A Comparative Case Study of the Implementation of Standardised Tools in Healthcare: the active role everyday technologies play in quality improvement

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List of abbreviations

ADNQ	Assistant Director of Nursing Quality
ANT	Actor–Network Theory
CCG	Clinical Commissioning Group
CCOT	Critical Care Outreach Team
CQC	Care Quality Commission
CQUIN	Commissioning for Quality and Innovation
CSCW	Computer-Supported Cooperative Work
DoH	Department of Health
ED	Emergency Department
EWS	Early Warning Score
ICU	Intensive Care Unit
NCEPOD	National Confidentiality Enquiry into Patient Outcome and Death
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NPT	Normalisation Process Theory
OPPs	Obligatory Passage Points
PDSA	Plan, Do, Study, Act
SSC	Surviving Sepsis Campaign
STS	Science and Technology Studies
UK	United Kingdom

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Abstract

The implementation of evidence-based medicine frequently hinges on the introduction of technologies and tools within established social practices, and so often requires behavioural or cultural change at the clinical frontline. This research explored the implementation of an evidence-based intervention, in the form of a standardised tool, in the English National Health Service (NHS). In this context, local implementation of an evidence-based intervention is under the influence of external forces such as: NHS targets and financial incentives; the political landscape; and the public and media.

Care bundles are evidence-based standardised tools that have become a widely used solution for a range of patient safety and quality issues. However, the evidence on their use is mixed. Complex sociological factors influence the success of their implementation, sustainment and spread. Initiation of a care bundle relies on assessment of a patient and the recognition that the specified 'bundle criteria' are met. This research explored the implementation of sepsis screening tools and the Sepsis Six care bundle. Sepsis screening tools are used to stratify the severity of sepsis in order to identify if administration of the Sepsis Six care bundle is indicated. The Sepsis Six care bundle is a bundle of six interventions that are all to be instituted within an hour of recognition of severe sepsis. Sepsis screening tools and the Sepsis Six are underpinned by evidence-based medicine and in the English NHS implementation has been incentivised through a financial target. Sepsis has also been the focus of political and media attention, with several high-profile cases of failures of care.

The field of implementation science seeks to create knowledge of implementation processes and develop an understanding of the uptake in routine practice of research findings and other evidence-based practices, in order to promote their systematic application. Implementation science

models, frameworks and theories have been developed to explain and predict aspects of implementation. In addition, the field of Science and Technology Studies (STS) offers a useful theoretical perspective to contribute towards implementation science by exploring the implementation of care bundles. By applying this perspective, care bundles are viewed as everyday technologies that play an active part in healthcare as opposed to being inactive, inanimate objects in the form of paper-based or computer-based tools.

Concepts from STS, specifically from Actor-Network Theory (ANT) and technology-in-practice, were applied in this research to study systematically and critically how and why external drivers and evidence-based interventions were interpreted, implemented and used in clinical practice. Using a conceptual framework based on ANT and technology-in-practice allowed a move away from the idea that technology impacts upon healthcare workers as an external force, and allows for technical interventions to be considered as active actors that affect implementation strategies.

A qualitative methodology, specifically ethnography, underpinned the research design and the theoretical foundations of this research. The ethnographic methodology allowed for the lived experiences of the actors involved to be accounted for in this exploration of the external drivers, the implementation of the care bundle and its use in clinical practice. The research design was a multi-site case study. This enabled a close and in-depth investigation and comparison within and across the case sites of the contemporary real-life phenomenon of care bundle implementation.

Two hundred hours of observation across the Emergency Department (ED), acute inpatient settings and relevant meetings were undertaken. Forty-seven semi-structured interviews were also undertaken with: executive board members; corporate nurses; doctors and nurses in management roles; and frontline doctors, nurses and support staff. Policy documents and internal documents were also collected. An inductive research strategy was used and the data were examined using thematic analysis to identify key themes. These

themes were then viewed through the lens of a framework constructed from concepts from Actor-Network Theory and technology-in-practice.

This research had two main aims: firstly, to ascertain how secondary-care organisations interpret and implement external drivers associated with care bundles; and secondly, to ascertain how care bundles are used in clinical practice. Analysis found that two actor-networks were simultaneously translated for the external guidelines to be interpreted and implemented, one at a corporate level and the other in clinical practice. The way that organisations mobilised around the external pressures and guidelines, their orientation towards improvement, and how external pressures were balanced against the intended purpose of these tools in clinical practice influenced the design of the local implementation strategies. In clinical practice, the characteristics of the clinical setting, experience of healthcare workers and their interpretation of the tools' scripts influenced their implementation and use in clinical practice. As such, different perspectives on the care bundle were not always aligned.

The two actor-networks could be connected by embedded governance reporting structures (from the executive board to the clinical frontline) and by quality improvement methods. This facilitated understanding of the influence of context on implementation, in addition to the use of quantifiable measures of compliance. By drawing on ANT and technology-in-practice, this research provides valuable insights for implementation science by demonstrating empirically that care bundles do not just slip into the social world of secondary care in the NHS.

Chapter 1: Introduction

1.1 The study

This research is concerned with understanding how organisations interpret external drivers and implement standardised tools in clinical practice. Secondary-care organisations in the English NHS are complex environments where multiple quality improvement initiatives are implemented on a regular basis. Such initiatives are generally influenced by forces external to the organisation, such as evidence-based medicine, financial targets, regulation mechanisms, the political landscape, the media and public interest. Senior leadership and corporate teams within organisations develop implementation strategies in the light of these external drivers. Organisations also differ in their infrastructure and resources for quality improvement. This can lead to variation in the delivery of initiatives at a local level. Consistent delivery of high-quality safe care is a common worldwide challenge in healthcare. In the United Kingdom (UK), as the population increases and ages, funding pressures in the health and social care system continue to grow. The Health Foundation and the Institute for Fiscal Studies in their collaborative report *Securing the Future: Funding Health and Social Care to the 2030s* (Charlesworth and Johnson, 2018) explored how the health and social care system in the UK will go about meeting increasing costs. The report indicated that, relative to the mission it is expected to deliver, the NHS is significantly underfunded. Therefore, it is vital that, in relation to quality improvement initiatives, the most efficient methods for implementing the best evidence are achieved.

The translation of evidence into practice is widely recognised as a complex activity. Wider system issues which are outside the control of quality improvement teams often impede the successful implementation of tried and tested quality improvement initiatives. Theory on the role and value of improvement work is still an emerging field. Implementation science aims to

build an evidence base on how healthcare providers and systems can improve their work by translating evidence into practice. Davidoff et al. (2015) argue that failure to use theory has limited the understanding of improvement initiatives and stymied the learning that can inform future interventions. Contributing to the theory of improvement through research literature is a vital component of the complex work required to improve healthcare (Ogrinc et al., 2015; Sheringham et al., 2017). There is also a growing recognition of the potential contribution of social science concepts and perspectives in developing the theoretical basis for improvement efforts (Waring et al., 2016). Allen et al. (2016) highlight how different sub-specialisms within sociology can make important contributions to an understanding of healthcare quality and safety. For example, the practices of quality and safety improvement often generate the introduction of tools and technologies into existing social practices. Science and technology studies (STS) offer a lens through which to theorise the effects of implementation of new tools and technologies in the workplace (Berg, 1997a,b,c).

1.2 The context

The consistent delivery of healthcare quality and safety remains problematic (Dixon-Woods and Martin, 2016). There is evidence that healthcare is not always safe and can lead to poor outcomes for patients (Francis, 2013; Kirkup, 2015). Failure to learn from incidents and variation in uptake and outcomes in evidence-based practices persist (Dixon-Woods, 2019). When an intervention has been proved to be successful, its spread from one organisation to another is a challenge. Horton et al. (2018: 3) argue that the 'replicability problem' is an urgent question for the public sector. The authors highlight that the NHS is a setting where many approaches exist to mandate uptake of quality improvement interventions but this does not automatically bring about change in outcomes. Much of the research into quality improvement and safety has been situated in the positivist paradigm and dominated by disciplines such as human factors and safety science, social psychology and

medical science, which has framed how it should be understood (Waring et al., 2016). This is reflected in policy and initiatives in the NHS such as financial incentives, where improvement can be measured and risk understood by objective and systematic analysis (Waring, 2013).

A landmark publication in the field of patient safety was *To Err Is Human* (Kohn et al., 1999), which highlighted the human tragedy and financial cost of medical errors in hospitals in the United States (US) and demonstrated that patient safety was a problem. Quality and safety theory and research responded by advocating that latent factors within the organisation were the threat, rather than individual incompetence. The result was a drive for initiatives that focussed on linear cause and effect models to identify risk and implement improvement. Such initiatives included, for example, root cause analysis, process mapping, 'Plan, Do, Study, Act' (PDSA), checklists and care bundles (Vincent, 2006). However, these approaches neglect the wider sociocultural factors; in particular, linear, cause and effect approaches are being challenged by methods that address the complexity of healthcare systems (Braithwaite et al., 2018; Reed et al., 2018). The failure to address social, cultural and organisational factors may contribute towards explaining why variation and the incidence of poor outcomes persist and why success in one setting is difficult to reproduce in another (Allen, 2017; Dixon-Woods, 2019). The Health Foundation's Safer Clinical Systems programme identified that, often, wider system issues impede the successful implementation of tried and tested quality improvement initiatives. Problems were 'symptoms of deep organisational pathologies with long histories and complex dynamics' and were outside the control of project teams (Dixon-Woods et al., 2014a: 13).

Quality improvement initiatives frequently hinge on the introduction of novel material and symbolic artefacts into established social practices and forms of social organisation, often with the premise of bringing about behavioural or cultural change (Allen et al., 2016). This results in multiple technologies and tools that are viewed as amenable to external manipulation being in use at

any one time. Studies of technology-in-practice have shown that when a tool is introduced into practice, a new actor is added to a strongly preconfigured world, and their introduction requires negotiations with all relevant extant elements (Berg, 1997a). Change initiatives predicated on linear behavioural change models often create difficulties that have consequences in their implementation, and inevitably generate unintended consequences, along with any benefits that they bring (Braithwaite and Coiera, 2010). Understanding the generative mechanisms of tools and their unintended consequences requires analysis of the relationship between the tool and practices, without exclusively attributing agency to the tool or the people working with it (Allen, 2009).

The introduction into clinical practice of sepsis screening tools and the Sepsis Six care bundle are ideal examples of a standardised tools that have been incentivised by a CQUIN for the period of 2015-2019. Sepsis screening tools are used to stratify the severity of sepsis in order to identify if administration of the Sepsis Six care bundle is indicated. The Sepsis Six care bundle is a bundle of six interventions that are all to be instituted within an hour of recognition of severe sepsis (UK Sepsis Trust, 2019). The screening tools and Sepsis Six are closely linked such that the implementation of one can imply the implementation of the other; the terms ‘care bundle’ and ‘tools’ are used interchangeably in many contexts in the text below.

Tarrant et al. (2016), in their ethnographic study, examined what makes timely sepsis treatment so challenging. The study found that the Sepsis Six care bundle was far from a set of simple steps: completion (of the Sepsis Six) involved a complex trajectory, comprising multiple interdependent tasks that required prioritisation and scheduling between staff across boundaries within organisations. As such, theory-based approaches to implementation of this improvement initiative were needed that went beyond a focus on individual behaviour change. Developing these approaches involved a strategy of moving back and forth from the world of theory to the world of action (Tarrant et al., 2016).

Braithwaite et al. (2018) concluded that to support coevolution between the tool and the work system in which it is embedded, it is essential to close the gap between work as it is imagined and work as it is done. According to Allen (2017: 1), 'popularity of these everyday tools has not been matched by their systematic and critical analyses'. Therefore, a sophisticated understanding of both the components of the implementation programme and its mechanisms is required to replicate a successful local implementation programme on a much larger scale.

