the carts into spaces where they could stand together and find room in busy ward environments. I analysed this with diagrams displaying how formations of staff using mobile computers had difficulty co-locating themselves to share information (see section 6.3.3). The laptops on wheels appeared not to facilitate real-time same-place mobile team working. Consequently, the ability of the ward round to work collaboratively was restricted. When using multiple portable computers, each member of the ward round tended to work in parallel, rather than together in a coordinated manner.

Furthermore, ward rounds became scattered over a greater number of locations, including those distant from the ward. These factors undermined the strength of the ward round as a collaborative multidisciplinary activity (Royal College of Physicians and the Royal College of Nursing, 2021).

There is little research that describes the impact of EPRs on ward rounds, but my findings are in keeping with the difficulties described by Morrison et al. (2008) in research which looked at the use of the EPR on ICU ward rounds. The introduction of just one mobile computer affected how staff were able to participate collectively in the ward round, through subtle changes in how the team organised themselves around the computer. In my research, several laptops caused additional barriers throughout the ward rounds, where they made it difficult for staff members to engage with one another, follow the action of the ward round, and maintain the flow of dialogues.

At the site of my research, part of the core ethos of the Lorenzo EPR was that all the hospital information systems were integrated into one 'place' (through the computer) and, in the case of Lorenzo, through one application. This single point of access, intended to reduce the number of logins and passwords required to access different systems (such as the medication chart or blood results), would previously have been materialised as distributed objects, for example, charts at the end of the bed, clinical notes in the main paper notes, or blood results available on the computer. Blending work into a single appearance, like when using a mobile computer, obscures the subtle hints of activity progress and coordination.

Büscher et al. (2001) describe how 'all work unpacks into a wide range of overlapping practices' that may appear to be 'a seamless web' but involve subtle situated adjustments to accommodate the setting. Observing landscape architects at work, they noted how the staff made mutual adjustments whilst working together on projects, consulting each other with attention to their colleagues' levels of concentration and 'interruptability'. This information could be ascertained with a 'glance' when the workers were close together, and the type of work being done was visible. How the mobile computers affected collaboration in the ward round context resonates with Büscher et al.'s description of 'virtual absence' where 'the screen as actant effectively "shoulders the other participants out of the scene"' (2001). The mobile computers in this context effectively *and physically* shouldered other participants from an effective collaborative space.

These findings highlight the multifaceted way that artefacts in healthcare can interfere with established practices and demonstrates the importance of considering how the materiality of technology, like the mobile computer in this case, can unintentionally disrupt established routines of collaboration.

9.2.6 Junior doctors and the materialised EPR

Dealing with shifting practices and changing materials also introduced the risk of providing an unsteady footing on which to learn how to do a ward round and manage patients. Routines can help to settle junior staff into new working environments, and routines on the ward have often been structured around locations. Greenhalgh (2008) described how routines and 'structuring devices' are used in healthcare to support the organisation of complex tasks. This connects to the work of Østerlund (2008), who described how documents, or the places that documents would be, could be used to direct staff to locations (with the example, meeting around the notes trolley at a specific time for a ward round).

When records were on paper, there were a limited number of places in which clinical staff would gather to collaborate with the records. With the mobile EPR, the locations are almost limitless, which adds an extra element of uncertainty to ward work. I have discussed how this locational flexibility creates difficulty for nursing staff, but it also complicates the adjustment of new doctors trying to orientate to the structure of ward work.

The strong attachment and dependence on mobile computers displayed by junior doctors during ward rounds signified the degree to which the use of electronic patient records had become engrained in their professional identity and daily workflow. The sentiment of feeling ineffective or 'useless' without near-constant access to patient data and order entry functions in the EPR underlined how deeply entwined these digital tools had become with their sense of capability and value in delivering care. As Rice (2010) found in their ethnography of the stethoscope and medical identity, doctors' identities can become profoundly linked to the use of certain medical technologies, shaping their perception of self-efficacy. Consequently, the reaction of junior doctors feeling 'lost' without mobile computers suggests that EPR proficiency is increasingly central to clinical identity formation and perceived competence.

Junior doctors were the conduit to the EPR, inputting and accessing the information, but relatively disconnected from the ward environment around them. This dependence and restriction could be detrimental to experiential learning on ward rounds, particularly where communication outside of the record is concerned (both with patients and other staff). I will return to this when I discuss the implications of my work to medical education.

9.3 Digital devices and patient care

9.3.1 Understanding 'care' in the NHS

To understand how care was being reshaped through the use of mobile devices, I first explored what it means to talk about care in the NHS. Being accountable for compassionate care in the NHS became politically sensitive following failures described in the Mid Staffordshire NHS Foundation Trust Public Inquiry (Cummings and Bennett, 2012; Francis, 2013b). Intentional rounding was one initiative introduced as a way of promising a minimum standard of nursing bedside safety checks, whilst also capturing data to prove that it had been done (Harris *et al.*, 2019). This became relevant to my research when a mobile technology, linked to the EPR, was introduced to record the data.

The mobile technology, an iPod, was implemented across the hospital trust, but was ultimately abandoned by the nursing staff. The rejection of the iPod, and the subsequent return to paper, opened an avenue for exploring how records at the bedside sit at a juncture between the organisation of care (and data collection) and compassionate care.

I found that the iPod, in replacing a paper record system, unsettled carefully balanced caring practices which were intertwined with accounting for care. Paper had allowed data collection to fall into the background when accompanied by friendly, warm interaction. Using the iPod altered the balance of these encounters, as the iPod needed explanation and introduction. Furthermore, the way in which the iPod demanded the close attention of the user made it appear that the priority of the staff member was whatever was on that device (or, as commonly assumed, 'mobile phone').

9.3.2 The presentation of care

To explain the tension that was created by the iPod at the bedside, I brought together two ways of thinking about the organisation of care on hospital wards. Firstly, my research found that bringing iPods to the bedsides unravelled the integration of sentimental work (the smoothing of care delivery (Strauss et al., 1985)) from organising work (measuring intentional rounding scores), which left the nurses feeling that they looked 'uncaring' and resulted in complaints from patients. When nurses used paper, they were able to carefully integrate administrative work with, for example, 'interactional work' or 'biographical work' (Strauss et al., 1985 – also see section 7.2.2 of this thesis) which played an important role in helping to create a personalised and caring environment. Using the iPod in the same spaces reframed the interaction, and staff had to begin from a position of defensiveness (that they were not on their phones).

Secondly, the 'invisible work' of nursing (Allen, 2014). The administration of the ward has been described as the 'invisible work' of nursing by Allen (2014). Understanding the organising work of nurses as a practice in itself, which has to be undertaken alongside and in tension with the presentation of professional, caring nursing, brings another angle to the use of technologies at the bedside.

Although the nurses were able to abandon the iPods and return to paper, this was not seen as a permanent switch by the IT department. Handheld devices to collect bedside data were due to be re-introduced to collect other physiological data, and it was likely that intentional rounding would also return to a digital format.

9.3.3 The wrong sort of visibility

Nursing's professional mandate is to provide a holistic model of care – encompassing the physical, social, economic, psychological, and spiritual (Nursing and Midwifery Council, 2018). The prevailing professional image is of the nurse as a caregiver. This idea of nursing tends to stand in contrast to the mainstay of actual nursing work, which increasingly revolves around the coordination and organisation of the ward (Allen, 2014). Accounting for the safety of patients through the system of intentional rounding was part of this.

Using the iPod at the bedside did not present an image of the nurse as a caregiver. The iPod was frequently misinterpreted as a personal mobile phone, which led to complaints and people taking photographs to try to 'catch' nurses on their phones. Nurses had to do extra work explaining that the devices were for clinical use, not personal phones, and this rectificational work was time-consuming. In addition, the small size of the iPods and the attention needed to use them correctly gave the impression that the nurses were distracted and not providing compassionate care. These issues, in combination with technical difficulties, resulted in the nurses moving away from the bedside to enter data. This was the opposite of the intent.

9.3.4 Different types of good care

These findings relating to systems of collecting intentional rounding data via iPod and paper reveal an 'inherent systematic tension' between different types of clinical work, both of which may be described as 'care' (Kitson *et al.*, 2014). Rhetoric about 'care' tends not to qualify the *type* of care being discussed. Non-clinical managers and clinical ward staff can sound united in talking about 'care', when on further exploration, they are talking about different ways of caring, which look towards different priorities.

Tensions arise in healthcare between different approaches to caring, as Annemarie Mol illustrated through the 'logic of care' versus 'logic of choice' in diabetes management (2008). With a logic of choice, practitioners present evidence-based options for patients to choose from, which can end discussion and privatise concerns. In contrast, a logic of care embraces open discussion to explore patient concerns, attuning to their 'mortal bodies' with compassion (Mol, 2008).

The opposing versions of care, which sat within 'intentional rounding', were unentwined through the use of the iPod. In other words, the iPod-in-use made visible the organisational work and created a barrier to personalised encounters. In addition, it required extra work, which centred the interaction on the technology and distracted nurses from paying full attention to the concerns of the patient. That is not to say that the organisational work of nursing is not 'good care'. Allen's concept of 'invisible work' (2014), which describes the normally unseen organisational work, is also 'good care' when it is used to carefully attune to the needs of patients with the resources of the hospital ward. Both components are important, and how they should be balanced is an ongoing debate in nursing (Feo and Kitson, 2016; Kitson, 2023).

One approach, as described by Mol et al. (2010), is to consider how sometimes 'different goods' must be taken together, even when they contain disparate values, because they have to co-exist within local and specific practices. At the juncture of different ways of caring is a friction which requires ongoing work to allow alternate types of care to co-exist. This manner of attending to care is termed 'tinkering' (Mol et al., 2010). For example, the flexible integration of intentional rounding into nursing practice was an example of how nurses managed this tension whilst also meeting the expectations of the organisation (Harris *et al.*, 2019).