1.3 The theoretical framework

The theoretical framework for this study draws on STS, specifically concepts from Actor-Network Theory (ANT) and technology-in-practice. STS starts from the assumption that science and technology are thoroughly social activities. The field investigates how technological artefacts are constructed and asserts that artefacts are marked by the circumstances of their production (Sismondo, 2004). Therefore, drawing on theories from this field of research offers a useful theoretical perspective to explore the implementation of standardised tools. From this perspective, tools are viewed as everyday technologies that play an active part in healthcare as opposed to being inactive, inanimate objects in the form of paper-based or computer-based tools. The relationship between healthcare workers and technologies and tools in clinical settings is a common question in healthcare improvement. Viewing this relationship as a sociotechnical phenomenon, through the lens of ANT and technology-in-practice, offers a way in which to view interactions between healthcare workers and technology to gain a more nuanced understanding of what happens when a new initiative is implemented.

ANT provides a conceptual framework for exploring the network of users and the standardised tools. ANT is concerned with the connections between humans and non-humans, and gives equal agency to people and things. Accordingly, heterogeneous actors are linked in a web of relations, an actor-network (Latour, 2005). ANT considers the interactions, negotiations and

behaviours of actors; and it is the role of the researcher to trace and understand these relationships (Callon, 1986). ANT, therefore, allows researchers to develop a rich understanding of the many complex and dynamic heterogeneous networks where multiple social and technical actors and the process of social change interact during the introduction of new technology (Cresswell, 2010).

During the 1990s, in the field of technology-in-practice, medical sociologists borrowed from the interdisciplinary field of STS to embrace a more dynamic way of analysing medical technologies. Drawing from social constructivism, the general purpose was to gauge what health technologies are based on the assumption that they have the power to transform workplaces in different ways. The introduction of an artefact requires negotiation with existing work practices, and it is through this process of convergence of technologies in practice that artefacts and workplaces transform each other (Timmermans and Berg, 2003).

Of particular interest to this research are the notions of 'map' and 'terrain' to describe the sepsis screening tool and Sepsis Six care bundle as formal tools and the empirical world (Berg, 1997a; Star, 1989). When the formal tools were implemented, the gap between the representation (map) and represented (terrain) had to be crossed. The distance between the representation and represented is crossed by a chain of re-representations that interlock the formal (map) with the empirical (terrain). It is this interrelation that results in the generative power and the change in work practices.

This research responds to the call to examine, systematically and critically, the role that everyday technologies have in organisational life (Allen, 2017). The study provides an opportunity to extend theoretical knowledge by demonstrating empirically how concepts from ANT and technology-in-practice can be used to explain the implementation of care bundles. The ultimate aim

is to improve patient care, and the findings will contribute towards the development of theory within the field of implementation science.

1.4 Contributions

This research offers two contributions to implementation science. Firstly, by tracing the associations of heterogenous entities, this research found that two actor-networks were simultaneously translated for the external guidelines to be interpreted and implemented: one actor-network operated at the executive and corporate level, as external guidelines were interpreted and as implementation strategies were designed; the other occurred when the tools were in use at the clinical frontline.

Secondly, by viewing the care bundle as formal tools, this research found that the fixed and rigid criteria inherent in the tools did not account for the wide span of characteristics of different clinical settings. As such, audit of compliance with care bundle implementation for external and internal purposes was unable to capture the intricate subtasks required for their use in clinical practice.

This research offers two contributions to ANT and technology-in-practice. The first relates to Berg's (1997a) application of concepts from ANT and technology-in-practice that underpin the conceptual framework applied in this research. By undertaking an ethnography, Berg (1997a) explored the implementation of the electronic health record within one Intensive Care Unit (ICU). He paid attention to how the social structures in the ICU influenced the implementation of a formal tool and queried how the formal tool actually worked in practice, by observing the intertwinement of the tool and practice in real time. He used the notions of distribution and drift to explain what the interrelation between the tool and clinical practice looked like when the tool was in use and argued that generative power arose from the interrelations of the tool and the healthcare workers and was not solely attributed to the tool or the healthcare workers.

This research offers further application of ANT and technology-in-practice to understand implementation of care bundles in two clinical contexts: the Emergency Department (ED) and the acute inpatient setting. The clinical contexts differed in configuration and work practices and also differed from Berg's ICU example. Moreover, the case study approach enabled the application of the conceptual framework to understand how the characteristics of two different organisations influenced the implementation of formal tools, and how two different clinical settings influenced the interrelation between the tools and clinical practice. This research demonstrated empirically how and why the social structures of two different organisations and two different clinical settings influenced implementation of a screening tool and care bundle.

The second contribution to knowledge relates to Akrich's (1992) notion of scripts. This research has explained that sepsis screening tools and the Sepsis Six care bundle were interpreted in different ways than was originally intended by the designers. The meaning attributed to the tools had an impact on development of implementation strategies and their use in clinical practice. Applying the notion of scripts to the implementation of standardised formal tools has contributed towards ANT and technology-in-practice by demonstrating how an empirical application of the notion of scripts can help to explain technologies-in-use.

1.5 Outline of the thesis

Chapter 2 – Literature review

This chapter provides a framework for the empirical study. The literature review will firstly give an overview of implementation science. The influence of external drivers, specifically financial incentives, on the interpretation, implementation and use of evidence-based medicine in the context of secondary care in the NHS will then be explored. The purpose is to set the background on implementation science as an approach to understand the complexity of implementing evidence-based medicine. Secondly, the

literature will introduce and then explore care bundles as a form of standardised tools to implement evidence-based medicine. The underpinning principles of care bundles will be unpacked. Sepsis screening tools and the Sepsis Six care bundle have been selected as the case for this research and the literature related to their implementation will be reviewed.

Chapter 3 – Theoretical framework

Chapter 3 outlines the theoretical framework for the research by providing a review of the literature related to ANT and technology-in-practice. Firstly, there is an overview with a focus on the concepts which make up the theoretical framework used in this research. The chapter explores how the theories have been applied in the literature to the implementation of information technology initiatives in healthcare. Following this, the chapter explains how, when applied together, concepts from ANT and technology-in-practice provide a useful and interesting theoretical perspective that has the potential to inform the implementation of tools associated with sepsis improvement. These theories emphasise the performative nature of quality improvement, and suggest that quality improvement comes from a contingent series of interactions between various actors in the networks involved in implementation. The chapter concludes with the two main aims of the research and the three research question derived from findings of the literature review and the theoretical framework.

Chapter 4 – Methodology

In this chapter the research methodology is described and the philosophical assumptions that underpin the study are set out. The rationale is made for selecting the methodological approach of ethnography and Yin's (2009) approach to case study as the method, with observations, interviews and documentary analysis. A reflexive account of the research process is presented. The case sites are introduced and a detailed description of the inductive analysis strategy follows. The chapter concludes with how the

research has addressed the four criteria of trustworthiness posited by Lincoln and Guba (1985).

Chapter 5 – Southside Hospitals NHS Foundation Trust and
Chapter 6 – Westside University Hospitals NHS Trust

Chapters 5 and 6 provide a rich description of the empirical findings at the two case sites. Each chapter begins with a narrative of historical events related to sepsis improvement and how external forces were interpreted and operationalised locally. A narrative of healthcare workers' experiences using the tools at the clinical frontline follows.

Chapter 5 describes how sepsis improvement at Southside was influenced by financial incentives and an absence of governance reporting structure related to sepsis improvement. Conversely, Chapter 6 illustrates how sepsis improvement at Westside was led by a stable multi-professional team for over 10 years. Improvement was supported by a quality improvement infrastructure that had received investment for a number of years and benefited from embedded governance reporting mechanisms. The data generated at both case sites showed that practices varied from patient to patient, between staff, from one shift to the next, and even hour by hour due to the unpredictability at the clinical frontline. The practices were influenced by what was happening in that moment in the clinical area, and were fluid, dynamic, flowing and erratic. In contrast to the physical environment, where frontline care was delivered, the tools were ordered, static and fixed. In the clinical setting at both case sites, work practices were more aligned to the recognition and treatment of sepsis in the ED than in acute inpatient settings.

Chapter 7 – Cross-case comparison

Chapter 7 presents the cross-case comparison of the findings. The comparison found similarities and differences between the case sites. Externally imposed financial incentives had an influence on implementation of sepsis improvement tools at both case sites. The temporal nature of the targets resulted in implementation plans devised to encourage behaviour change

towards the target. At Southside, there was evidence of 'silo working'; the corporate nursing team was responsible for implementing the financial target and sepsis improvement, which resulted in periods of uncertainty as the external sepsis guidelines and the terms of the financial targets changed. At Westside, a multi-professional team was empowered to lead sepsis improvement and it developed approaches using a quality improvement methodology which aligned with local need. At both case sites, concern was expressed about how reliance on the tools might result in a barrier to the staff's development clinical knowledge and judgement in the recognition and timely treatment of sepsis. A gap emerged between the perception that the tools required underpinning knowledge, and the perception that the tools were simple, quick and easy to use. At both case sites, the tools served multiple purposes and embodied diverse scripts that impacted upon everyone involved in their implementation, from the executive board to the clinical frontline.

Chapter 8 – Discussion

The empirical findings from the case sites and the cross-case comparison are discussed within the context of ANT, technology-in-practice and implementation science. Analysis found that two actor-networks were simultaneously translated for the external guidelines to be interpreted and implemented, one at a corporate level and the other in clinical practice. The findings and use of concepts from this literature suggests that financial incentives can shape implementation strategies but tend to drive the focus of improvement activity towards achieving the narrow focus of the financial target. This results in a drift from the intention of the evidence-based medicine which underpinned the design of the tools. However, drift can be mitigated by a quality improvement infrastructure and governance system that supports and enables improvement outside of financial targets. When implemented, the gap between tools and practice was crossed by a chain of re-representations. Each re-representation contained a multitude of actions and decisions that were highly distributed across a range of heterogeneous

entities, which resulted in the various elements drifting. The degree of distribution and drift was influenced by the proximity of healthcare workers, patients, tools and equipment to each other and the problem-solving skills of healthcare workers.

Chapter 9 – Conclusion

Drawing on the empirical and theoretical findings, I argue the care bundles as examples of standardised tools, do not slip into some predefined space in the workplace and getting tools to function as intended requires sensitivity to the work setting and awareness of potential unintended consequences. The implications for implementation science are outlined, along with strengths and limitations of the study and suggestions for future research.

Chapter 2: Literature review

2.1 Introduction

Over the course of the twentieth century, scientific enquiry and, as such, knowledge production and dissemination, have become systematic and protocol driven (Broom and Adams, 2012). Accordingly, within the field of healthcare the view has been widely taken that every decision a doctor makes should be supported by scientific evidence (Timmermans and Angell, 2012). The reliance on scientific evidence in order to standardise such decision-making has been labelled evidence-based medicine (Sackett et al., 1996). The result was a philosophical shift towards regulation and systematisation of healthcare and the expectation that professional practice would be influenced by the distillation of research findings into guidelines (Berg, 1997b).

The latter part of the twentieth century saw the rise of international consensus committees whose goal was to streamline the application of scientific knowledge through the aggregation of findings from clinical trials into practice guidelines. Consensus development became a model for producing clinical guidelines (Weisz et al., 2007). Broom and Adams (2012: 1) suggest that this 'fundamentally changed the way both science and medicine were practiced in terms of research priorities and practice guidelines.'

Despite the development and influence of international consensus committees, the translation of research evidence into practice is widely recognised to be a complex task. A review of UK health research funding (Cooksey, 2006) articulated the growing recognition amongst policymakers and service leaders that, despite significant public investment in health research, new evidence-based interventions and technologies did not smoothly transfer from the research environment into routine clinical practice or service organisation. The translation of research into practice is

traditionally referred to as occurring within a pipeline, that is, as a rational, linear process, from bench to bedside, in a stepwise manner. The *Report of the High Level Group on Clinical Effectiveness*, more commonly known as the Tooke Report (Tooke, 2006), pointed to the variation in implementing evidence-based practice and suggested that research needs to recognise how care is provided in more nuanced ways than was previously understood. The field of implementation science has been developed in recognition of the need for focussed effort to understand the translation of evidence-based medicine into clinical practice (Bauer et al., 2015).

The literature review will firstly give an overview of implementation science. The influence of external drivers, specifically financial incentives, on the interpretation, implementation and use of evidence-based medicine in the context of secondary care in the NHS will then be explored. The purpose is to set the background on implementation science as an approach to understand the complexity of implementing evidence-based medicine.

Secondly, the literature will introduce and then explore care bundles as a form of standardised tools to implement evidence-based medicine. The underpinning principles of care bundles will be unpacked. Sepsis screening tools and the Sepsis Six care bundle have been selected as the case for this research and the literature related to their implementation will be reviewed. The overarching aim of this literature review is to offer a foundation for the empirical study.

2.2 Implementation science

Implementation Science seeks to understand factors that determine why an evidence-based intervention may or may not be adopted (Handley et al., 2016). It is a growing field within healthcare and was born out of the recognition that translating evidence-based medicine into clinical practice to benefit patients is an adaptive and dynamic process that needed to be addressed through a research agenda to understand and improve the process

of implementation (Damschroder, 2019). The Health Foundation (2011) made a distinction between improvement, as optimising the benefits of change, and implementation science, as maximising learning from improvement. Accordingly, the aim of implementation science is to build an evidence base on how healthcare providers and systems can improve their work by translating evidence into practice. Eccles and Mittman (2006: 1) define implementation science as:

> the translation of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services.

Implementation science draws on the use of theory to build knowledge about what works, how and why (Damschroder and Hagedorn, 2011). Kislov (2018) states that theoretically informed improvement research implies:

> a dialogue between the theoretical and the empirical, whereby the researcher uses a particular case or set of cases as an opportunity for further refining previous conceptualisations of general processes contained in the earlier theoretical accounts.

Healthcare is a complex setting where multiple interventions are implemented with the intention of improving quality and safety (Allen et al., 2016; Dixon-Woods, 2019). Damschroder (2019: 1) produced a schematic of key foci for implementation science (Figure 1) and highlights that these foci are embedded, interact and are influenced by multiple levels of contextual domains, including individuals and inner and outer settings. Implementation scientists seek to understand the roles and impact of each of these dimensions.

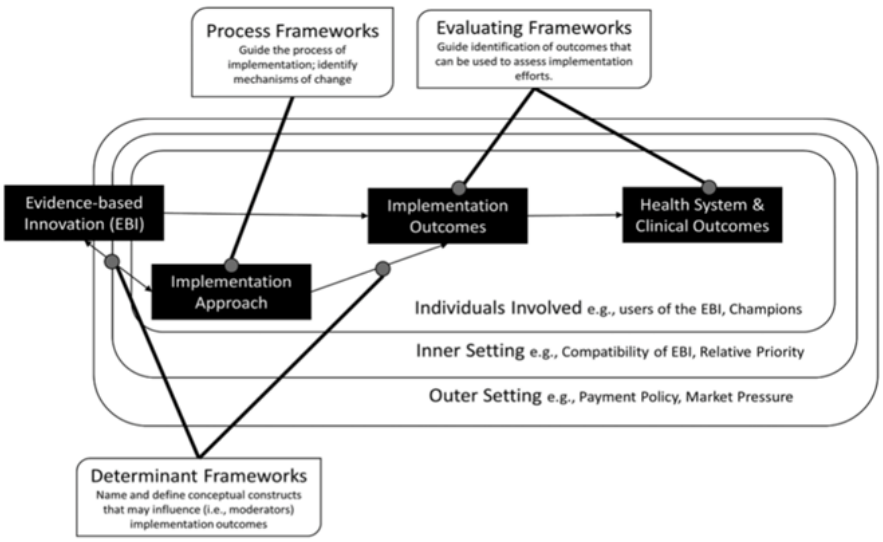


Figure 1. Schematic showing key foci for implementation science (Damschroder, 2019: 1)

In recent years, the growing evidence base related to implementation strategies, actors and contexts has been used to inform the development of theories, models and frameworks (Kislov et al., 2019). The use of theory in improvement can help to identify any unintended consequences and impact on organisational function and processes, so that balancing measures may be integrated into plans (Dixon-Woods, 2019). According to Damschroder (2019: 5), by focusing on developing and testing methods to spread successful sustained implementations broadly, across diverse settings, a well-developed theory can guide the practice of implementation and 'enables knowledge to emerge out of seeming chaos'. Therefore, using a theoretical framework for implementation can help to guide planning and communication between stakeholders and provide structure in identifying key relationships and their connection to the desired outcomes.

In the field of implementation science, several theories and theoretical frameworks have been developed and applied empirically. For example, Normalisation Process Theory (NPT) is concerned with the social organisation of implementation, and the embedding and integration of practices into social contexts (May and Finch, 2009). In collaboration with May and with insights

from NPT, Allen's most recent work (2018, 2019) draws on concepts from ANT and other sociological theories (in addition to NPT), to develop Translational Mobilisation Theory (TMT), a middle-range theory that 'explains how emergent projects of collective action are progressed in complex organisational contexts' (May, 2019: 36). In response to the failure and partial successes of technology-supported innovations in healthcare, Greenhalgh et al. (2017) developed the Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework. The framework has been developed to facilitate complex thinking with a view to generating insights about technological advancements in healthcare. Each framework has been designed to offer a structured approach to exploring the dynamic nature of complex sociotechnical systems in which healthcare improvement initiatives are implemented.

Despite the growing field of implementation science theories and conceptual frameworks the consistent delivery of high-quality, safe healthcare continues to be a common worldwide challenge. The influence of external drivers, specifically financial incentives, are a source of challenge for implementation of evidence-based medicine in healthcare.

2.3 Sources of challenge for implementation of evidence-based medicine in healthcare

Within the English NHS, the delivery of services is frequently perceived to be in a context of crisis, be it due to increasing public expectations, budgetary constraint or widely reported failings in care (Francis, 2013; Kirkup, 2015). Hospitals are increasingly seen as risky places, 'a field full of dangers', not simply a domain where patients are cured and cared for (Zuiderent-Jerak and Berg, 2010: 324).

Healthcare organisations are complex environments where multiple quality improvement initiatives are implemented on a regular basis to address the issues of quality and patient safety. Such initiatives are generally influenced

by forces external to the organisation, such as evidence-based medicine and financial targets. As such, healthcare systems are complex, and are challenged internally and externally by political, technical, professional and social influences. Standardisation of care, in the form of tools such as care bundles, pathways and checklists, is a widely used mechanism in the translation of complex scientific research findings into practice. Indeed, such standardised tools are often considered to be a crucial component of healthcare policy and quality improvement initiatives (Ferlie et al., 2000). They are, though, commonly a fixed and rigid representation of complex evidence-based medicine that require local interpretation and implementation strategies which typically have to be adapted to local contexts (Kislov, 2018).

Despite attempts to standardise the delivery of healthcare and improve healthcare through the use of evidenced-based medicine, variation in uptake between organisations persists (Davidoff et al., 2015). Adherence to standardised tools is frequently low, with messy, complex and interactive processes influencing their diffusion and adoption (Greenhalgh et al., 2014). Very rarely does a single method change people's behaviour. Rather, the variability in patterns and speed of diffusion can be accounted for by the influence of the local context. Even those innovations supported by robust scientific evidence can face complex and problematic processes in being translated into practice (Ferlie et al., 2000; Fitzgerald et al., 2003). Furthermore, the range, diversity and complexity of external expectations and requirements that NHS organisations face present a challenge for creating unifying visions for patient safety and quality, and for setting clear objectives (Dixon-Woods et al., 2014b).

Accordingly, in the NHS there is a 'replicability problem' regarding the implementation, sustainability and spread of quality improvement innovations. Many approaches exist to mandate uptake of quality improvement interventions but there is evidence that this does not automatically change outcomes (Horton et al., 2018). The volume of initiatives and the influence of external drivers can result in hurried implementation.

Davidoff et al. (2015) comment that this often results in implementation that does not include outcome measures to assess impact and that the social and technical processes that an initiative is intended to improve are often unclear. Moreover, a lack of understanding about why an implementation strategy was a success or failure can thwart replication elsewhere (Taylor et al., 2014). Dixon-Woods (2019), in her recent Harveian oration, commented that the current uptake of quality improvement activity in the NHS is uneven. Balancing competing pressures of delivering the service with building awareness of quality improvement approaches and capacity to deliver quality improvement were cited as a challenge.

The Health Foundation's Safer Clinical Systems programme identified that wider system issues often impede the successful implementation of tried and tested quality improvement initiatives. Such issues were 'symptoms of deep organisational pathologies with long histories and complex dynamics and outside the control of project teams' (Dixon-Woods et al., 2014a: 13). Local organisational context is therefore important in helping or hindering change.

Much of the research into quality and safety and into how externally driven improvement can be interpreted, adapted to and implemented in the local context has been situated in the positivist paradigm and dominated by subjects such as human factors, safety science, social psychology and medical science, which has framed how it should be understood (Waring et al., 2016). This is reflected in policy and initiatives in the NHS, such as financial incentives, where improvement can be measured and risk understood by objective and systematic analysis (Waring, 2013). Such conditions create a bureaucratic form of management, resulting in the need to display compliance (Dixon-Woods et al., 2014b). NHS organisations put a considerable amount of time, effort and resource into data collection and monitoring systems. Frontline staff responsible for delivering care and treatment frequently have to collect data, but often see this as merely a box-ticking exercise (Dixon-Woods et al., 2013).

In this research, financial incentives were an external driver on the implementation of an evidence-based intervention in healthcare. Financial incentives generate bureaucratic work; they foster standardisation and require documentation of adherence to standards (Sauder and Espeland, 2006). Information gathered for financial targets is drawn upon by other healthcare staff for different purposes. Secondary utilisation of information results in its presentation as a commodity; in the present context, the output required for the financial target then becomes an attribute of the organisation rather than the service a patient has received from a healthcare worker (Allen, 2009). Berg and Goorman (1999) argue that information should be conceptualised as always being entangled with the context of its production. For instance, for a typical clinical audit, administrators, well away from the clinical frontline, require more detailed and timelier information about aspects of the patient's journey.

According to Berg and Goorman (1999) this results in a change in the way that staff work – to improve care through standardisation – but also means that they have to provide information on targets and quality assurance. When the information is for secondary (non-care) purposes, there is an additional burden on healthcare workers, which Berg (1999b) considers to be highly problematic. Extra tasks take time away from staff's primary responsibility: patient care. Implemented in the name of improvement, tools can lead to an additional burden on workers and may diminish quality by diminishing the time available for patient care. A review of financial incentives, with a focus on Commissioning for Quality and Innovation (CQUIN) payment framework used in the English NHS, to incentivise implementation of sepsis screening tools and the Sepsis Six will now be presented.

2.4 Financial incentives in healthcare and their impact on quality improvement

Since the 1980s, many countries have required that healthcare organisations demonstrate performance against indicators and provide assurance that

performance targets are achieved (Levy et al., 2014). In this setting, auditing and inspecting practices become highly valued and important tools of change. Power (1999) termed this 'the audit explosion'. This explosion was also driven by political demands on behalf of taxpayers, patients and others for greater accountability and transparency of service-providing organisations (Gleeson and Knights, 2006). This reflects Power's (1999) argument that performance measurement systems more generally create and support a window on organisational life, one which is often demanded by outside agencies, and which makes various kinds of internal and external intervention possible.

Data collection requires investment in staff to collect and register the right information and to render clinical work accessible and quantifiable (Sauder and Espeland, 2006). The very nature of financial indicators means that they draw attention to what can be measured and define cut-off points for what constitutes compliance (Wallenburg et al., 2016). Therefore, a financial target implies a 'script' that specifies the roles of users, skills and final outcomes (Franco-Santos and Otley, 2018: 698). Target-driven financial schemes can, though, result in goal displacement and gaming (Hood, 2006; Mannion and Braithwaite, 2012). Preoccupations with demonstrating compliance with external expectations, failing to listen to negative signals, and a lack of knowledge of the real issues at the frontline are all reported to create blind spots within an organisation (Dixon-Woods et al., 2014b). Dixon-Woods (2019) recently commented that under these conditions organisations are stimulated to improve but do not necessarily know how to improve.