9.3.5 Care for the ward timetable

The careful intertwining of intentional rounding into nursing practice was facilitated by a flexibility of timing. With paper records, the timing of the intentional rounding was orchestrated so that the tempo of the work was aligned with the rhythm of care on the ward. The temporal rhythm of the paper-based system was carefully crafted but loose enough that small adjustments could be made in reaction to unpredictable daily events, which are common in acute medical environments (Reddy *et al.*, 2016). The iPod was inflexible to these adjustments. It was either done or not done, on time or not. Consequently, in order to bring together (or tinker) with 'compassionate caring' and 'organisational caring' in these situations, workarounds were introduced to shape the new temporal rhythm (Jagannath *et al.*, 2019).

Management of the ward timetable is a further type of organisational work, which again can be considered to be part of 'invisible work' (Allen 2014). In qualitative research investigating technologies used by Danish elderly care nurses, Dupret (2017) argues that the way in which staff work around technologies can be a reflection of professionalism. For example, refraining from using monitoring technologies (e.g. checking blood pressure) in elderly patients who are terminally ill. In these cases, professionalism is being sensitive to which details to attend to, and the workaround is not necessarily 'bad' but in line with located professional ethics. This highlights the complex dynamics of professionalism within healthcare environments. It suggests that the manner in which staff interact with, and at times bypass, certain technologies does not necessarily indicate an omission in responsibility. Rather, the ability to be able to 'tinker' (Mol *et al.*, 2010) with practices to arrange them to best suit patients can reflect professional ethics and sensitivity to caring practices (Dupret, 2017).

The literature review (chapter 2) presented accounts of how technology has been framed as a mechanism through which time can be freed up, delivering 'the gift of time' (Topol, 2019); see section 2.4.6. This sentiment was echoed at Compass Hospitals, where it was also anticipated that the iPod would 'free up time to care'. However, my research suggests that the incorporation of mobile devices at the bedside does not necessarily 'free' up time. Instead, the devices structured time, which limited the ability of staff to react flexibly to the dynamic nature of the ward and the needs of patients.

Paper systems enabled tinkering and intertwining of ways of caring, which could '[hold] together all those versions of care in the air without letting them collapse into collision' (Law, 2010, p. 69). Building on the work of others (Bardram, 2000; Allen, 2014) who have argued that nurses are central to the temporal articulation of ward activities, I found the iPod interfered with the nurses' ability to 'tinker' (Mol et al., 2010) with the temporal rhythm of the ward. The loss of temporal flexibility introduced by the iPods was a further reason for their rejection. This was also another indication that where EPR devices were introduced, the mobilisation of data capture was prioritised over delicately balanced clinical practices.

Along with the other arguments I have put forward about devices I saw in use at Compass, this critique is not necessarily a proposal to return to paper systems, nor am I claiming that paper systems were 'better'. I am highlighting how and why the new materialities of the EPR did not do what they were expected to do and the ways in which they produced unintended consequences for clinical work. Handheld mobile digital devices are often proposed as a solution for a multitude of clinical problems (Shah *et al.*, 2019; Harvey and Powell, 2019). My research has found that they cannot be assumed to be an uncomplicated option. Beyond the technical difficulties of useability and connectivity, mobile devices at the bedside should be carefully scrutinised to avoid adversely disturbing the balance and tempo of care coordinated by nurses (and other ward staff). Where they are used, adopting a 'logic of care' to envision their use alongside patients (Mol, 2008), could offer flexibility in thinking about the ways in which the devices could be tailored to make their use more acceptable and adaptable to both staff and patients.

9.4 The materiality of communication

9.4.1 Paper as a communication tool

This chapter was centred around communication and the material coordination of communicative practices. I drew attention to how the differences between the material affordances of the paper and digital systems reshaped practices and potentially introduced new, unanticipated risks. In chapter 6, I explored how paper records had been used in collaborative medical work to distribute information within spaces, creating a location that drew staff together. In this chapter, I laid out how, as well as gathering information and people together, paper records were used directly and indirectly as a device in communication (Coiera, 2015). Through these observations, I emphasise how the paper medication chart had materiality, which supported communication in a way that the digital record does not.

9.4.2 Interruptive communication

Wards have been described as 'interruption-driven' environments (Coiera, 2000), where the interrupting is recognised as disruptive but also accepted as a necessary compromise to get things done. Staff described how the paper medication chart was used as a tool to interrupt. Gesturing with the chart was a way of interrupting or making visible an immediate request, or as put bluntly by one staff nurse, to 'shove a prescription chart under their nose' (see page 205). This action effectively drew the attention of the recipient and served as a clear indication that a request or order was being made. In contrast, an electronic prescription chart could not be held and passed over as a signal of a task transferred or a decision to be made.

Paper charts possessed a physical immediacy and mediated dialogue between staff, which the EPR failed to replicate. The proximity that paper records required also created opportunities for informal conversations, which were able to enrich and strengthen prescribing decisions through the sharing of knowledges and contexts (Borrott *et al.*, 2017).

The concept of 'interruptability', or the ability to gauge when a colleague may be available for interaction, is often contingent on visibility and proximity (Büscher *et al.*, 2001). Paper documents can act as visual clues, indicating the type of work being performed. However, this is not the case when using mobile computers or computer terminals, which provide little to no insight into the intensity of the ongoing task. This can lead to a 'visual absence', a situation where, despite the co-presence of workers, the benefits of proximity are negated due to the nature of the technology in use (Büscher *et al.*, 2001).

The electronic chart did not have mechanisms to support implicit communication such as this, which could help to expand how the 'illusion of communication' (Dykstra, 2002) can be understood (see section 2.4.4.3). It is not just the sensation or feeling that information has travelled automatically, but the lack of physical artefacts to which to delegate for support. It is difficult to have an 'illusion of communication' if the chart is still in your hand and needs to be 'handed over'.

In addition, my findings indicate that paper medication charts had an underappreciated role in facilitating verbal communication between junior doctors and nurses. Consequently, without paper and bolstered by the false reassurance of task transmission within the EPR, interprofessional communication suffered.

Communication supported by a paper-based system, despite seeming inefficient due to its reliance on interruptions and spontaneous interactions, held a unique value. Implementing a digital system may have seemed to be an automatic enhancement, but unexpected consequences arose from reshaping paper-based practices. Digital platforms may offer alternative ways to facilitate communication, but the development of these necessitates a detailed understanding that the issues emerging from digitalisation are partly rooted in the materiality of practices that have evolved through the usage of paper.

9.4.3 'Portable places'

Part of the issue with communication is that not infrequently on hospital wards, doctors and nurses are unfamiliar with each other. Junior doctors move frequently around hospitals in a manner which has been described as nomadic (Bardram and Hansen, 2010). As described above, paper-based medication charts played a significant, yet undervalued, physical role in facilitating interprofessional communication between junior doctors and ward staff. Junior doctors are often transient workers on wards, sometimes only known by their job title (e.g. 'the FY2'). The transient nature of junior doctor work can restrict the formation of interprofessional relationships, which may inhibit the development of collaborative practice (Milne et al. 2015). With the remote accessibility of the EPR, the potential for increasing physical distance between the staff groups could further augment the problem.

As I described in relation to collaboration (see section 9.2.3), paper records and charts also functioned to form spaces in which people could be found, which facilitated the chances of paths crossing and communication occurring. The paper medication charts functioned as a type of 'portable place' (Østerlund, 2008), whereby documents in particular spaces had 'social meanings', which were entwined in the practices and understandings of the ward staff. For example, the paper chart could be strategically placed in a location on the ward where jobs were known to accumulate, such as near the nurse's station. This system was easily accessible to both doctors and nurses and made work-to-be-done visible. It also made *work-being-done* visible, enhancing nurses' 'peripheral monitoring' and 'social awareness' of who was accessing which notes and, consequently, where they needed to direct attention (Heath *et al.*, 1994, 2002; Bardram and Hansen, 2010).

As Nicolini (2007) has described, hospital medicine has previously relied on unplanned crossings of paths as much as it has on scheduled meetings.

> *'All medical personnel have 'war stories' to tell about when they were just 'passing by' and noted some mistake made by another colleague, and how their intervention saved the day and prevented a catastrophic consequence.' Nicolini (2007)*

The paper medication chart (as well as paper notes) facilitated the creation of 'passing by' moments. They brought doctors and nurses to the same places, thereby increasing the opportunities for face-to-face interactions.

However, the EPR did not serve the same purpose in terms of communication. Instead of supporting staff as a mediator of communication (Berg, 1996), the EPR seemed to function more as a 'repository' (Chase *et al.*, 2014) or a 'passive information archive' (Fitzpatrick, 2000). Fitzpatrick (2004) described how the localised 'tailorability and flexibility' of paper records allowed them to serve as a 'working record' rather than merely a repository. This functionality was partly attributed to the physical, easily accessible nature of paper, and the 'diverse distributed collection' of the paper record (see section 9.2.3).

In the absence of the physicality of the paper record to facilitate communication, the Lorenzo EPR had to rely on being supported by verbal communication, especially regarding time-critical tasks. For the reasons detailed above, including the decrease in opportunities for face-to-face communication, this assists in understanding why I observed a fragmentation in interprofessional communication on the wards.

9.4.4 The EPMA cart

The digitalisation of the paper medication chart also encompassed the introduction of a new mobile device, an 'Electronic Prescribing and Medicines Administration' cart (EPMA cart), the purpose of which was to transport and dispense medications at the bedside.

The EPMA carts were intended to increase the efficiency, safety, and mobility of electronic medication administration, but paradoxically this resulted in decreased mobility and the introduction of new risks. The bulky design made the EPMA carts challenging to manoeuvre into patient bays, and some nurses avoided moving them altogether. As a consequence, established practices of communication and directly verifying patient identification against medication charts at the bedside - a critical safety measure - were disrupted. Furthermore, the cart's obtrusive presence created a physical barrier between nurses and patients, disrupting patient-nurse communication and potentially compromising the integrity of patient confidentiality.