The unintended consequences of financial incentives may have a perverse impact on organisations. Directive performance management systems have been shown to produce strategic behaviour or gaming as individuals alter the way in which they behave to fulfil performance expectations (Hood, 2006). Rigid targets can lead to measurement fixation and tunnel vision, with an undue focus on the dimension of performance included in the measurement system, displacing other important but unmeasured aspects of performance (Smith, 1995; Mannion and Braithwaite, 2012). Compliance with financial

targets typically has to be demonstrated for each quarter in the financial year. This adds a temporal nature to the achievement of targets. Smith (1995) uses the term myopia to describe how financial targets can lead to excessive concentration on immediate short-term issues to the exclusion of important long-term considerations.

The quality of care is complex and involves all kinds of qualitative valuations that are hard, if not impossible, to quantify and capture in an indicator (Wallenburg et al., 2016). To explain the impact of measuring clinical practice against a target, Mannion and Braithwaite (2012: 571) refer to 'quantification privileging', which is a preoccupation with reducing complex social phenomena to numbers and the attendant loss of the appreciation of qualitative or softer aspects of healthcare. This can lead to aspects of care that are not (or cannot be) measured being overlooked (Hood, 2006). As a result, data should be indicative rather than definitive and interpreted in the light of local context. Sangaramoorthy and Benton (2012) argue that through processes such as quantification, social realties are transfigured, resulting in datasets that reflect the priorities of the audit, rather than reality. The intention may be to improve patient care but the message is often about a need to meet a target, or to reduce an incidence rate, which can crowd out this intention, leading Wadman et al. (2018: 2) to refer to a 'vicious cycle of quality control'.

Behavioural science theory has offered insights into why financial incentives do not always lead to the desired output. When people are intrinsically motivated, they experience interest and enjoyment, and feel competent and self-determining (Deci and Ryan, 2000). The effect of financial incentives on intrinsic motivation has become known as 'crowding out', and self-determination is impaired when the actor feels that an outside intervention is restricting their autonomy. Outside interventions, when they are perceived as controlling, can crowd out intrinsic motivation; thus, financial rewards, made conditional on performance, can crowd out intrinsic motivation (Frey and Jegen, 2001). A logic that underpins financial incentives is a reliance on

individual behaviour change and, consequently, upon strategies to improve individual performance rather than system or process issues. This reliance can lead to improvement strategies that pertain towards blame and isolating individuals in the hope that getting them to change will improve uptake of a new innovation (Aveling et al., 2015). Furthermore, Wensing and Grol (2019) argue that without analysis of the impact of behaviour change approaches, then systemic and organisational problems are potentially ignored. McDonald (2014) comments that, despite a lack of sound evidence, policymakers continue to embrace incentives as a lever for change. However, in practice, financial incentives have failed to realise the potential benefits of changing professional behaviour and alignment with policy goals.

In 2009 in the English NHS, the Department of Health introduced the CQUIN payment framework in the English NHS. The key aim of the CQUIN framework (DoH, 2008a) was to support a shift towards a vision set out in *High Quality for All* (DoH, 2008b), of an NHS where quality is the organising principle. The premise of CQUIN is that monies are used to incentivise providers to deliver quality and innovation improvements above the baseline requirements set out in the NHS Standard Contract (DoH, 2016b). This CQUIN was selected as the financial incentive to study in this research as the terms of the CQUIN contract typically require healthcare organisations to implement and audit compliance with an evidence-based intervention such as a checklist, care pathway or care bundle. A review of the CQUIN payment framework will now be presented.

2.4.1 Financial incentives in the English NHS

In 2012 the Health and Social Care Act (Secretary of State for Health, 2012) introduced large-scale structural reorganisations in the NHS. A payment system through which commissioning bodies purchase healthcare from providers was used to promote efficiency in a context where demand is high and resources are finite (Marshall et al., 2014). Clinical Commissioning Groups (CCGs) were the organisations responsible for commissioning services from

secondary and community providers. Within this system, pay-for-performance schemes, such as the CQUIN payment framework, linked financial payments between CCGs and providers with the quality of care delivered. This was done on the basis that measuring improvement in clinical processes was expected to lead to better patient outcomes (Meacock et al., 2014). However, the system was criticised for the complex interorganisational relationships that had to be formed to navigate the newly established complex organisational networks (Walshe, 2013).

An Impact Assessment (DoH, 2008c) was undertaken prior to the introduction of the framework. The Impact Assessment highlighted how CQUINs would allow local commissioners and providers to negotiate the details of an agreement within an overarching national framework. The intention was that the local agreement would generate enthusiasm from providers to promote engagement with the scheme rather than being imposed upon the provider by an external source. In addition, it was believed that local design would identify goals and priorities that were not known centrally and allow for different degrees of 'stretch', dependent on an organisation's current level of performance (DoH, 2008c: 25). The intention of the policy, according to the Impact Assessment, was to support the provision of better patient outcomes by embedding quality improvement as part of the commissioner–provider discussion and making the payment system reflect quality (DoH, 2008c). Further, the process was intended to lead to quality improvement across the NHS (Kristensen et al., 2013). However, a number of cause-and-effect theories formed part of the Impact Assessment, which according to McDonald et al. (2013), led to assumptions on the effect CQUINs would have on patient outcomes.

Since their inception in 2009, the financial value of CQUIN schemes has increased. In 2009/10, the CQUIN payment framework covered 0.5% of a provider's annual contract income; from 2016 it increased to 2.5%, meaning that CQUIN allows NHS commissioners to hold back 2.5% of the provider's payments contingent on quality (DoH, 2016b). The CQUIN payment

framework made a proportion of provider income dependent on local organisations meeting the agreed quality improvement goals. Payment of expected funds were withheld if targets were not met (DoH, 2008a). Therefore, the CQUIN framework can be seen as a penalty not a bonus scheme (Meacock et al., 2014).

Meacock et al. (2014) commented that the local design of the CQUIN schemes made it difficult to evaluate their overall impact. Kristensen et al. (2014) undertook a large mixed-methods study with NHS staff at 12 case study sites to explore the benefit of locally designed CQUIN schemes. They found that the local schemes did not generate local enthusiasm due to insufficient involvement of frontline staff. Whilst identification of local need and priorities was successful in defining indicators, agreeing thresholds and setting prices was a process requiring specific expertise that did not exist in each locality. Due to the high degree of local experimentation, it was difficult either to draw lessons about the design process or, subsequently, to determine the CQUIN's impact on patient outcomes. The authors concluded that to allow for systematic learning, despite the policy goal of local improvement, a more structured national framework would be preferable.

McDonald et al. (2013) conducted an evaluation of the CQUIN framework and found that as a result of the wide range of schemes and indicators in the national CQUIN picture, assessing their impact was problematic. Implementation of the CQUIN framework departed from the underpinning theory, which, as described above, was to support the provision of better patient outcomes by embedding quality improvement as part of the commissioner–provider discussion (DoH, 2008c). The evaluation found that the schemes were useful in helping commissioners and providers to identify local quality improvement needs. However, the schemes could place a heavy burden on participants and did not involve frontline clinicians. Consequently, in the absence of the anticipated engagement, the authors conclude that the schemes are unlikely to generation local enthusiasm. This has led 'to a muted potential impact of the policy' (McDonald et al., 2013: 23).

According to Donabedian (1966), health outcomes are the ultimate validators of the quality of hospital care. However, incentive schemes tend to focus on processes, as these are generally more straightforward to measure than outcomes and are easier to attribute to providers (Doran et al., 2017). This view is supported by Cochrane Collaboration's review of reviews, based on four systematic reviews of 32 studies, which concluded that financial incentives are generally effective in improving targeted process of care, but there was little evidence for improved patient outcomes (Flodgren et al., 2011). Pross et al. (2017) consider that quality reporting needs to be actionable, with the ability to differentiate between care units so that providers can assess their own performance relative to national and competitor benchmarks. However, because of the differences between care units this implies risk adjustment, but also demands standardised and validated indicators and data inputs.

Incentive schemes, therefore, as a consequence of their one-size-fits-all nature, promote a guideline-driven approach and rely on providers responding in predictable and rational ways (Doran et al., 2017). However, in England, CQUIN indicators were interpreted at trust level, which resulted in output being seen as complex and not comparable across trusts (Pross et al., 2017). A review based on 22 systematic reviews of pay-for-performance programmes warned that the positive impacts of incentives were difficult to separate from those of other local improvement initiatives implemented contemporaneously, thus further reducing the possibility of any fair comparison between organisations (Eijkenaar et al., 2017).

Performance measurement should ensure rapid iterative improvement of process measures, with measures revised promptly when errors are identified in specifications, new evidence is introduced or unintended consequences uncovered. In reality, in the case of CQUINs, any measure modification and eventual implementation occurred in the next fiscal year (Bilimoria, 2015). Once the terms of the contract had been agreed between the CCGs and the provider, they remain fixed for the financial year. Providers reported

compliance with the target each quarter and, if the targets were met, the providers receive a proportion of the annual payment. Despite the intention that CQUINs encourage innovation, this temporal restriction on payment may result in an unintended consequence of stifling provider innovation.

2.5 A sociotechnical approach to implementation science

The literature reviewed so far in this chapter has shown that implementation of evidence-based interventions in clinical practice is complex, with the use of financial incentives contributing towards this complexity. Indeed, over decade after the Tooke Report (Tooke, 2006) was published, translating evidence into practice continues to take a rational-linear approach. High-profile researchers in the field have commented:

> when designing intervention and implementation strategies, as well as when conducting rigorous evaluations, there is a tendency to reduce messy world situations into the individual component parts in an attempt to determine the relationships between them. Doing so risks overlooking the complex and intricate patterns that emerge from their interactions. (Reed et al., 2018: 2)

Braithwaite et al. (2018: 3) add that a rational approach does not account for the complexity of the healthcare setting, which is 'characterised by uncertainty, emergence, and embedded unpredictability'. To address the gap between the production of research and the delivery of evidence-based interventions, there needs to be an understanding of how best to translate evidence to achieve improvements in care (Auerbach et al., 2007; Greenhalgh et al., 2014, Reed et al., 2018). Before turning to the selected focus of this research – care bundles and the Sepsis Six as an example of an evidence-based intervention that has been financially incentivised – the next section will discuss the role that implementation science can play in addressing the sources of challenge for implementation reviewed in this chapter.

An issue related to financial incentives in quality improvement is that unintended consequences can occur distally to the target intervention.

Current approaches to improvement 'do not always lend themselves to their detection and correction' (Dixon-Woods, 2019: 50). In addition, with the focus mostly on the desired outcome, as highlighted in this literature review, quality improvement projects do not always consider their impact on the system as a whole. The result is initiatives that are focussed on linear, cause-and-effect models to identify risk and implement improvement (Waring et al., 2016). As such, there is a conceptual division between the design of an intervention that is linear and driven by external requirements and the dynamic nature of the context in which it is applied. May et al. (2016: 1) consider that, as a result, the context is often framed as creating barriers to the smooth delivery of the intervention:

> the problem for implementation science is that contextual 'confounders' that act as barriers to implementation are in fact what constitute the normal conditions of practice and are rarely taken into account in that form. Contexts are dynamic: contextual factors that might constitute barriers to implementation in one place may facilitate it in others.

Without a thorough understanding of context, implementing and sustaining any innovation is a complex undertaking (Bauer et al., 2015). Recognising that implementation processes are sets of accomplishments, and their contexts are non-linear, emergent and dynamic, located within a whole system, acknowledges that adoption of implementation interventions is likely to differ between contexts (Chandler et al., 2015). Accordingly, a poor theoretical underpinning of implementation activities makes it difficult to understand and explain why implementation efforts both succeed and fail (Dixon-Woods et al., 2013; Davidoff et al., 2015; Nilsen, 2015). Therefore, there is a need to establish the theoretical bases of implementation and strategies to facilitate implementation (Nilsen, 2015).

This research has drawn upon ANT and technology-in-practice, to view external drivers as actor-networks and to trace their associations as they were interpreted and implemented, from the executive board to the clinical frontline in secondary care in the NHS. Care bundles were viewed as formal

tools, actors that 'do things' when implemented within existing social practices. Accordingly, the view was taken that quality improvement initiatives frequently generate interventions that hinge on the introduction of novel material and symbolic artefacts into established social practices and forms of social organisation, often on the premise of bringing about behavioural or cultural change (Allen et al., 2016). This results in multiple technologies and tools that are viewed as amenable to external manipulation being in use at any one time. However, when a tool is introduced into practice, a new actor is added to a strongly preconfigured world, and its introduction requires negotiations with all relevant extant elements (Berg, 1997a). Change initiatives predicated on linear behaviour change models (such as financial incentives) often create difficulties that are consequential for their implementation, and inevitably generate unintended consequences, along with any of the intended benefits that they bring (Braithwaite and Coiera, 2010).

Understanding the generative mechanisms of tools and their unintended consequences requires analysis of the relationship between the tool and practices without exclusively attributing agency to the tool or the humans working with it (Allen, 2009). Dixon-Woods and Martin (2016) comment that specific interventions, such as care bundles and checklists, have been persistently emphasised as being the way in which to implement guidelines in practice, in order to improve quality. However, focussing on tools as the solution opens up the risk of overlooking the impact of context on implementation and the steps taken by an organisation to enable facilitating conditions such as infrastructure and technology.

The focus of the research was the implementation of a contemporary approach to translating complex guidelines into clinical practice, with the aim of improving quality and patient safety. This contemporary approach is the 'care bundle.' The implementation of care bundles is under the influence of external drivers such as evidence-based medicine and financial incentives. Such external drivers are interpreted at a corporate level in the organisation

and then implemented in clinical practice with the intention if improving quality and patient safety.

The care bundle selected for the research is the Sepsis Six. Initiation of a care bundle relies on assessment of a patient and the recognition that the specified 'bundle criteria' are met. In the case of the Sepsis Six, recognition that sepsis may be present and risk stratification of the severity of sepsis is required in order to 'trigger' (or not) administration of the Sepsis Six. Sepsis screening tools have been widely implemented to support healthcare workers to identify when the patient's condition 'triggers' the Sepsis Six care bundle (UK Sepsis Trust, 2018). As such, the focus of this research is sepsis screening tools and the Sepsis Six care bundle.

This literature review will now turn to care bundles, sepsis care bundle as a specific case and the historical development of sepsis care improvement including sepsis screening tools and the Sepsis Six.

2.6 Care bundles as a prominent example of the implementation of an innovation within healthcare

Care bundles are an example of a technology aimed at standardising healthcare to improve quality. In 2001, the US Institute for Healthcare Improvement developed the concept of the care bundle in response to the perceived need to reduce variation in intensive care services. The overall aim was to improve the reliability of care processes through the standardisation of care, using evidence-based guidelines (Haraden, 2014). The original concept recommended that a care bundle should contain three to five interventions based on level-1 evidence. In this context level-1 evidence is considered to be the randomised controlled trial (Resar et al., 2012). It is claimed that a care bundle enables multidisciplinary teams to work in unison to deliver the best possible care by bringing together scientifically grounded concepts that are both necessary and sufficient to improve the clinical outcome of interest (McCarron, 2011).

Initiation of a care bundle relies on assessment of a patient and the recognition that the specified 'bundle criteria' are met. The focus of measurement is the completion of the entire bundle as a single intervention, within a specified timeframe, rather than completion of its individual components (Patient Safety First, 2011). It is argued that the elimination of an individual step or component of the bundle negates a positive outcome (Simmonds et al., 2013; Steimo et al., 2015). Importance is placed on the consistent and systematic application of all elements within a bundle rather than on individual selective elements (Tanner et al., 2015).

A common characteristic of a care bundle is that it forms part of wider patient safety initiatives and implementation programmes. Compliance with the care bundle is measured as an indication of the provision of high-quality, safe patient care. However, adherence to care bundles depends on the interplay between factors that act as barriers or inhibitors (Camporota and Brett, 2011). Commonly, lack of knowledge, unavailability of resources, high costs, fear of adverse events and disagreement on the strength of the supporting evidence (Rello et al., 2002), in conjunction with external barriers, can affect a physician's ability and willingness to execute recommendations (Cabana et al., 1999). In addition, regardless of the strength of evidence, some clinicians oppose the concept of care bundles in general, arguing that bundles are used by industries as a marketing tool, deprive clinicians of clinical autonomy and increase the risk of over- or under-treatment (Amerling, 2008). Further, opponents argue that care bundles may be inappropriately adopted as a measure of organisational performance or suffer from positive publication bias and lack of external validity in the real world (Camporota and Brett, 2011).

Policy-driven care bundles have become a widely used solution to a range of patient safety and quality issues in healthcare. Their apparent simplicity suggests that their adoption can effectively address complex system issues. However, the evidence for their use is mixed. Implementation teams are faced with complex sociological and cultural challenges that continue to

dominate regardless of the evidence base and implementation methodology applied (Catchpole and Russ, 2015). Resistance to their implementation is often viewed as symptomatic of the culture or leadership or wider tensions between professionals and managers (Allen et al., 2016).

Berg (1996) considered that in healthcare the protocol is essentially a linear set of normative rigid statements that regulate action through a recipe, thereby creating an illusion of a single answer and an optimal intervention to every medical problem. This proposition can be applied to care bundles. Therefore, by advocating the care bundle approach, the work of managing a patient's health is reduced to a series of rational, formal steps, which in theory will solve the problem of variation in healthcare (Berg, 1997b). Proponents of the care bundle claim that the interventions are open for local adaptation and are not intended to remove the need for clinical judgement (Dellinger et al., 2004). However, clinical judgement is not considered to be a linear process and involves multiple facets that are at odds with the epistemological and ontological underpinnings of the care bundle. These are that healthcare work is a separate entity from the healthcare worker and can therefore be distilled into a set of instructions (Berg, 1996). When using clinical judgement to make a decision, the healthcare worker applies tacit knowledge. However, the care bundle does not include all domains of healthcare work. In addition, observational studies used to measure compliance with care bundles and in the field of patient safety research follow a measure and manage orthodoxy underpinned with positivistic epistemology (Waring, 2009).

Sepsis care is underpinned by evidence-based medicine and in the English NHS has been subject to the CQUIN scheme to incentivise improvement through a financial target. Sepsis has also been the focus of political and media attention, with several high-profile cases of failures in care. Therefore, sepsis is an appropriate and interesting case to research the influence of external drivers on the interpretation, implementation and use of a care bundle as an example of formal tools in healthcare.

2.7 Sepsis care bundle as a specific case

Sepsis is a potentially life-threatening condition caused by the body's response to an infection. It presents with various non-specific symptoms, making it difficult to recognise and diagnose. Delay in treatment increases the risk of mortality; sepsis kills at least 52,000 people a year in the UK. The National Confidentiality Enquiry into Patient Outcome and Death (NCEPOD) in 2015 identified an overall mortality rate of 28.9% (NCEPOD, 2015). And yet sepsis is relatively easy to treat if it is identified early. If unrecognised, however, the patient's condition is likely to deteriorate and lead to multi-organ failure and death. It is estimated that sepsis costs the NHS £2 billion every year. Early diagnosis could save 14,000 lives in the UK (UK Sepsis Trust, 2018).

It is often difficult to distinguish clinically between sepsis and severe infection. Without a clear definition of sepsis, it is challenging to provide early diagnosis and prompt treatment. Sepsis definitions have changed over time, and this has contributed to challenges in recognising the condition and therefore initiating treatment. Daniels and Nutbeam (2017) comment that with a complex condition, such as sepsis, for a definition to be operationally feasible at the bedside, multiple components are required. However, definitions are essential to promote a common language between healthcare professionals and to establish criteria and thresholds for intervention.

The following section provides an overview of the changes to international sepsis guidelines and care bundles. As indicated in section 2.6, initiation of a care bundle relies on assessment of a patient and the recognition that the specified 'bundle criteria' are met. In the case of the sepsis care bundle, patient assessment is undertaken by the healthcare worker using their tacit knowledge and/or with the use of a sepsis screening tool. Therefore, section 2.7 provides a brief overview of literature on sepsis screening tools. The purpose is to provide the reader with an insight into the complexity underpinning the development of sepsis care improvement before the data

are presented in Chapters 5 and 6, which explore the challenges associated with interpreting external guidance (in addition to the associated financial incentives) faced by the sepsis teams at Southside and Westside.

2.7.1 The case of sepsis care improvement

In the early 1990s, the paradigm of sepsis as a condition that is chiefly the concern of intensive care units was challenged. It was advocated that sepsis should be treated by applying similar urgent diagnostic and therapeutic principles as used in stroke, heart attack and trauma, at the point of presentation in the ED (Nguyen et al., 2017). The first definitions of sepsis were established in 1991, with a consensus committee defining stages of sepsis: systemic inflammatory response syndrome, sepsis, severe sepsis and septic shock. When two or more of the criteria are met, the patient has systemic inflammatory response syndrome (Bone et al., 1992). Identification of systemic inflammatory response syndrome triggered early and directed treatment: taking blood cultures; establishing the source of infection; and the administration of appropriate antibiotics, intravenous fluids and oxygen (Rivers et al., 2001). In 2001, Rivers et al. conducted a randomised controlled trial of the early treatment of patients with sepsis before they were admitted to the ICU. They concluded that when care was provided at the earliest stages of severe sepsis, it had significant short-term and long-term benefits. As such, early treatment became a fundamental component of care for patients with severe sepsis. In 2001 a consensus meeting at the International Sepsis Definitions Conference reported that concepts from 1991 of sepsis, severe sepsis and septic shock remain useful to clinicians and researchers (Opal et al., 2003).

The Surviving Sepsis Campaign (SSC) was formed in 2002 with the intention to reduce global sepsis mortality by 25% between 2004 and 2009. In June 2003, the SSC's guidelines on the recognition and management of sepsis were published. In September 2003, the SSC initiated a partnership with the Institute for Healthcare Improvement to produce sepsis care bundles and an

improvement campaign. In 2004, the SSC's 6-hour and 24-hour care bundles were published (Dellinger et al., 2004). In 2006, Kumar et al. published their landmark paper in *Critical Care Medicine*, which demonstrated that each hour of delay in the administration of antibiotics to patients in septic shock was associated with a 7.6% increased risk of death. Timely administration of broad-spectrum antibiotics remains a prominent aspect of sepsis care today (NICE, 2016; DoH, 2016a; UK Sepsis Trust, 2018).

A revised set of SSC guidelines were published in 2006 and included changes to ICU-level treatment; the care bundles remained unchanged. With publication of the third iteration of the SSC guidelines in 2012, the original care bundles were significantly revised, however: the 24-hour bundle was abandoned and focus turned to the first six hours of care for the patient with severe sepsis, with the development of 3-hour and 6-hour care bundles (Dellinger et al., 2013). In 2016 a consensus committee of 55 international experts met to provide an update to the 2012 SSC guidelines. The consensus committee advocated that sepsis and septic shock should be treated as medical emergencies and treatment should begin immediately. In addition, hospitals should have performance improvement programmes for sepsis (Rhodes et al., 2016).

In the same year, new definitions for sepsis and septic shock, known as Sepsis-3, were published (Singer et al., 2016). The international consensus committee concluded that the criteria for systemic inflammatory response syndrome were of inadequate specificity and sensitivity, and that the term 'severe sepsis' was redundant. As a result, it was removed from sepsis definitions, leaving the terms 'sepsis' and 'septic shock'. 'Sepsis' now referred to patients with evidence of organ dysfunction who would have been described as in severe sepsis prior to 2016. Patients who met the criteria for systemic inflammatory response syndrome in the presence of infection where considered to have uncomplicated sepsis (Singer et al., 2016). The international consensus committee also took the view that there was an important need for features of sepsis to be identified and measured in ways

that were simple, and that would be available promptly, at a reasonable cost and burden (Singer et al., 2016). In 2018, in response to the 2016 guidelines, leading members of the SSC published an update on the care bundles. The 3-hour and 6-hour care bundles were combined into a single 'hour-1 bundle'. Members of the SSC were of the view that an approach to treatment that was targeted at the first hour after diagnosis reflected the clinical reality at the bedside (Levy et al., 2018).