As I have described above, the support of interprofessional communication on medical wards is not just about the content of what is communicated synchronously or asynchronously. Elements such as the utilisation of ward spaces, visibility, and co-presence contribute to 'social awareness', fostering efficient communication (Heath *et al.*, 2002; Bardram and Hansen, 2010). Therefore, even small reductions in nurse mobility can have far-reaching impacts on the exchange of information. Moreover, the EPMA cart introduced what Pine and Chen (2020) term 'physical misalignments', instances where the materiality of information sources unintentionally clash with established clinical workflows. Pine and Chen (2020) explain that the cohesion of practices and information sources can be unexpectedly delicate, with minor spatial or temporal alterations potentially creating 'unneeded complexity, frustration, ineffectiveness, and potential for safety risks'. Such misalignments can adversely affect the efficiency and safety of healthcare work by obstructing the co-location of information and practices.

Jensen (2006) proposes that those introducing electronic patient records often take a 'techno-logic' approach that prioritises the technical benefits of new technologies over considerations of their actual use in practice. This viewpoint risks blindness towards the problems that can emerge in real-world implementation. An EPR-centric outlook, predicated on the belief that advancing these systems inherently drives safer care, can overlook risks introduced by the materiality of technologies. This techno-logic aligns with how other devices described in this thesis seem to have been conceived – with the mobilisation of the

EPR at the forefront of decision-making and an assumption that practices would automatically adapt.

The results of my research identify how the addition of wheels to a computer is not enough to support mobile working on hospital wards, at least to support practices which were reliant on paper and the way that paper acted. The new materiality of the EPMA cart led to spatial and mobility changes, which introduced potential safety risks through altered communication and the misalignment of information sources (Pine and Chen, 2020). As such, carefully considering how new technologies integrate with the sociotechnical realities of healthcare work is necessary. If not, unintended consequences can arise that disrupt communication, coordination, and holistic care delivery.

9.4.5 Distance and trust

Electronic patient records introduce distance into clinical work, enabling remote access to data and actions such as prescribing. Whilst this does afford efficient informational access from across the hospital network, my research adds how there were unanticipated effects on practices which were to some degree reliant on interprofessional trust.

Paper records necessitated physical proximity for viewing, sharing, and writing in medication charts. This encouraged routine contact between clinicians, supporting interprofessional familiarity and the cultivation of trust (Clarke, 2003; Calnan & Rowe, 2008). With digitalisation, the material constraints demanding proximity are lost. Reduced face-to-face interaction can hinder trust development, which is built through communication and shared experiences (Sutherland et al., 2022), and trust can become fragile without regular contact (Jarvenpaa & Leidner, 1999). As prescribing practices extended across the hospital, ward staff conveyed a growing dependence on distant colleagues with whom they had less personal understanding and experience.

Telemedicine demonstrates this stretching out of practices across distance and time. Through exploring 'telecardiology' clinics, Nicolini (2007) found that the distancing between professionals necessitated renegotiation of how clinical activities are made accountable when proximity and associated local knowledge are lost. However, my research indicates such effects of stretching out practices also permeate conventional hospital spaces.

In these reconfigured environments, junior doctors are more frequently in situations where they have to place trust in distant nurses during remote prescribing. While an EPR system can provide comprehensive patient information, applying judgement still requires skill. Doctors, especially less experienced ones, may lack a nuanced understanding of a patient's situation without seeing them in person. They may not know when to ask more incisive questions or when to go and physically examine a patient.

During urgent situations, accessing electronic prescriptions can delay emergency treatment compared to paper charts. The time-consuming process poses significant challenges for nurses, who must make pressured decisions about trusting doctors who request verbal medication orders, which may not promptly materialise as promised electronic prescriptions.

The transition from paper to electronic records stretches out clinical practices across space and time in ways that disrupt established pathways of communication and trust between healthcare professionals. Formerly clustered around tangible artefacts like medication charts, care is increasingly digitally dispersed. This unravelling of collective practice reveals that while digital systems facilitate certain efficiencies, they can reconfigure the spaces sustaining trust and undermine the interpersonal foundations underlying effective communication.

9.5 Reflecting on the research questions

In light of the findings chapters and the discussion above, I now return to the research questions set at the start of this thesis.

How does the material housing of the electronic patient record on ward rounds shape the way that medical staff collaborate?

The materialising EPR has added significant challenges to how medical staff collaborate on hospital wards. This has occurred through the new materials and affordances of the EPR, as well as the loss of old materials and the affordances of paper records. The affordances of the EPR, the use of mobile computers, and the removal of paper records have all contributed to the reconfiguration of the ward round process. But the EPR has not replaced the role of the paper record in assisting collaboration. The EPR increased accessibility to the record at a distance, but locally on the ward, the mobility of the record was limited by the mobile computers. This combination has resulted in difficulties in real-time same-place mobile team working.

Prior research in medical sociology and computer-supported cooperative work (CSCW) by Strauss et al. (1988) and Bardram and Bossen (2005) provided the foundation for this current work. My research advances knowledge of how collaborative work has been supported by paper records by demonstrating how it fails to be supported by the materiality of the EPR. By comparing the tangible properties of paper records, which functioned as a sophisticated network of physical coordination tools, with mobile computers, I emphasise the role that artefacts had in both the evolution and holding together of collaborative practices.

These findings join research which has stressed how the materiality of paper records provided numerous layers of contextual information and facilitated the physical and visual sharing of information (Nygren and Henriksson, 1992; Berg, 1996; Büscher *et al.*, 2001; Coiera, 2015). The material affordances of paper and the physical interactions it promoted were not satisfactorily replicated by the mobile computers on ward rounds, and it did not appear that the mobile computers were designed to support such work. The mobile computers were better suited to supporting individual workers, not a group of staff trying to move and use them collectively. This underlines the importance of paying attention to how the materiality of the devices is used to facilitate collaboration in complex medical practices. Medical practices are not abstract processes, but a dynamic amalgamation of shared spaces, people, and tangible objects, all of which interact in intricate patterns to provide care and maintain patient safety. Scrutinising the critical role of the medical record's physicality unveiled its profound influence on facilitating collaboration among healthcare professionals. This is vital in creating a workflow that, in its essence, promotes the highest standards of patient-centred care.

How does the physical replacement of paper with mobile computers change the way that care is carried out and delivered?

The use of iPods made visible the differences between 'compassionate care' (Strauss *et al.*, 1985) and the logistics of care delivery and management (Allen, 2014), causing tension among nurses and patients. The pressure for nurses to be visible with these devices was not what patients expected and interfered with the daily routines and coordination of the ward.

With paper records, nurses carefully integrated data collection into conversations and encounters with patients. The iPod made administrative work more visible and central, requiring explanation and attracting negative attention. This interrupted the nurses' ability to smoothly intertwine emotional support and sentimental work into their routine workflow (Strauss et al., 1985).

Furthermore, the prominent use of iPods misaligned with nursing's mandate to provide holistic, patient-centred care. The devices appeared to prioritise data entry over interpersonal connection, posing a challenge to nurses' professional identities, which are deeply rooted in providing care.

The inflexible, time-bound nature of the iPod disrupted nurses' ability to adapt workflows and record-keeping to suit the variable pace of the ward. Removing paper reduced their capacity to 'tinker' and intertwine different forms of care (Mol et al., 2010).

Calls have been made to pay attention to the materials of care (Buse et al., 2018), but the technologies which more visibly touch patients, such as ventilators (Willems, 2010) or glucose monitors (Mol, 2008), tend to be foregrounded. The findings I have presented here emphasise how the materiality of the medical record can also profoundly shape caring processes at the bedside.

My research shows that seemingly simple mobile devices cannot be assumed to be uncomplicated options in care settings. Beyond technical issues, replacements for paper systems need careful assessment considering their impact on relational, coordinative, and temporal aspects of care work. This challenged holistic care, nursing identity, public perceptions, coordination rhythms, and the flexibility required to balance different forms of care in a complex ward environment.

My research shows that seemingly simple mobile devices should not be assumed to be straightforward options within care settings. Beyond technical issues, replacements for paper need careful assessment, particularly regarding their impact on the relational, coordinative, and temporal aspects of care work.

How does the use of an electronic patient record reconfigure communicative practices between clinical staff groups in hospitals?

I found that the use of electronic patient records (EPRs) was reconfiguring communicative practices between clinical staff groups in hospitals. The paper chart as a physical artefact supported communication through co-presence, proximity, and social awareness (Büscher *et al.*, 2001; Heath *et al.*, 2002; Bardram and Hansen, 2010). However, the interconnectedness which paper encouraged was not supported by the materiality of the EPR.

The paper medication chart, as a ‘portable place’, facilitated communication by creating opportunities for face-to-face interactions through the physical proximity of staff and patients (Østerlund, 2008). The remote accessibility of the EPR resulted in an ‘illusion of communication’ which disturbed doctor-nurse communication (Dykstra, 2002; Ash *et al.*, 2007d; Chase *et al.*, 2014). In addition, electronic prescribing and medicines administration (EPMA) carts, due to their design and weight, reduced the mobility of nurses, which introduced physical misalignments (Pine and Chen, 2020), new risks to safe prescribing, and further disruptions to workflows which supported communication.

Though EPRs provide extensive informational access, the loss of proximity also undermines interprofessional trust, which is needed to support coordination between staff groups. In these reconfigured spaces, communicative practices become stretched out across space and time, requiring renegotiation of norms and accountability (Nicolini 2007), which are tested when trust is balanced against risk and the production of a 'perfect' account in the EPR (Pine and Mazmanian (2014)).

As the spaces and rhythms of clinical work are digitally transformed, greater attention must be paid to the sociotechnical relations through which professional coordination, situated knowledge, and conditional trust are cultivated. Thoughtful reconfiguration of these dynamics is essential to realise the benefits of digitalisation while avoiding unintended consequences for the social fabric of caring practices.

This discussion has drawn together the devices and practices analysed in this thesis through the reconfiguring materiality of the EPR. I now move on to the concluding chapter, where I draw out the contributions to knowledge, discuss the implications of the research, and reflect on the strengths and weaknesses of the thesis.