The literature on the efficacy of, and compliance with, the sepsis care bundle begins in 2004, with the first of the SSC guidelines and the 6- and 24-hour care bundles (Levy et al., 2004). The sepsis bundles were intended to be accomplished during specific time intervals following the presentation and recognition of a patient with severe sepsis or septic shock. Several studies suggest that the SSC care bundles reduce mortality but adherence is poor (Levy et al., 2014). In their systematic review and meta-analysis of observational studies on the effect of performance improvement programmes on compliance with sepsis bundles and mortality, Damiani et al. (2015) found that transferring evidence into clinical practice has proven difficult. Implementation initiatives included education, clinical decision-support tools and dedicated staff. Their findings suggested that any reduction in mortality seen following implementation of a performance programme could not be causally linked to greater adherence to the SSC guidelines. That is, the raised profile of sepsis as a result of a programme may be associated with reduced mortality rather than the implementation of the guidelines themselves.

Cowen et al. (2016) conducted a study which aimed to identify what junior doctors perceive to be the barriers to improving care for patients with sepsis and to assess the ability of junior doctors to recognise sepsis. The greatest barrier to improving sepsis care was the time pressure on doctors on call; in addition, knowledge of sepsis amongst junior doctors was poor. This is perhaps why the combination of education programmes and process improvement resulted in the greatest compliance (Damiani et al., 2015).

2.8 Sepsis screening tools

The sooner sepsis is identified the quicker patients can be treated and the potential for deterioration reduced. However, as highlighted early detection of sepsis can be challenging. Signs and symptoms of sepsis can be difficult to differentiate from other acute conditions (Rothman et al., 2016). The SSC recommends routine screening for sepsis at all levels of acute care (Dellinger et al., 2013). Screening tools are comprised of a set of criteria based on sepsis definitions and have been developed in paper form and automated electronic form. They are commonly completed by nurses (Bhattacharjee et al., 2017).

Paper-based screening tools have been identified as having several disadvantages. Completion is susceptible to human error and is performed intermittently when the nurse has a suspicion that sepsis may be present. In the event of severe sepsis being recognised and the sepsis care bundle being triggered the nurse has to inform a doctor for a plan of care and prescription of treatment, which can result in delays. Automated screening commonly occurs when healthcare staff input patient physiological observations into an electronic device. Automated screening can mitigate the risks associated with paper screening by screening the patient automatically and sending an automated prompt to doctors if the sepsis care bundle is triggered (Bhattacharjee et al., 2017).

Shah et al. (2018) evaluated the impact of a sepsis screening tool to determine its impact on the sepsis care bundle compliance in the ED. Increased compliance with the bundle was not observed, however there was a decrease in antibiotics administration time. A sepsis order set was also implemented at the same time which may have contributed to the reduction in time for the antibiotics to be received. The authors conclude that the study supports the initiative to promote early recognition and treatment of sepsis. Alberto et al. (2017) conducted a systematic review of screening for sepsis in general hospitalised patients. Included in the review was the sepsis screening tools and alert mechanism mediated by technology and the paper-based

screening tool. The electronic tools collected data in real time including laboratory values and vital signs. Prediction tools were based on an algorithm with levels of decision criteria. Alerts were sent to nurses who then escalated the treatment of the patient with severe sepsis to physicians. Similar clinical variables were applied in the paper-based screening tool. The electronic screening tools either identified sepsis continuously or at intervals. By contrast, the paper-based tool was used by nurses at the beginning of their shift. The electronic tools performed poorly in identifying sepsis patients, paper-based nurse-led tools appeared to be more sensitive but where only studied in small samples. Alberto et al. (2017) noted that in each paper included in the systematic review the implementation of screening tools was accompanied by a programme of improvement which included training and raising awareness of sepsis.

2.9 The UK context

To operationalise the sepsis care bundles in the UK context, the UK Sepsis Trust (formed in 2010) developed sepsis screening tools and the Sepsis Six care bundle. The Sepsis Six care bundle is a bundle of six interventions that are all to be instituted within an hour of recognition of severe sepsis (UK Sepsis Trust, 2019). Sepsis screening tools are used to stratify the severity of sepsis in order to identify if administration of the Sepsis Six care bundle is indicated. A prospective observational cohort study across a 500-bed general hospital found that simplified pathways, the Sepsis Six and education programmes, termed the 'Survive Sepsis' programme, can contribute to improving sepsis recognition and treatment (Daniels et al., 2011). In the UK, a number of political drivers have influenced implementation of the Sepsis Six care bundle. In 2013, an All Parliamentary Group on Sepsis was formed whose purpose was to provide a way in which parliamentarians, organisations and those affected by sepsis could discuss current provision. The group received clinical advice from the UK Sepsis Trust (All Parliamentary Group on Sepsis, 2013).

At the same time, the Parliamentary and Health Service Ombudsman (2013a) found failures in the recognition, diagnosis and early management of those who died from sepsis. In the same year the ombudsman published the report *An Avoidable Death of a Three-Year-Old Child From Sepsis* (Parliamentary and Health Service Ombudsman, 2013b), which catalogued a series of missed opportunities for healthcare staff to recognise and treat sepsis. In 2015, NCEPOD recommended that all hospitals should have a formal protocol for the early identification and immediate management of patients with sepsis. It indicated that the protocol should be available for all staff to use, staff should have training in its use and compliance with it should be audited regularly. Adherence with the Sepsis Six care bundle should also be audited (NCEPOD, 2015). In 2016, the National Institute for Health and Care Excellence (NICE) published guidance on sepsis: recognition, diagnosis and early management guidance. The guidelines included new risk stratification tools. The UK Sepsis Trust endorsed the guidelines and updated its own screening tools (UK Sepsis Trust, 2018).

To improve sepsis recognition and management in the English NHS, sepsis CQUINs were introduced in 2015. NHS England associated improvement with better outcomes for patients with sepsis, and with the potential to make financial savings (NHS England, 2015). The cross-system action plan published by NHS England in 2015 considered the challenges and opportunities a CQUIN related to sepsis would bring. The need to improve the recognition and treatment of sepsis had been widely cited in the reports of investigations into avoidable deaths from sepsis. The 2015/16 national sepsis CQUIN focussed on patients arriving at hospital emergency areas including oncology, paediatrics and maternity (Figure 2).

2a. Timely identification and treatment for Sepsis in emergency departments

Indicator	
Indicator name	Timely identification and treatment for sepsis in emergency departments
Indicator weighting (% of CQUIN scheme available)	50% of 0.25% (0.125%)
Description of indicator	There are two parts to this indicator: • The percentage of patients who met the criteria for sepsis screening and were screened for sepsis • The percentage of patients who present with severe sepsis, Red Flag Sepsis or septic shock and were administered intravenous antibiotics within the appropriate timeframe and had an empiric review within three days of the prescribing of antibiotics. The two indicators apply to adults and child patients arriving in the hospital via the Emergency Department (ED) or by direct emergency admission to any other unit (e.g. Medical Assessment Unit) or acute ward.

Figure 2. The 2015/16 national sepsis CQUIN

2b. Timely identification and treatment for Sepsis in acute inpatient settings

Indicator	
Indicator name	Timely identification and treatment for sepsis in acute inpatient settings
Indicator weighting (% of CQUIN scheme available)	50% of 0.25% (0.125%)
Description of indicator	There are two parts to this indicator: • The percentage of patients who met the criteria for sepsis screening and were screened for sepsis • The percentage of patients who present with severe sepsis, Red Flag Sepsis or septic shock and were administered intravenous antibiotics within the appropriate timeframe and had an empiric review within three days of the prescribing of antibiotics. The two indicators apply to adults and child patients who are acute hospital inpatients

Figure 3. The 2016/17 national sepsis CQUIN

The CQUIN sought to incentivise providers to screen all patients for whom sepsis screening was appropriate and to rapidly initiate intravenous antibiotics within an hour of presentation for those patients who had suspected severe sepsis. Screening had to be carried out using an appropriate tool.

The 2016/17 CQUIN built on the 2015/16 CQUIN by extending the targets to other acute inpatients. That is, the second part of the indicator aimed to

incentivise the provider to identify and treat sepsis in all acute inpatient settings (Figure 3).

The CQUIN indicator comprised two parts with equal weighting (DoH, 2016a). The first part remained the same as the 2015/16 CQUIN. It sought to incentivise providers to screen all patients for whom sepsis screening is appropriate and to rapidly initiate intravenous antibiotics within an hour of presentation for those patients who had suspected severe sepsis. There was the addition of a review within three days of prescribing the antibiotics. If the patient remained an inpatient, the medical team would be required to conduct a review to determine if the antibiotic prescription was appropriate. The target sought to incentivise providers to screen all patients who meet the criteria for sepsis screening and, for those patients who have suspected severe sepsis, rapidly initiate intravenous antibiotics. For the acute inpatient population, the timeframe for antibiotic administration once severe sepsis had been identified was extended from 60 minutes to 90 minutes (DoH, 2016b).

Figure 4 provides a timeline of key external events in international and national sepsis improvement.

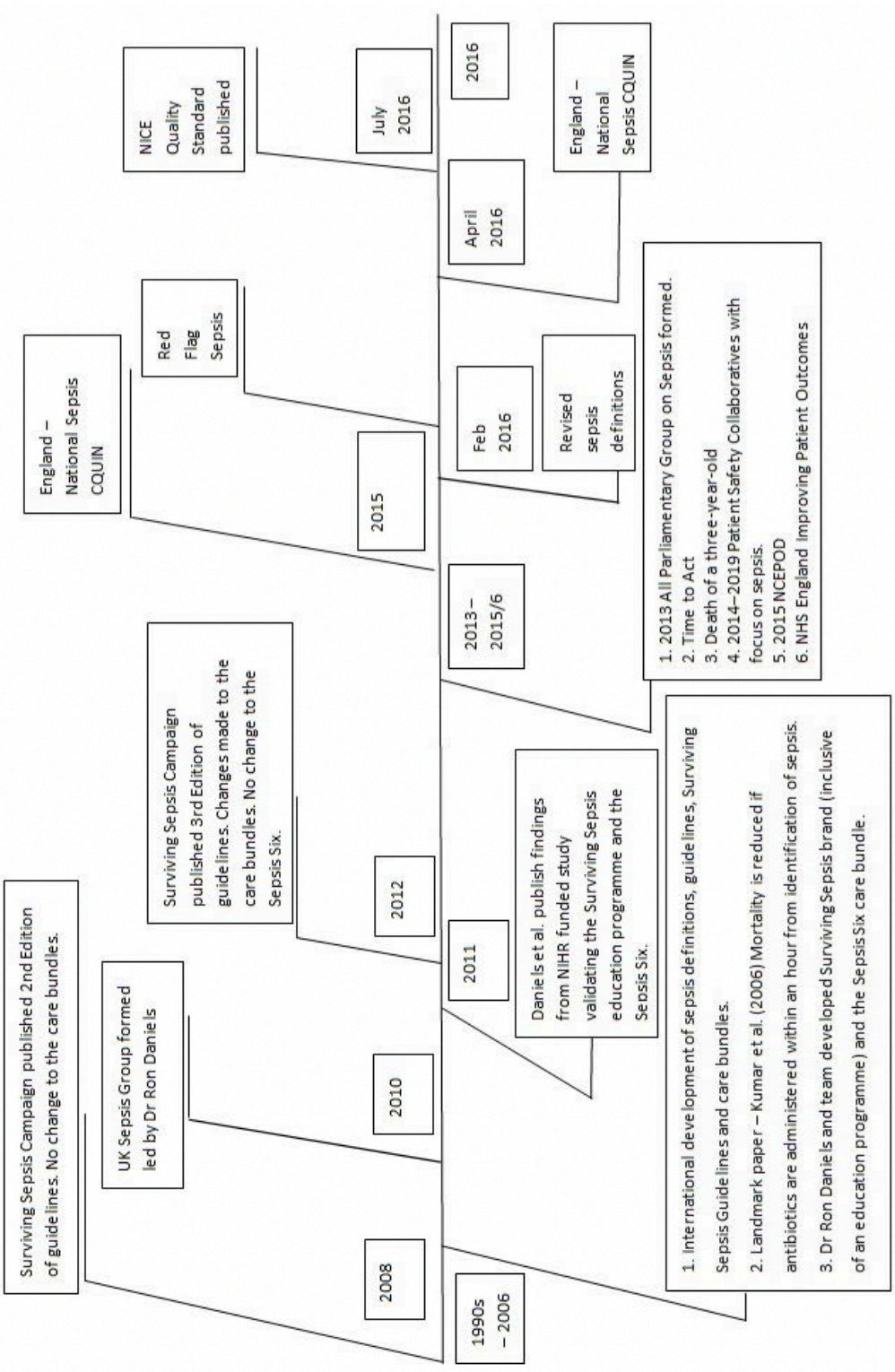


Figure 4. Timeline of key external events in international and national sepsis improvement

2.10 Implementation of the Sepsis Six

Gatewood et al. (2015) reported on a quality improvement initiative that was implemented in the ED to improve care of patients presenting with signs and symptoms of sepsis. The intervention consisted of a nurse-driven screening tool and management protocol, a computer-assisted pop up screening alert and automated sepsis treatment order sets. A before and after retrospective cohort study found that baseline period compliance was 28%. The launch of the sepsis initiative resulted in overall bundle compliance peaking at 71%. Mortality rates were used to determine the clinical impact of the process improvement effort and dropped from 13% to 11%. The trend in increased compliance and reduced mortality was not found to be statistically significant. Other concurrent quality improvement efforts in the ED and the ICU may have also impacted clinical outcomes.