10 Conclusions

10.1 Introduction

In this chapter, I will bring together the themes and points of exploration which have accumulated across the course of this thesis. I will present an overview of the research before discussing the contribution to current knowledge that this thesis has made. This will lead to a discussion of the broader implications of the study and how the key learning points might assist in developing recommendations for practice, as well as highlighting avenues for future research.

10.2 Overview of research

This thesis began by introducing the background and context for the research, which was to question how the use of an electronic patient record system was shaping communication, collaboration, and care on NHS hospital wards. The longstanding political ambitions to digitally transform the NHS were described, including previous initiatives such as the National Programme for Information Technology. I laid out my professional background and how my use of an EPR as a doctor led to the development of this project.

The literature review (chapter 2) explored how the medical record can be understood and the ways in which it has been reconceptualised when transformed into a digital object, the EPR (Greenhalgh et al., 2009, Swinglehurst., 2012., Carboni et al., 2022). I discussed how, in practice, the EPR is often described as producing unintended or unanticipated consequences. My thesis contends that these views tend to focus on unembodied digital records interacting almost directly with the medical social system. But how these things happen, how these practices occur in space, physically interacting with the materials which house the EPR, is often overlooked.

The following chapters, three and four, established the methods and methodologies used to collect and analyse the findings presented in chapters six, seven, and eight. In chapter three, the research methodology and design used in this thesis were described. The chapter began by setting out the philosophical grounding of the thesis and how this informed the choice of methods. My positivist background in clinical medicine and research was discussed, and, in contrast, how this research would be grounded in a constructivist paradigm using qualitative methods. I laid out how my approach was influenced by actor-network theory, which was employed as a lens through which to conceptualise the research questions. Ethnography was introduced, and I explained why ethnographic methods were complementary to a sociotechnical lens in investigating the use of the EPR in a healthcare setting. Chapter four provided a detailed account of the methods used to collect data. The methods of data collection – observations, interviews, and the collection of documents – were presented. My insider/outsider positionality as a researcher and doctor was reflected upon, and the measures taken to enhance trustworthiness in the context of doing qualitative research were described. To analyse the data, I described how reflexive thematic analysis was utilised. Prior to presenting the findings, I introduced the research site, the EPR system, and the IT team involved in the study.

Chapter six explored the role played by the materiality of the EPR in underpinning effective collaboration in complex medical practices. I highlight how the affordances and constraints of the EPR and the use of mobile computers are reshaping ward rounds. I also shed light on the challenges posed by the removal of paper records, which have long supported collaborative work on wards. The transition from fixed computer systems to mobile technologies was anticipated to bring about increased flexibility and mobility within hospital wards. However, my observations indicate that collaborative medical work, when mobilised digitally, still faces spatial restrictions, albeit in different ways. I also explain how I found that the attachment and reliance on mobile computers during ward rounds, particularly among junior doctors, revealed how deeply ingrained the use of EPRs had become in their professional identity and workflow.

Chapter seven investigates the digitalisation of 'intentional rounding' and its consequential impacts on care. Specifically, I describe the introduction of mobile devices for this process, intended to improve efficiency and accountability, but which inadvertently led to challenges. This chapter elaborates on the issues arising from mobile device use, including the interruption of traditional rhythms of care and difficulties in integrating compassionate care into data entry tasks. I discuss how the shift from paper to a digital device altered the visibility, adaptability, and overall workflow of nurses, leading to a retreat from the bedside. Lastly, the chapter reflects on the intricate interplay between the materiality of digital technology and everyday ward-based practices, highlighting the need for a nuanced approach in technological implementations within healthcare settings.

Chapter eight analysed the transition from paper records to electronic patient records (EPR) on hospital wards, focusing on the materiality of these systems and their impact on communication. The physicality of paper records provided an implicit form of communication and coordination, offering visible cues to staff about ongoing tasks. This is a role that the materiality of the EPRs has struggled to fill, thereby disrupting the flow of interprofessional work. The new EPR systems, while aimed at improving efficiency, led to unintended consequences, such as reduced visibility of task performance and challenges in synchronous communication. The transition also impacted medication administration practices, introducing physical barriers, altering traditional verbal and observational communication, and introducing new risks. The tangible presence of paper records not only facilitated effective communication but also fostered trust and connection among healthcare professionals. These aspects have been destabilised in the wake of the digital 'transformation'. This chapter underlines the importance of considering the materiality and sociotechnical implications of EPR systems to navigate these challenges and enhance safety and communication in healthcare settings.

In chapter nine, I brought together the findings and discussed how this research has contributed to and developed the concept of the materialised EPR. The materialised EPR contributed to the reshaping of established ward round routines and disrupted collaborative practices between medical staff. Junior doctors appeared reliant on constant EPR access, limiting broader learning experiences and interpersonal connections on ward rounds. Introducing mobile devices like iPods to record care data at patient bedsides also disrupted nurses' ability to delicately balance compassionate care with invisible organisational work. Furthermore, the inflexible temporality of the iPods prevented nurses from adjusting ward rhythms to intertwine different types of caring practices. In addition, paper records like medication charts facilitated communication and interprofessional familiarity in ways the electronic patient record could not replicate, which may undermine trust between clinicians. The materiality of new mobile technologies like the EPMA cart also disrupted established communication practices and introduced spatial misalignments that posed potential patient safety risks. These findings have emphasised the importance of understanding how the EPR is used as a physical artefact in an embodied way.

10.3 The contributions of this research

This thesis makes an original contribution through providing an ethnographically-informed account of the use of digital records and technologies at the bedside and in hospital wards during a period of transition from paper to electronic patient records.

A key part of the originality of my research has been how it was an exercise of intertwining absence and presence, to describe what I saw through the shadows of what used to be in place. This has enabled me to view practices and their materiality through both the EPR and paper records. These parallel viewings have facilitated the exploration of collaborative, communicative, and caring practices in richer detail. Greenhalgh et al. (2009) identified that there was 'much room' for 'detailed study of the communicative dimensions of collaborative clinical work' including that the '"hidden work" of those close to the patient (e.g. nurses and administrative staff) should be a particular focus'. The findings of this thesis speak to that gap and present detailed insights into how medical ward rounds, interprofessional communication, and bedside care are enacted through evolving sociomaterial relations between practitioners and patient records. Focused attention to materiality has helped to explain how digitalisation can undermine collaborative practices even as it enhances accessibility.

My research draws on my insider clinical experience while maintaining analytical distance as an observer. This facilitated a unique and nuanced interpretation of the changes underway in environments familiar to me. Clinically, this provided a contribution to understanding how the materials housing the EPR are being integrated into collaborative medical practices, such as ward rounds. As such, findings from my research contributed to 'Modern ward rounds' guidance from the Royal College of Physicians and Royal College of Nursing, with the inclusion of a new (albeit short) section entitled 'The role of technology' (2021, p. 32).

My analysis of the physicality of ward rounds expands understanding of how they are enacted with EPRs versus paper records. Attention to this illustrates that despite the purported benefits of digitalisation, the materialisation of the EPR can undermine coordinated teamwork at the bedside and provides perspectives that could inform sociotechnical system design to better support collaboration.

Theoretically, this project demonstrates the value of sociotechnical approaches that take seriously the role of physical objects and digital materials in constituting practice. Combining the lens of actor-network theory with an ethnographic approach enabled the tracing of how EPR technologies shape networks of people, materials, and knowledge across hospital spaces. This reveals ongoing transformations in record-keeping and implications for practice, medical education, and policy, which will be discussed below.

Methodologically, the pragmatic adoption of ANT contributes to literature on applied sociotechnical health research (Cresswell, 2019). My method of using illustrations based on traced photographs provides a novel perspective and way of looking at objects. My technique of combining photographs and illustrations both draws careful attention to objects and adds a layer of anonymity, which could have useful applications in healthcare research environments.

In the NHS, the transition to digital records has been, and continues to be, a slow process. Although there has been a huge amount of research considering the implementation of the EPR, paying close attention to how it is happening in practice, to scrutinise how work is being reconfigured, continues to be as important as it ever was. This research comes at a time when paper is still sporadically maintained in pockets (of people and practices) and captures a time when the memories of paper records are still vivid. These memories are also my own. My research has traced the associations, interactions, and transformations within this network during a unique period of transition. I have witnessed how the absence of paper-based records still exerts influence on the routine work of staff, through practices and ways of interacting that formed around the paper record.

Overall, this thesis expands on the subtle but consequential ways in which the materiality and mobility of the EPR reconfigure central elements of ward work. It provides transferable insights into sociotechnical dynamics that could inform and guide the design and integration of technologies in complex healthcare settings.

10.4 Implications for Practice, Policy, and Education

In this section, I will discuss the implications of my research for policy, education and practice. These implications and any recommendations I make are made with the limitations of the research in mind. EPR use is not new, but mobile EPRs on paperlight wards are in the early stages of use in the NHS, and this research is unique in exploring that area qualitatively.

My research represents a snapshot of the use of mobile devices in a single hospital trust between 2018 and 2019. Whilst this project focuses heavily on specific devices, the tensions that were produced by the material disturbance of practices are likely to resonate across settings. Other hospital trusts will have chosen to use devices in other ways, along with various and changing versions of EPRs. This will inevitably result in different outcomes (both positive and negative), but nonetheless, there are issues and questions that arose in the course of this research that are transferrable across technology in healthcare. The value of the data in qualitative research lies not only in the data itself, but also in what the data reveals about the broader phenomena under investigation. Through careful and critical engagement with the data, I have been able to make contributions to understanding, explaining, and interpreting the sociotechnical network of the materialising EPR in a nuanced and context-sensitive manner.

10.4.1 Policy Implications

As seen from my analysis of laptops on wheels and EPMA carts, there needs to be a greater emphasis on the usability of new technologies within the social setting of the intended environment. At the time of my fieldwork (2018 – 2019), Compass was trying to use devices in ways which were relatively new across the NHS. The computer trolleys were made to their own specifications, and they had little experience from other trusts to draw on. Considerable resources had been deployed in implementing those devices.