In the UK it has been suggested that delivering six simple interventions (Sepsis Six) within an hour of recognition of sepsis may improve outcome on the general ward setting (Daniels et al., 2011; Szakmany et al., 2015). Szakmany et al. (2015) conducted a feasibility pilot to establish incidence of sepsis on general wards and to establish if the Sepsis Six was being reliably delivered to these patients within an hour of recognition of the condition. Sepsis was present in just 2% of the ward patient population; simple bundles were not administered and critical care involvement was rare. Yet despite the small percentage of the ward-based population being diagnosed with sepsis, the sepsis mortality for this patient group was 35%. Drawing on behavioural theory to identify mechanisms of change, Steinmo et al. (2015) found limitations in the application of behavioural tools across an organisation due to the differences even between wards of how Sepsis Six had been implemented.

Tarrant et al. (2016) conducted an ethnographic study examining frontline clinical practice in implementing the Sepsis Six. They found that implementation strategies to promote reliable use of the Sepsis Six primarily

focussed on education, engaging and motivating staff and providing prompts for behaviour, along with efforts to ensure that the required equipment was readily available. Although these strategies were successful in raising staff awareness of sepsis and engagement with implementation, completing the bundle within an hour was not straightforward. Rather than being an apparently simple sequence of six steps, the Sepsis Six actually involved a complex trajectory comprising multiple interdependent tasks that required prioritisation and scheduling, and which was prone to problems of coordination and operational failures. Tarrant et al. (2016) concluded that implementation efforts that focus on individual behaviour change to improve uptake of the Sepsis Six should be supplemented by an understanding of the bundle as a complex trajectory of work in which improving reliability requires attention to coordination of workflow, as well as addressing the mundane problems of interruptions and operational failures that obstruct task completion.

Tarrant et al. (2016) findings reflect the literature on sepsis management in the ED. Higginson and Boyle (2018) found that in periods of overcrowding, assessing patients in corridors was suboptimal and compromises effectiveness. Furthermore, O'Keefe Gatewood et al. (2015) found that early screening interventions can lead to expedited delivery of care to patients with sepsis. Peltan et al. (2018) investigated the association between ED crowding and door-to-antibiotic time in ED sepsis. They found that in over 3,500 ED sepsis patients there was a consistent association between increased ED crowding and decreased antibiotic timeliness.

According to Marwick et al. (2014), the incidence of a new septic episode occurring in acute inpatient settings is sporadic. Furthermore, in the event of sepsis in acute inpatient settings, delivery of the Sepsis Six was an interdependent task and not all ward nurses had the skills to undertake key tasks such as cannulation (Tarrant et al., 2016). Breen and Rees (2018) in a questionnaire survey of doctors and nurses in an acute hospital setting found that the resources and skills required for Sepsis Six completion varied

significantly between ward nurses and ED nurses. Venepuncture and cannulation skills differed with 79% ED nurses possessing these skills compared with 48% of ward nurses. In addition, Roberts et al. (2017) found that ED nurses regularly did venous blood gases and blood cultures. This was a strong facilitator in the recognition of sepsis and administration of the Sepsis Six. In the ward setting Marwick et al. (2014) found the longest delay was between medical review and antibiotic prescription highlighting that decision-making amongst junior doctors contributed towards delays.

Jones et al. (2016) make a distinction between patients with sepsis on admission to hospital and patients who develop sepsis in hospital. There are significant differences in incidence and mortality between these two groups; 85% of sepsis cases are seen on admission, and result in a mortality rate of 12%, compared to 15% of sepsis cases developing in hospital, with a mortality rate of 35%. Odden et al. (2015) systematically assessed the SSC guidelines for the inclusion of adult ward patients. Despite evidence that patients with sepsis initially diagnosed on the wards faced higher mortality rates, Levy et al. (2014) found that there was little supporting evidence guiding the care of ward patients in the guidelines. Odden et al. (2015) note that ward patients with sepsis are a heterogeneous group. Bhattacharjee et al. (2017) identified that sepsis in acute-inpatient settings can occur at any time. Therefore, screening is often performed longitudinally rather than on arrival or within the first four hours of arrival at hospital as in the ED setting.

2.11 The Early Warning Score as a tool for sepsis recognition

The use of 'track and trigger' scores such as the Early Warning Score (EWS) and National Early Warning Score (NEWS) is common in the English NHS to recognise the deteriorating patient and escalate care. The NICE sepsis standard recommends using EWS to assess patients with suspected sepsis (NICE, 2016). Hamilton et al. (2018: 247) conducted a meta-analysis and systematic review of the literature to estimate the accuracy of EWS for mortality in sepsis. The results suggested that EWS cannot be used to predict

who will or will not die of sepsis and consequently should not be used alone to 'prognosticate in patients with sepsis'. The authors make the important point that EWS was not designed as a diagnostic or predictive tool. Rather, it is intended to be used to track and trigger patients and act as an escalation tool to medical staff and Critical Care Outreach Teams (CCOTs). CCOTs have played a key role in the identification of deteriorating patients, including patients with sepsis, and were introduced in the early 2000s. Several studies in the late 1990s identified that acutely ill patients often have poor outcomes due to deficiencies in the knowledge and skills of healthcare professionals working outside critical care departments (McQuillan et al., 1998; McGloin et al., 1999). In order to address these issues, it was recognised that critical care should be driven by patient need, not geographical location. CCOTs were suggested in a Department of Health report on comprehensive critical care (DoH, 2000). Hospitals devised their own services according to local need and available resources. Supported by critical care consultants, the teams comprised critical care nurses and, in some cases, a respiratory physiotherapist. According to the Department of Health (2000) their remit was:

- to avert admissions to critical care through early recognition of critical illness
- to facilitate timely and appropriate admission to critical care
- to enable discharge to the ward from critical care areas
- to share critical care skills across acute areas.

As illustrated by this literature review, improvement in sepsis recognition and management has been and continues to be a complex undertaking, driven by several forces, ranging from updates in guidelines following results from scientific trials to media reports of unrecognised sepsis leading to patient harm and loss of life. As a global high-profile healthcare issue, sepsis has been the focus of international and national improvement initiatives that have been interpreted in local programmes of improvement. As illustrated in

section 2.8, initiation of the Sepsis Six care bundle relies risk stratification of the patients presenting condition. The sepsis CQUIN's (DoH 2015; 2016a) required that patients are screened for sepsis. Therefore, the Sepsis Six care bundle and sepsis screening tools are an appropriate and interesting case to study the implementation of a care bundle in practice.

2.12 Conclusion

This chapter has shown that implementation of evidence-based medicine in practice remains problematic and is under the influence of external drivers. Allen (2017: 696) coined the term 'polyformacy' to describe the increasing number of tools that are implemented, all with the intention of improving an aspect of care. Allen (2017) made a call for such tools to be viewed as actors that 'do things' when implemented within existing social practices. Given the nature of the issues highlighted in this chapter and in response to this call, investigation from a social science perspective of the external drivers, implementation and use of care bundles as an example of tools used to implement evidence-based medicine in practice is warranted. To investigate the complexity of these issues and develop research questions, a theoretical framework in the interpretivist paradigm was required. The next chapter will review the theory which underpins this research.

Chapter 3: Theoretical framework

3.1 Introduction

The implementation of evidence-based interventions in sepsis care was presented in Chapter 2 as an example of the complexities of implementing evidence-based medicine. It was proposed that the complexity of the context, including financial incentives, may impact on how effectively the care bundle was implemented in secondary care in the English NHS. An empirical exploration of this issue required a theoretical framework that would allow for factors external to the organisation, such as the international and national evidence base, as well as internal factors, such as local context and resources, to be conceptualised and studied as influential factors in the implementation of the care bundle. STS, specifically an ANT and technology-in-practice perspective, is offered here as the theoretical framework for the research. STS starts from an assumption that science and technology are active social processes and investigates how scientific knowledge and technological artefacts are constructed. It also asserts that artefacts are marked by the circumstances of their production (Sismondo, 2004).

Healthcare is a technologically intensive and dynamic environment, with new interventions emerging regularly. These range from the most sophisticated scanner or item of surgical equipment to everyday technologies such as the patient record (Berg, 1996). In addition, the increasing prevalence of standardisation, for example through the use of paper and electronic forms, highlights the need for a more sophisticated view of the relationships between humans and objects. Rather than a positivist approach that considers the linear cause and effect of implementation, ANT and technology-in-practice offer a lens through which to explore the complexity and fluidity of reality, which results in a more nuanced picture of the dynamic relationships that occur when a new initiative is implemented (Allen, 2017; Cresswell et al.,

2010). ANT and technology-in-practice can help researchers to 'zoom in' on the way networks are formed at any point in time (Cresswell et al., 2010). Previous applications of these theories in the implementation of technology in healthcare suggests that they provide an appropriate theoretical framework (Prout, 1996; Berg, 1997a,b,c; Berg and Bowker 1997; Berg et al., 1998; Berg 1999a,b; Mol, 2002; Allen, 2009; 2012; Cresswell et al., 2010, 2011; Vezyridis and Timmons, 2014).

3.2 Actor-Network Theory

ANT was introduced into the social sciences by Callon (1986), Latour (1987), and Law (1987) in the mid-1980s. Within this research, the intention is to draw on key concepts from ANT in a pragmatic application, rather than a purist application, in studying the implementation of the care bundle. ANT is not so much a theory but rather a way of looking at the world or sociality and materiality (Latour, 2005). It conceives of the world and its entities as relational; entities have no inherent quality but acquire their attributes as a result of their relations with other entities. ANT challenges some common epistemological convictions by rejecting essential subject/object or society/technology distinctions (Law and Hassard, 1999). To emphasise its focus on tracing actors within a network and to describe the processes by which the network achieves stability epistemologically, ANT is informed by the concept of translation (Callon, 1986). ANT is interested in the connections between humans and non-humans, and gives equal agency to humans and non-humans – to people and things. According to ANT, such heterogeneous actors are linked in a web of relations, known as an actor-network. Each actor is dependent on the entire network, where the system of mutual influence is between people and objects (Law, 1987).

The significance of an actor in a network is determined by its ability to enrol other actors into programmes of action (Latour, 2005). The fundamental aim of ANT is to explore how networks are built or assembled and maintained to achieve a specific objective. ANT is an approach that is interested in the

tensions between the actor, network and technology and how they manifest in practice. It assumes that all networks are heterogeneous or sociotechnical. According to ANT, the different points in the network have to align for the network to be effective. But, the actors do more than their position in the network; they are tied up in other intersecting networks (Cresswell et al., 2010). A shifting alignment between actors can lead to the network becoming unstable or reforming in different patterns (Booth et al., 2016). Each actor has its own diverse set of interests; thus, stability of the network results from the continual translation of interests. A stable network is formed when all the actors are able to align in unison. There are four stages of translation. Table 1 describes each stage (Latour and Law, 2018: 7).