Many hospitals are still procuring new devices, but accounts of material 'failures' are rarely shared (Dixon-Woods and Martin, 2016). Such accounts could be valuable in assisting in (expensive) decision-making in other trusts. On the contrary, positive stories about these devices remain published on social media and hospital websites, even after they have been removed from use. In a similar way, 25 years after former Secretary of State for Health Frank Dobson explained that technological change was needed in the NHS (see section 1.1), NHS policy documents continue to stake service improvement and the promise of time efficiency on the potential of technology and innovation:

> *'The widespread safe, effective and ethical adoption of these innovations will be one of the most important ways of delivering the stretching productivity ambitions in this Plan.' The NHS Long Term Workforce Plan (NHS England, 2023)*

However, this optimistic viewpoint does not always align with staff experiences, or the research I present here. Despite an acceleration in digital transformation in some areas following the Covid-19 pandemic (Sheikh et al. 2021), evaluations continue to reveal a disconnect between policy aspirations and how technology is being implemented across the NHS (Health and Social Care Committee, 2023).

It is possible that part of the problem in openly sharing less than positive experiences with mobile computing devices and EPRs may be the issue of 'commercial sensitivity' and how hospital trusts are vulnerable to being test sites for technology companies offering services at reduced prices (or free). Entering into these sorts of agreements may deter hospitals from being open, consciously or not, about how new technologies failed or were unsuitable. IT departments may worry that sharing technological 'failures' could deter companies from wanting to work with them in the future. If a drug company were working with a hospital trust in a similar manner, they would undergo higher levels of ethical scrutiny and compulsory reporting of results.

Mechanisms to keep track of technologies in the NHS have recently been strengthened. The NHS Transformation Directorate has introduced the 'Digital Technology Assessment Criteria (DTAC)' (2021) and audit (2022) for all new digital technology, including hardware, software or a combination of both. These criteria assess compliance with a number of measures, including product 'usability and accessibility', marking supporting information (*supplied by the product developer*) against NHS Service Standards. The principle of this appears to be a step in the right direction, but the focus is currently dominated by data standardisation and interoperability (Faculty of Clinical Informatics, 2022). In addition, if the responsibility for information provision sits with the product developer, thorough consideration of the social setting in which the product would be placed may be lacking.

Frameworks which have been developed to evaluate the abandonment of technologies in healthcare are complex (see the NASSS framework, Greenhalgh et al., 2017). Reporting where a device has failed to be adopted in one location is not necessarily transferable across different care settings. What may be more valuable would be an iterative and collaborative process between the IT division and the setting in which the technology is used. Most organisations would say that their IT implementations were collaborative, but this relationship needs to be maintained beyond 'roll out'. Options could include adopting a 'human factors' approach (Cresswell *et al.*, 2017). This systematic approach takes into account the interaction between people, technology, and work environments, accommodating for a diversity of healthcare settings and the dynamic nature of technology use. This process could support health information technology deployments to be sensitive to the complex and dynamic realities of settings and encourage a culture of collaboration and learning.

10.4.2 Education implications

As secondary care becomes progressively digitalised, for healthcare students to be able to participate fully in patient care and to prepare for future practice, they will need to learn how to use electronic patient records. The educational implications of this research highlight the need to expand the focus of training programs for EPR users beyond 'technical' proficiency. While competence in EPR use is undoubtedly important, staff need to be supported in understanding how EPRs might reconfigure their working practices, particularly where changes in collaborative and communicative practices might have an impact on patient safety.

The results of my research identify why this is important. The EPR introduced a fracturing in interdisciplinary communication and a distancing between healthcare professionals. Along with learning to use the EPR, I have described how staff were still uncertain of how they were meant to adjust their practices and best communicate and collaborate with one another.

I also found that the EPR, materialised via mobile computers, appeared to have become intertwined with junior doctors' sense of competence and effectiveness in managing patient care. As such, medical educators should consider addressing the sociotechnical competencies necessary for navigating this digital-dependent landscape, which includes not only the ability to use EPR systems but also an understanding of the influence on clinical practice, interpersonal interactions, and professional development.

A series of reports, including the Topol Review (2019), the NHS Long Term Plan (2019) and 'Data Driven Healthcare in 2030' by Health Education England (2021), have urged the NHS to transform its workforce to become 'digitally ready'. The main focus of this is to build a skilled 'data driven' workforce, with roles in data architecture and informatics, alongside how there needs to be 'organisational transformation' through 'IT education and training' of the clinical workforce. This is framed as an emphasis on educating healthcare staff to better 'harness the potential' of digital systems through *technical* competencies and capabilities. Where Health Education England gives space to the 'human factor elements of training', they describe how resistance should be overcome with 'mindful persuasion of the benefits of technology' (2021). The findings of my research have demonstrated that the training needs to be more nuanced than this. Drawing from the examples in my fieldwork, focusing solely on technical training would not have helped the nurses using the iPod at the bedside, or have assisted the members of the ward round team in standing together in such a way that supported collaboration. To continue to emphasise the competent technical use of the materialising EPR misses opportunities to learn from and rethink how practices are reshaping around the various devices hosting and moving the EPR in the real-world spaces of hospital wards.

A further reason for emphasising the importance of collaborative work outside of and around the EPR, is to strengthen the resilience of ward staff to IT failures. A report by Guy's and St. Thomas' NHS Foundation Trust (2023) describes how challenging it was for staff to re-adjust to paper processes over a prolonged period of EPR downtime:

> *'The stress placed on clinical decision makers and others during this period cannot be underestimated. Whilst some clinicians reported being comfortable working on paper, for the majority this was an*

> *overwhelmingly a negative experience, especially those who were unfamiliar with paper working.' Guy's and St. Thomas' NHS Foundation Trust (2023)*

The incident highlights the complexity of how specific materials for medical records become intricately linked with local practices, meaning hospitals cannot expect to substitute one out and replace it directly for another. It is not sufficient to only have backup systems in place; healthcare staff need to be familiar with these systems and confident in their use. The complete reliance on an EPR without such familiarity will lead to delays in patient care during a system failure, causing avoidable stress for staff and potential risks to patients. This again underlines the need for a comprehensive approach to EPR education that extends beyond the technicalities of using the system.

10.4.3 Practice Implications

My research has emphasised how focusing attention on the materials of the EPR has value in opening up new understandings of medical work and the role of the medical record. As a result, more detailed knowledge about medical work and digital devices becomes available to help guide decision-making about the future of medical practices. However, it remains uncertain whether the devices can be reshaped to suit the types of work that the medical community has traditionally undertaken or whether practices (such as the ward round) should be reimagined around the affordances of the available digital devices.

My research found a variety of ward round practices across locations, often characterised by minimal immediate nursing input and fragmented communication systems. With limited resources and an increasingly strained healthcare system, reconsidering the location and mobility of collaborative ward activities may be an avenue of exploration. For example, modern ward rounds may be better suited to being at least partially static in spaces specifically tailored to opening up and sharing information on more suitable interfaces, e.g. larger screens.

This thesis has illustrated clinicians' uncertainties in adapting their practices to the EPR. As one participant put it, 'We don't know how to do the modern ward round'. While the goal of this thesis was not to devise new systems for conducting ward rounds, the findings suggest that the question of 'how to do the modern ward round' warrants further exploration. In 2021, the Royal College of Physicians and the Royal College of Nursing updated their guidance on best practices for multidisciplinary ward rounds (Royal College of Physicians and the Royal College of Nursing, 2021), where the use of technology was included for the first time. As EPR usage increases and paperlight wards become the norm, it will become more critical to incorporate the EPR and the materiality of digital records throughout the ward round guidelines.

In addition, my research indicates that there needs to be more thoughtful consideration and follow-up of the actual physical devices used in practice in hectic and complex medical environments, such as the hospital ward. As with the example I gave where staff had dilemmas of trust whilst prescribing in emergency scenarios, it is within these contexts that material changes can have wide-ranging 'unintended consequences', which ultimately can compromise the efficiency of staff and the safety of patients.

10.5 Suggested directions for further research

I have discussed the implications of my research for practice, policy, and education. I will now outline the potential implications of my work for future research.

One of the consequences of taking a sociotechnical approach to research, by which I mean how I followed the EPR across diverse locations and talked to a broad range of staff, is that my thesis has not been able to encompass all my findings or represent all the voices I heard. I will approach some of these areas now as I turn to recommend directions for further research. I will also make suggestions based on insights I gained in the process of doing my research, which my study did not address.

10.5.1 Patient experience of digital devices

This remit of this project did not directly encompass talking to patients. Patient experience is largely missing from accounts of hospital-based EPR implementation and use. In my research, I found that devices had the potential to be misunderstood and confusing to patients and the nursing staff worried about appearing uncaring while interacting with iPods. This suggests that there is a need for healthcare professionals, organisations, and policymakers to broaden the scope of the impact of the EPR and take into account how digital devices and the EPR influence the experience of being an inpatient. It could be revealing to ask patients how they experience the use of bedside technologies, to understand how they interpret what they see from their bedsides, and how they feel when devices are interacted with around them. Answering these questions would enable us to know more comprehensively how hospital-based EPR implementation and the use of associated digital devices, could impact patients' experiences and feelings of safety during their hospital stays. Understanding these aspects could inform the development of patient-centred strategies in EPR implementation, ensuring that the shift towards digitalisation enhances rather than detracts from the patient experience.

10.5.2 Care of medical records

Knowledge of how to manage the EPR could be gained through understanding more about how paper medical records have traditionally been cared for. I was not able to give this space in the main thesis, but the medical record depot was a further fieldwork location in this project. The records depot was an impressively large site, with staff who cared deeply about the care of the paper notes in their custody. They had questions about the EPR concerning the curation and management of the content of the digital records. They queried who was looking after the digital notes and who was keeping the digital notes in order. They worked meticulously to keep the paper notes tidy and orderly and were concerned that the size and organisation of the digital note seemed to go unseen. As my project became less about the actual EPR itself and more about the interaction between the staff and the devices housing the EPR, I focused more on those materials and away from the medical records depot. Further research in this area could help to reveal unique insights into forms of care and curation of the paper medical record, which could have relevance for the development of the EPR.

10.5.3 Medical education and the EPR

I introduced this issue when I discussed the educational implications of my project. The education of health professionals and trainees needs to incorporate the use of the EPR, and as I have described, this should go beyond the technical aspects of EPR use and health informatics. Across the NHS, there continues to be considerable variation in the extent of digitalisation, the EPR systems, and the materials used to house them. So, to learn how to use one EPR would be a thin slice of what you might need to know as a rotational doctor moving between multiple hospital trusts or an agency nurse working across the country. The NHS is far from a standardised organisation, so it has always been the case that ward to ward, hospital to hospital, knowledge of specific local practices was required to work in a new location. How and if this is experienced differently through paper or digital records is unknown. In addition, how medical students manage and adapt to these different practices is also unclear. Subsequently, there is a need for research that explores how this transition is being experienced.

10.6 Strengths and limitations

In this section, I will reflect on the strengths and limitations of my research. Some of these factors are intertwined with my methodological choices, and others were inherent in the context of undertaking doctoral research, but being aware of these areas and understanding how this work has come to be the way it is, helps to outline the limitations of what can be understood by this research.

My own positionality as a researcher has been threaded throughout the thesis. My research questions were set not only by where the 'gaps' were, or where calls for further research were located, but also through what I was drawn towards from my own experiences. This prior knowledge allowed me to focus on practices and locations that I found to be underrepresented in the literature.

I chose to follow the EPR as it was mobilised in various forms, across what I consider to be one of the messiest locations in the hospital, the acute medical ward. All wards have to deal with the uncertainty of routine and schedule, as urgent work and emergencies will often arise, but on the medical ward, the unexpected is more routine. GP surgeries, outpatient departments, and surgical wards can set their schedule by appointments or theatre lists. Intensive care units are also more controlled, with higher staffing levels, fewer patients, more technology, and space around beds which afford (and restrict) other ways of standing with computers (see Morrison et al. (2008)). But on the acute medical ward, the turnover of patients is higher, the patients get moved around more, and they might suddenly get very sick. Effective communication and collaboration are critical in these environments, so my contribution to understanding how the EPR plays a part in these environments is particularly valuable. As such, I believe my focus on medical wards is a strength of this research, but it also means that some of the findings might speak more strongly to more hectic medical environments, than, for example, an outpatient department.

It is also important to state that my investigation of the EPR was more expansive than I could reflect in this thesis. I have drawn attention to elements of this in my suggestions for further research. In a similar way to the medical record, this thesis is not an archive, so decisions had to be made about which stories to tell. Those choices were made by tethering the findings to the original research questions. But ultimately, this thesis is formed through my experience across the whole hospital trust, and what I know about medical records beyond the 'shop floor' is entangled implicitly or explicitly with my interpretation of what I saw and heard throughout.

Taking inspiration from ANT, as has been described elsewhere, generated more data than I could present in my findings and I had to decide what to foreground (Cresswell *et al.*, 2010). This meant that the individuals I observed and spoke to within the medical records warehouse, for example, have not been fully represented. If I was to undertake this project again, narrowing the focus of my overall aims and research questions might have assisted in tightening the boundaries of my research site.

In tracing the EPR across the hospital network, I saw it in many forms, but the devices which were interacted with on the wards have been privileged in my account here. This means that the materiality of the EPR infrastructure is missing. The efficiency, stability, and security of the servers and networks that support EPRs, for instance, also have consequences for care delivery. I also did not seek ethical approval to look into the EPR and how it was interacted with as software. For example, how the arrangement of the EPR user interface could also have been shaping medical practices. These gaps could be seen as a weakness in my research, particularly as the usability (or lack of usability) of EPRs, was a common concern amongst staff. My thoughts on this are as follows. Primarily, I turned my attention to the part of the EPR network that I felt had undergone the least scrutiny – that being the materials through which the EPR was being mobilised. Secondly, whilst in the field, the interaction between the staff and the mobile computers captured my interest, and in the *familiar* world of the ward, became *the strange* that gave me a point of focus (O'Reilly, 2012).

10.6.1 Access and gatekeepers

As described in the methods chapter (section 4.2), my access to the wards only started to open up through a chance meeting on a train. Before that point, I struggled to connect with the ward staff. My clinical contact in the hospital, the Chief Clinical Information Officer, authorised that my project could take place but did not assist in setting up a specific site in the hospital or a ward-based contact for me to liaise with. As I lacked a senior clinician gatekeeper invested in my project and working on the wards, I did not feel as integrated into the clinical areas as I had hoped. In addition, Compass had recently been inspected by CQC and was facing a great deal of scrutiny based on the outcome of their report. I felt that they were fatigued from being observed, and in being sensitive to that, I moderated my observations so as not to place undue burden on any single team. This limited the extent to which I was able to observe medical work. However, although the findings of this thesis have focused on medical work, this was through following the broader network of actors associated with the EPR, rather than a solely staff-focused project. Consequently, I was able to immerse myself in the EPR, through other actors and sites, despite not being able to access the ward staff for as many observations as I had hoped.

10.6.2 The generalisability of qualitative research

It is important to stress that this research captures what I saw, heard, read, and wrote from a particular hospital trust, using a single EPR (Lorenzo), at a specific time. The descriptions and accounts of paper-use are also largely retrospective in nature, which may be coloured by a nostalgic perspective of the NHS, which in turn could be influenced by various factors.

The hospital trust at the centre of this research project made numerous decisions and took certain paths, on the basis of their own circumstances. As a result, their approach will not be replicated in exactly the same way elsewhere. For example, other hospitals may have chosen alternative devices, in different quantities, and may not feel that the specific collaborative issues I described with the mobile computers are applicable to them. Some hospitals, perhaps particularly outside of the NHS, may have their wards arranged so that the physical and spatial issues described in this thesis are less of a consideration. It is also possible that other EPR systems (e.g. Cerner, EPIC) will contribute to alternative configurations of work which shape practices in different ways than I found at the site of my research.

But, whilst it is important to define the specific context and limitations of a project, beyond the specificities of laptops on wheels, my research speaks to broader themes of technologically-mediated care and interprofessional work which can apply across healthcare settings. In the methods section of this thesis (section 4.5.3), I addressed the issue of generalisability by describing how qualitative research can prompt readers to consider how and to what extent their research findings are transferable to other settings, rather than attempting to match up conditions between contexts.

Importantly, stories told through qualitative methods can ‘resonate’ (Tracy, 2010) and find use away from their specific set of circumstances. The digitalisation of medicine has gained momentum since I started this project, especially in the wake of Covid-19 and the increase in video-consultations (Wherton *et al.*, 2022). But as I discussed in the implications of this research, policy and education remain predominantly directed at the technical aspects of EPR use. This outlook needs to broaden to capture social and material elements of use which contribute significantly to the safe use of medical records.

10.7 Closing remarks

I began this PhD with a story of how I had experienced the implementation of an EPR in my own clinical workplace, a small hospice inpatient unit. I grew intrigued by the unexpected ways in which the change of patient records, from paper to digital, could affect the whole multidisciplinary team. Somehow, the absence or change of material was able to alter the way we were working. This PhD gave me a set of analytical tools with which to try and understand that experience, a lens through which to look at different clinical environments, and to ask what was going on in other places with digital records. I learnt to pay attention not only to the ‘EPR’, but to embrace the ‘EPR’ within an intricate network of relations to other actors, which gave me a new appreciation of how intrinsic materiality is to so many of the practices on hospital wards.

In the drive to become paperless, the expansive possibilities of digital records have dominated the ways in which medical work is proposed to be shaped in the future. But my research shows that there are still lessons to be learnt from how medical practices have evolved alongside and through the use of paper. What were thought to be limitations of paper’s materiality, actually supported systems of communication and collaboration that encouraged interconnectedness between staff, and in caring for patients. This matters because in the organisation of complex acute medical care, face-to-face interaction and relationships between healthcare staff support and enrich both working well as teams and providing safe, timely, and compassionate care.

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Appendix A. Project paperwork

11.1.1 Participant Information Leaflet - Observations

Who can you contact for further information?

If you have any questions about the study, please contact the main researcher:
Dr Victoria Reay
PhD Student
v.reay@lancaster.ac.uk
01524 593938

Research Supervisors:

Dr Lisa Wood - Lecturer
Lancaster Medical School
Lancaster University LA1 4YG
01524 592503
l.a.wood@lancaster.ac.uk

Dr Liz Brewster - Lecturer
Lancaster Medical School
Lancaster University LA1 4YG
01524 595018
e.brewster@lancaster.ac.uk

Who has reviewed the project?

This study has been reviewed and approved by the Lancaster University Faculty of Health and Medicine Research Ethics Committee.

Thank you for taking the time to read this information leaflet

Who can you contact for further information?

If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to the researcher, you can contact:

Dr Jo Knight
Research director
01524 594800
jo.knight@lancaster.ac.uk
Lancaster Medical School
Lancaster University LA1 4YG

If you wish to speak to someone outside of the Faculty of Medicine Doctorate Programme, you may also contact:

Professor Roger Pickup
Associate Dean for Research
01524 593746
r.pickup@lancaster.ac.uk
Faculty of Health and Medicine (Division of Biomedical and Life Sciences)
Lancaster University LA1 4YG

Resources in the event of distress
Should you feel distressed either as a result of taking part, or in the future, the following resources may be of assistance:

V0.1 | 13.07.2018 | IRAS 238925

The Electronic Patient Record and Medical Work

Health & Medicine | Lancaster University

Participant information sheet
Observations

My name is Victoria Reay and I am a PhD student at Lancaster University. I would like to let you know about the project I am carrying out at this hospital.
My research is looking into the ways that hospital staff use electronic patient records and computers.
I have been given permission to undertake this work by the Chief Clinical Information Officer, Dr

What is the study about?

The purpose of this study is to look at the way that the electronic patient record (EPR), or Lorenzo, is used by staff on hospital wards. I want to look at how the use of Lorenzo shapes the way that clinical work is carried out. I am particularly interested in the way that the mobile computer (or computer on wheels) is used to access Lorenzo and how it is used (and not used) during ward rounds and ward work.

Why have I been approached?

You have been approached because I am interested to hear from people who use
Lorenzo, and/or participate in ward rounds, and/or come into contact with the mobile computer.

Do I have to take part?

No. It's completely up to you to decide whether or not you take part. You are free to withdraw at any time without giving a reason. If you do decide to take part, please keep this information sheet, and I will ask you to complete a consent form.

What will I be asked to do if I take part?

I am an experienced healthcare professional and understand the time pressures on a busy medical ward. I will aim to be as unobtrusive and sensitive to your work as possible so as not to disrupt any patient care or make your job more difficult.

Watching you at work

The observation periods will last from 15 minutes to three hours (in the case of ward rounds) depending on the type of activity taking place.
I am interested in watching any work relating to the use of Lorenzo or the computer on wheels. I am not looking to access or document any clinical information. My research will be looking at the way that hospital workers interact with the technology and Lorenzo (for example, how it facilitates or inhibits your work).
During the course of your work, when appropriate, I may ask you to explain aspects of what you are doing. I may take down some notes with pen and paper. These notes will be typed up and used for analysis at a later point.

Photography

During the observation process, there may be situations which would be better captured and described through images. The intention is to use the photographs to aid sketching/drawing representative images, removing any identifying features, thereby rendering them anonymous. Photographs would only be taken with permission. The original photographs will be destroyed after they had been used to create drawings.

Are there any risks?

There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and/or contact the resources provided at the end of this sheet.

Are there any benefits?

Although you may find participating interesting, there are no direct benefits in taking part.

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Will my data be identifiable?

No, notes from the observations will be anonymised, and anything you say during the observations will be confidential.
The data collected for this study will be stored securely:
• Any photographic images will be deleted after they have been studied and converted to hand drawn illustrations. These illustrations will anonymise any identifying features. The computer files will be encrypted and the computer itself password protected.
• Any personal data will be confidential and will be kept separately from your interview responses.
There are some limits to confidentiality: if what is said in the interview makes me think that you, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of ward staff about this. If possible, I will tell you if I have to do this.
At the end of the project's timeframe, all research data will be kept securely and accessible, according to Lancaster University's Research Data Management policy (a minimum of 10 years). For further information about how Lancaster University processes personal data for research purposes and your data rights please visit:
www.lancaster.ac.uk/research/data-protection

What will happen to the results?

The results will be summarised and reported in a PhD thesis. This may be submitted for publication in an academic or professional journal. No individual participant or hospital will be identifiable in any of the published material.

11.1.2 Participant Information Leaflet - Interviews

Who can you contact for further information?

If you have any questions about the study, please contact the main researcher:

Dr Victoria Reay
PhD Student
v.reay@lancaster.ac.uk
Telephone 01524 593938

Research Supervisors:

Dr Lisa Wood - Lecturer
Lancaster Medical School
Lancaster University LA1 4YG
Telephone: 01524 592503
l.a.wood@lancaster.ac.uk

Dr Liz Brewster - Lecturer
Lancaster Medical School
Lancaster University LA1 4YG
Telephone: 01524 595018
e.brewster@lancaster.ac.uk

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Research director
Tel: 01524 594800
jo.knight@lancaster.ac.uk
Lancaster Medical School
Lancaster University LA1 4YG

If you wish to speak to someone outside of the Faculty of Medicine Doctorate Programme, you may also contact:

Professor Roger Pickup
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Tel: 01524 593746
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Faculty of Health and Medicine (Division of Biomedical and Life Sciences)
Lancaster University LA1 4YG

Resources in the event of distress
Should you feel distressed either as a result of taking part, or in the future, the following resources may be of assistance:

The Electronic Patient Record and Medical Work

Health & Medicine | Lancaster University

Participant information sheet
Interviews

My name is Victoria Reay and I am a PhD student at Lancaster University. I would like to let you know about the project I am carrying out at this hospital. My research is looking into the ways that hospital staff use electronic patient records and computers.
I have been given permission to undertake this work by the Chief Clinical Information Officer, Dr

What is the study about?

The purpose of this study is to look at the way that the electronic patient record (EPR), or Lorenzo, is used by staff on hospital wards. I want to look at how the use of Lorenzo shapes the way that clinical work is carried out. I am particularly interested in the way that the mobile computer (or computer on wheels) is used to access Lorenzo and how it is used (and not used) during ward rounds and ward work.

Why have I been approached?

You have been approached because I am interested to hear from people who use Lorenzo, and/or participate in ward rounds, and/or come into contact with the mobile computer.

Do I have to take part?

No. It's completely up to you to decide whether or not you take part. You are free to withdraw at any time without giving a reason. If you do decide to take part, please keep this information sheet, and I will ask you to complete a consent form.

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What will I be asked to do if I take part?

I will be approaching a variety of staff members to talk to me individually about their experiences with Lorenzo and/or the mobile computers. These interviews will last approximately 15 – 45 minutes.
With permission, they will be audio-recorded onto a secure-encrypted device, before being typed up for later analysis. The recording will be stored with an anonymous unique participant number and the information obtained will be stored securely and will only be used for this study. You are free to stop at any point during the interview, and can ask for the recording to be erased.

Are there any risks?

There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and/or contact the resources provided at the end of this sheet.

Are there any benefits?

Although you may find participating interesting, there are no direct benefits in taking part.

Will my data be identifiable?

Will my data be identifiable?
The information you provide during interviews will be fully anonymised.
The data collected for this study will be stored securely:

- Audio recordings will be transferred to a secure computer after the interview and then deleted from the recorder. The computer files will be encrypted and the computer itself password protected.
- The typed version of your interview will be anonymised. Direct quotations from your interview may be used, but your name will not be attached to them.
- Any personal data will be confidential and will be kept separately from your interview responses.

There are some limits to confidentiality: if what is said in the interview makes me think that you, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of ward staff about this. If possible, I will tell you if I have to do this.

At the end of the project's timeframe, all research data will be kept securely and accessible, according to Lancaster University's Research Data Management policy (a minimum of 10 years). For further information about how Lancaster University processes personal data for research purposes and your data rights please visit

www.lancaster.ac.uk/research/data-protection

What will happen to the results?

The results will be summarised and reported in a PhD thesis. This may be submitted for publication in an academic or professional journal. No individual participant or hospital will be identifiable in any of the published material.

11.1.3 Patient Information Leaflet

Who can you contact for further information?

If you have any questions about the study, please contact the main researcher:

Dr Victoria Reay
PhD Student
v.reay@lancaster.ac.uk
Telephone 01524 593938

Research Supervisors:

Dr Lisa Wood - Lecturer
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Lancaster University LA1 4YG
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l.a.wood@lancaster.ac.uk

Dr Liz Brewster - Lecturer
Lancaster Medical School
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Telephone: 01524 595018
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Thank you for taking the time to read this information leaflet

V0.1 | 13.07.2018 | IRAS 238925

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Research director
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Lancaster Medical School
Lancaster University LA1 4YG

If you wish to speak to someone outside of the Faculty of Medicine Doctorate Programme, you may also contact:

Professor Roger Pickup
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Tel: 01524 593746
Email: r.pickup@lancaster.ac.uk
Faculty of Health and Medicine (Division of Biomedical and Life Sciences)
Lancaster University LA1 4YG

Who has reviewed the project?

This study has been reviewed and approved by the Lancaster University Faculty of Health and Medicine Research Ethics Committee.

The Electronic Patient Record and Medical Work

Health & Medicine | Lancaster University

Information sheet for patients and visitors

My name is Victoria Reay and I am a PhD student at Lancaster University. I would like to let you know about the project I am carrying out at this hospital.

My research is looking into the ways that healthcare staff use electronic patient records and computers.

I have been given permission to undertake this work by the Chief

Why am I doing this research?

Previously a patient's information (results/clinic letters/hospital stays) was kept in the form of a paper medical record.
These paper records have been in use alongside computers for many years, but recent changes have meant that now most information is directly added to and stored in a computer record.
This is sometimes called the **electronic patient record** (EPR), and in this hospital it is known as 'Lorenzo'.

Through my own experience as a doctor, I have developed an interest in exploring how the use of computers and the electronic patient record is shaping the way that healthcare professionals work.
The transition to working with electronic notes, compared to paper notes, has been more difficult than anticipated.

My project will involve **watching the ways that healthcare staff interact with and use computers** to try and give some explanations as to why.

Hopefully this will help to guide future development of electronic notes and **improve the delivery of clinical care**.

What will this research mean to you?

I will be on this ward to watch the ways that the healthcare staff work. You may see me taking notes on the activities that I see, or asking the staff questions. If I am observing any activity that involves your personal care, such as a ward round visit, I will ask for your permission (verbally) at the time.
You are free to refuse, can do so at any time, and do not need to give an explanation.
I will not be taking any notes which contain confidential patient information, or any personal information relating to visitors.

What happens if I do not want to be observed?

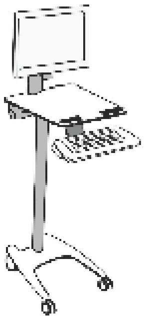
If you do not want to be involved in this study then please tell myself or any other member of the team looking after you here on this ward.

Poster

Health & Medicine | Lancaster University

The Electronic Patient Records and Medical Work

How have electronic records changed your work?



We are interested in electronic records and how hospital work is changing through their use:

- Ward rounds with mobile computers
- Accessing and finding information
- Communication with colleagues

Do you work with Lorenzo?

We are looking for participants to be observed at work and/or take part in short recorded interviews (lasting from 15 to 45 minutes).

If you have any questions about the study, would like further information or would like to take part, please contact the main researcher:

Dr Victoria Reay
PhD Student
01524 593938 (voicemail)
v.reay@lancaster.ac.uk

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11.1.4 Consent form (interviews)

Health & Medicine | Lancaster University

Consent Form: Interview

Study Title: The Electronic Patient Record and Medical Work

By filling out the form below, you confirm that you have read and understood the Participant Information Sheet (version 0.1) and wish to participate in the described study. Please mark each box below with your initials if you agree. If you have any questions or queries before signing the consent form please speak to the principal investigator, Dr Victoria Reay.

		Please initial each statement
1	I confirm that I have read the information sheet and fully understand what is expected of me within this study	
2	I confirm that I have had the opportunity to ask any questions and to have them answered.	
3	I understand that my interview will be audio recorded and then made into an anonymised written transcript.	
4	I understand that audio recordings will be kept until the research project has been examined.	
5	I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected	
6	I understand that the information from my interview will be pooled with other participants' responses, anonymised and may be published.	
7	I consent to information and quotations from my interview being used in reports, conferences and training events.	
8	I understand that the researcher will discuss data with their supervisor as needed.	
9	I understand that any information I give will remain confidential and anonymous unless it is thought that there is a risk of harm to myself or others, in which case the principal investigator may need to share this information with their research supervisor.	
10	I consent to Lancaster University keeping written transcriptions of the interview for 10 years after the study has finished.	
11	I consent to take part in the above study.	

Name of Participant ___________________ **Signature** _______________________ **Date** _________

Name of Researcher ___________________ **Signature** _______________________ **Date** _________

The Electronic Patient Record and Medical Work
Version number 0.2 | 28.08.2018 | IRAS 238925

Lancaster University
University House,
Lancaster, LA1 4YW, UK
www.lancaster.ac.uk

11.1.5 Consent form (observations)

Health & Medicine | Lancaster University

Consent Form: Observations

Study Title: The Electronic Patient Record and Medical Work

By filling out the form below, you confirm that you have read and understood the Participant Information Sheet (version 0.1) and wish to participate in the described study. Please mark each box below with your initials if you agree. If you have any questions or queries before signing the consent form please speak to the principal investigator, Dr Victoria Reay.

		Please initial each statement
1	I confirm that I have read the information sheet and fully understand what is expected of me within this study	
2	I confirm that I have had the opportunity to ask any questions and to have them answered.	
3	I understand that the researcher will be observing everyday working practices. I understand that the researcher may be taking notes which may later be typed up and anonymised.	
4	I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected	
5	I understand that the information from the observations will be pooled with other observations, anonymised and may be published.	
6	I consent to anonymised information and quotations from my observations being used in reports, conferences and training events.	
7	I understand that the researcher will discuss data with their supervisor as needed.	
8	I understand that any information I give will remain confidential and anonymous unless it is thought that there is a risk of harm to myself or others, in which case the principal investigator may need to share this information with their research supervisor.	
9	I consent to Lancaster University keeping written data relating to the observations for 10 years after the study has finished.	
10	I consent to take part in the above study.	

Name of Participant ____________________ **Signature** ________________________ **Date** _________

Name of Researcher ____________________ **Signature** ________________________ **Date** _________

The Electronic Patient Record and Medical Work
Version number 0.2 | 28.08.2018 | IRAS 238925

Lancaster University
University House,
Lancaster. LA1 4YW, UK
www.lancaster.ac.uk

Appendix B. Interview questioning guide

11.1.6 Interview questioning guidance

Version 0.2 290318

Introduction	Check consent Reconfirm re. anonymity Recap aims Check if any questions and happy to proceed with recorder Explain may make notes as well
General questions	Check job role, how long in post? How long using Lorenzo? Other computer systems?
Lorenzo	Ask to explain basic position regarding the use of Lorenzo

Understanding how using the EPR and mobile computer has changed working processes:	
Creating overview/getting to know the patient	How has the use of Lorenzo changed getting to know a patient? How does Lorenzo allow the creation of clinical overview? And in different contexts – when the patient is newly admitted (when content of notes may be minimal), and after a long inpatient stay (where the converse would be true).
Finding information	How does the interviewee locate information within Lorenzo?
Impact on communication with other members of staff	Changes in the frequency/quality of communication during ward round and before/after the ward round. Remembering to tell someone something (keeping a list?) Channels of communication – have they changed? Use of bleeps, phones, mobiles, email the same or shifted?
Trust of information	Codes and diagnoses in the notes – how do you check/trust them?

Work boundaries	How these have changed? Where have the responsibilities shifted and what effect has this had on team dynamics?
Information	How has what is written on the ward rounds changed (the character of the notes - the use of narrative/patient story) How do protocolized ward rounds in Lorenzo compare to using paper records? Does it feel as if you are writing for a different audience in Lorenzo? (awareness of change in audience, broader or different, or none?) Who do you think reads your notes? Who do you write your notes for?
Workarounds	When do you use paper? What do you use it for? If uses paper - how did you learn to use paper alongside the EPR?

Further questions arising from observations (23/03/19)

How do you learn to use the EPR 'on the job' if you cannot easily see other people at work?

Consultants: do you write your own notes on a ward round? How much control do you like to have over what is written? How much do you check what is written? How much do you check that diagnoses have been coded?
Do the doctors consider the computers a barrier to caring or displaying that they care?
Does the EPR shape the way they conduct their ward round in so far as they feel it affects their ability to care for their patients?
Lorenzo is accessible from any enabled computer. How has the ability to look at the records from a far changed your practice? Has it changed the way you do your ward rounds/where you do your ward round?

Who do the EPR users imagine they are writing the record for?

Are the managers aware of the paper workarounds in use? Why might they think workarounds are employed?

Can you imagine working without the EPR? How would your work change if you went back to using paper notes to record ward rounds?

11.1.7 Observation Guidance

(0.1 130718)

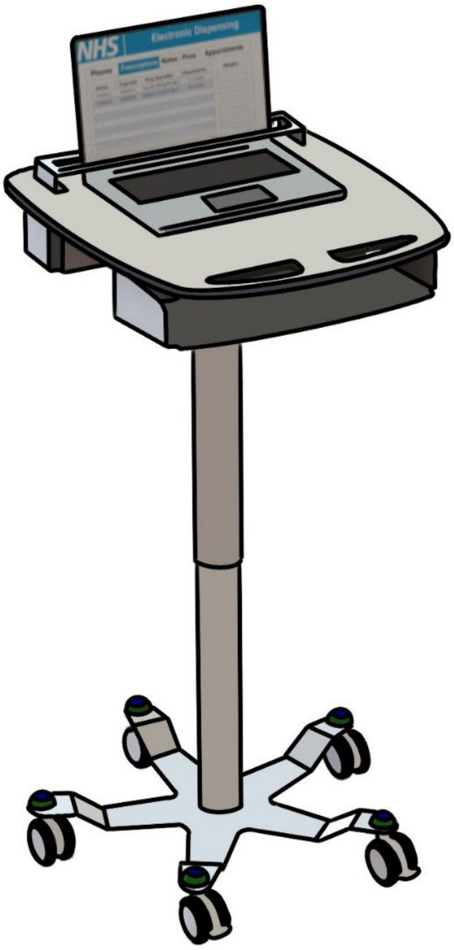
The ward layout	
Where the computers are located (and quantity):	Fixed computers Office Wall points Mobile Staff:computer ratios (based on observations)
Which staff use which computer where, and when (i.e. are there computers allocated to specific staff groups, do some groups have priorities at certain times).	Estimates of time will be approximate and based on the trends of observations over days.
Where are the mobile computers situated?	How long is the mobile computer in use: As a mobile computer As a fixed computer (i.e. not being moved before or after use) Time spent plugged in. Time spent unused.
The paper trolleys	Are they in use? Where are they situated? What are they used for?
The mobile computers	Brand, age, battery life. Ergonomics – ease of use, manoeuvrability. Height (whose height is it kept at – who adjusts it, who doesn't) Who maintains it? Who cleans it? Does it get in the way of beds/patients?
The ward rounds	Description of the ward round Timings and persons present Who is in charge? Who moves the trolley? Positioning of the trolley? Screen direction – to medics or patient? Is the patient shown the screen? When discussing the patient which way is the computer orientated? EHR:other use. Is the internet used? Who types? Is it dictated/checked? At bedside or afterwards? Is paper used concurrently?

	What for and when: - formal papers (observation chart) - informal papers (patient list) Any other workarounds in use? - For example: Notepad, MS Word, copy and paste, google, email. Are mobile phones in use? The use of the iPod for recording meals/intake - Is this used around the ward in lieu of paper
Hospital network	Behind the EPR At medical records At IT helpdesk Beyond the hospital (data storage facilities onsite and off)
Other	What else is the mobile computer used for? Admissions, clerkings, to lean on. Waiting/loading time

Appendix C. Product literature

ValuLite Laptop Cart

Perfect. For every hospital environment.



Features

This Laptop Cart has a small footprint and it is easy to manoeuvre in tight spaces or congested areas. It has a simple hand-operated height adjustment for true seated and standing positions. Up to 19" Laptop securely enclosed, with access to ports & drives on all sides. This Laptop Cart is great for infection control and has an under work surface for file or keyboard storage.

- Secure laptop enclosure
- Access to ports & drives on all sides
- Height adjustable
- Easy to manoeuvre in tight spaces
- Easy grab handles for ease of manoeuvrability
- Cables concealed for Infection Control & Security
- Extremely lightweight and durable design
- Simple installation
- Medi-white colour can be cleaned with all hospital grade sterilants
- Infection control compliant
- Supplementary power pack available on request
- Range of infection control accessories

Benefits

- Minimal footprint for congested areas
- More time to care
- Extremely robust
- Secure
- Infection control
- Ergonomic
- Secure laptop with easy access to all ports

Applications

- EPMA
- EPR
- PACS Review
- Information access at the bedside

Accessories

Scanner

Sharps bin

Mobile Printer