Table 1. The four stages of translation in ANT (Latour and Law, 2018: 7)

1. Problematisation	One set of actors defines a problem that is perceived to be shared and enacted by other actors. The first set of actors then institutes a range of solutions to the problem, engendering the possibility of becoming an obligatory point of passage.
2. *Interessement*	The first set of actors defines roles for the second set of actors and seeks commitment to the proposed course of action.
3. Enrolment	The commitment to the course of action is then enforced through the necessary means (inducement, persuasion, manipulation etc.), following which the course of action is enacted.
4. Mobilisation	The second set of actors is mobilised to support the first set, transforming themselves into an obligatory point of passage. Thus, interests have been translated between the first and second set of actors in a temporary network in which all objectives have been aligned and the course of action followed through.

The value of ANT lies in challenging assumptions of separation between material and human worlds. The conceptualisation provides a useful tool for investigating complex relationships between human and non-human actors, in which boundaries between relationships are blurred (Cresswell et al., 2010). Tracing associations between actors can lead to a rich account of the network of human and non-human actors and their interactions; this allows the researcher to question how the connections make an impact within the

context in which they exist (Allen, 2012). Agency and action are therefore understood not just as purely human processes, but as processes facilitated or enabled by heterogeneous networks composed of human and non-human elements (Fox, 2000). Therefore, the task of ANT is always to empirically observe:

> how practitioners act as one piece with an assemblage of actants, non-human as well as human, to build networks and chains which achieve certain ends; while recognising that both human and non-human materials have resistive agency: the capacity to act back, granting or refusing translation. (Fox, 2000: 863)

ANT takes a stance that challenges many conventional epistemological ideas by rejecting any distinction between a subject or object, nature or culture, and/or technology and society. Entities (technologies, organisations and humans) do not have any significance on their own, but rather their significance depends on the nature of their relations with other entities in the network and their role may change as their relations change. Relations are therefore not static or permanent (Williams-Jones and Graham, 2003).

The introduction of a new actor in an established network requires the components to reorganise around the new actor (Silvis and Alexander, 2014). The functioning of the whole network will be affected when a new actor is introduced. Networks are constantly evolving, as social reality is assumed to be both complex and fluid (Latour, 2005). ANT allows researchers to develop a rich understanding of the many complex and dynamic heterogeneous networks where multiple social and technical actors and processes of social change interact – during technology introduction. In this way, ANT provides a useful analytical lens for the present research, as the acute-care hospital environment is complex, with multiple actors that interact and evolve in a complex way. Booth et al. (2016: 112) argue that ANT can be:

> a usable tool to develop accounts of sociotechnical interaction that occur between various human and non-human actors that may be otherwise ignored or minimised.

Technologies are not simply passive and are never value-neutral, but always exist in value-laden social and technical relations. During their design phase, objects have embedded within them a 'script' to determine how the technology will function and the extent to which it may be shaped by other actors. The scripts are not necessarily fixed. Moreover, they may be translated by actors in ways not intended by the designers (Singleton and Michael, 1993). Akrich (1992) developed the concept of the script to describe the vision of use designers hold when they are building technologies. The script contains certain prescriptions that may or may not materialise. This is because, while users may enact the scripts once they take up the technology, they may also create workarounds to modify the script and technology to fit in with their daily practices. The script is considered by Latour (1994) as the potential held by the technology that may constrain or enable the user but does not fully determine the user's action. Therefore, technologies can shape a framework of action, but users might use the technology in a way unforeseen by the designer (Akrich and Latour, 1992).

ANT is not considered to be a theory, but rather an adaptable series of 'sensitivities' that assemble 'a rich array of explorative and experimental ways of attuning to the world' (Mol, 2010: 265). ANT has been criticised and faces epistemological and ontological challenges. These are summarised in Table 2 and will be discussed and developed in more detail Chapter 4 (on methodology). On this basis, Cresswell et al. (2010, 2011) advocate integrating other theoretical lenses with ANT. Accordingly, to extend ANT, concepts from the closely aligned field of technology-in-practice have been applied in this research.

Table 2. Limitations of the ANT approach (Cresswell et al., 2011: 323)

The role of wider social factors	ANT pays little attention to wider, macro-environmental factors.
Going beyond description	ANT can help to describe how relationships between actors change, but has limited explanatory power.
The positioning of human and non-human actors	ANT networks are made up of a number of both human and non-human actors. These actors are, however, different in a number of respects and, furthermore, both have a history that is likely to have shaped them, which ANT fails to take account of.
The problem of defining the networks	There is difficulty determining where the network boundaries are, as the number of actors in any given network is indefinite.
The role of the researcher	The role of the researcher in influencing and shaping the network is not accounted for.

3.3 Technology-in-practice

During the 1990s, medical sociologists largely borrowed from the interdisciplinary field of STS to embrace a more dynamic way of analysing medical technologies. Drawing from social constructivism, the general purpose was to gauge what technologies do, based on the assumption that they have the power to transform workplaces in different ways. Timmermans and Berg (2003) comment that the introduction of an artefact requires negotiation with existing work practices, and it is through this process of convergence of technologies in practice that artefacts and workplaces transform each other. Taking this position, technology is viewed as one actor amongst the multiple changing configurations of social and technical elements where the technology is used (Law and Hassard, 1999). Technology-in-practice encompasses a broad definition of technologies, from mundane artefacts such as a thermometer, medication or medical record to sophisticated technologies such as a computerised tomography (CT) scanner. Technologies are not considered isolated devices but are embedded in heterogeneous networks with healthcare workers, patients, and other technologies (Timmermans and Berg, 2003).

An example of how technology-in-practice has been applied in the analysis of medical technologies is from Mol and Elsman (1996). The authors illustrated the technology-in-practice approach in their paper about the role of duplex ultrasound in the detection of diseased leg vessels. The paper focussed on the intricate ways in which two aspects of diagnosis, the detection of disease and the design of treatment, relate. The social practicalities that infiltrate every aspect of diagnosis could not be captured in an all-inclusive statement. For those who hold that detection and design are inseparable, the multiple aspects of diagnosis, such as vessels, surgeons, patients, equipment and hospital organisations, were interrelated and irreducible to the other. Mol and Elsman (1986) took the position that the duplex technology was not simply manipulated by the healthcare worker but performed a calculable reality of vessel disease. Therefore, the technology did not just reflect the illness but actively constituted its existence.

More recently, Allen (2009) has drawn on technology-in-practice to explore the development of care pathways. She found that the care pathway emerged from a series of negotiations, which involved assumptions about existing work practices and how the tools might function in practice. As a result, a multiplicity of interests was inscribed into the tools. In 2012, Allen applied the concepts of 'affordances' and 'drift' to help understand the context for quality improvement using integrated care pathways as a case study. Allen (2012: 463) focussed on the 'logic of artefacts and their implications for practice'. Of particular interest to the present research was the concept of drift. Allen (2012) used the notion of drift to understand when a technology is used differently from the originators' intent. Although the developers of the integrated care pathways designed them meticulously, when used in practice there were inevitably elements that had not been foreseen. This resulted in the various elements pulling apart in the process of drift (Dodier, 1995).

A major contributor to the field, Berg, whose work has been drawn upon earlier in this thesis, originally developed the argument that mundane technologies are 'fully fledged' actors in healthcare systems. Berg provides

insights into the role of medical records (Berg, 1996), protocols (Berg, 1997b) and related health information technologies (Berg, 1999a). Artefacts used in medical practice frequently have multiple roles as representing and accounting devices. Berg (1996) highlights how formal requests made on or via the medical record are important, as they make evident that the patient was dealt with in an optimal and rational way, creating an image of daily surveillance and attention. As a result, building an artefact can be a political process, with each one emerging from a trajectory typified by negotiations and ad hoc modifications (Berg, 1996). Allen (2009) argues that such a conflicting agenda creates challenges in inscribing this multiplicity of interests into the actual technology.

The practices of reading and writing bring to life the medical record, allowing it to have a mediating role in the organisation of medical work; without these practices, the record would be dead, disconnected and without any relevance (Law and Lynch, 1990). Berg (1996) highlights how the medical record is commonly perceived as merely representing what has taken place. The paperwork is a crucial part of this transformation in that it affords the representation of the patient. However, the record also mediates and stipulates work, not by determining behaviour, but rather by affording the manageability of a plethora of divergent tasks and the production of a problem that is manageable for hospital routines.

Berg (1996) found that formal workflows embedded in the medical record are constantly superseded by situational exigencies, which are dealt with through informal and ad hoc procedures. However, such reworking is not a symptom of improper use. The flexibility these procedures acquire is essential to their functioning in complex and fluid practices like medical work. Practices of reading and writing produce a streamlined, decontextualised summary that is stripped of the situational uncertainties and the specific context in which they emerge, yet these summaries form the basis for re-evaluation of the patient. The record is, therefore, part and parcel of the ongoing (re)construction of the present (Berg, 1996). However, formal procedures stand powerless in the face

of informal social practices; Berg (1997b) argues that seeing how the formal and informal merge and interlock is the most promising route to understanding medical practices. Berg (1996) also suggests that the record mediates the creation and maintenance of hierarchies between and within professional groups. The record is one of the ways power differences are materially constituted.

Berg (1997b) considers that the protocol is 'cook-book medicine' and deskills the healthcare worker and therefore poses a threat to autonomy. The idea of regulating action through a recipe is not a new concept: protocols were an important subject of medical research effort during and after World War II. As the field of clinical research grew, the protocol was the tool used to facilitate replication of actions in other healthcare institutions (Berg, 1995). As such, the idea that variation exists in medical practice and that a tool with standards embedded within it can bring physician compliance with clinical research became more prominent (Berg, 1997b).

According to Berg (1997b) there will always be elements of the patient's emerging trajectory that protocols do not cover and the healthcare professional will then have to use clinical judgement. However, when the ability to apply clinical judgement is lacking in the individual, the protocol, as a tool, falls short of the original intention. While tools may serve as useful prompts for directing action in certain contexts, their highly structured design and selective focus excludes certain information necessary for all situations and coordination of work. The meaning of the situation is therefore not an inherent property of the information contained in the protocol. Information is translated by staff and presented in different forms for different purposes and audiences, which involves taking a particular perspective (Boland and Tenkasi, 2001). Information may also require reinterpretation in light of new information (Berg, 1996).

Berg (1997b) suggests that protocols contribute to the loss of importance of information that is difficult to explicate and/or quantify. In the formal process

for the implementation of a protocol, importance is placed on the completion of explicit statements as the end result, not the steps taken to achieve them. As such, the less easily codified aspects are denied. In reality, the healthcare worker is expected to be patient-centred and considerate of scarce resources. Depending on the situation, the healthcare worker may deviate from the protocol and make decisions based on intuitive knowledge and clinical judgement rather than scientific data. This decision-making represents a different logic and a different rationality, a logic that cannot be measured but appears to an external auditor simply as non-compliance. Experience, and thus judgement, is dynamic and develops over time (it is tacit knowledge); therefore, it is possible that healthcare workers may adhere to protocol instructions more in a situation where they have little or no experience. However, this is still not a linear process, as the patient, context and team – and indeed interruptions – are different, so are therefore likely to be at odds with the definitions set out in a protocol.

Decision-making and care delivery are rarely linear processes as typically set out in the protocol definition; in fact, they are dependent on a multitude of factors. Decision-making is a social process and is dependent on a number of actors (Berg, 1999a). There are a multitude of distractions in the clinical environment: time pressures, interruptions, sudden deterioration of the patient and varying experience of colleagues, all of which have an impact on the dynamics of the team. Furthermore, this dynamic varies throughout the day and night, given the flow of patients, changing shift patterns and use of temporary staff. Berg (1997b: 1083) describes a 'clash between the formal image of healthcare practice embedded in a protocol and realities of the social world of healthcare'.

Healthcare practice is much more fluid. Healthcare workers, at the same time as being expected to adhere to a set of instructions, are expected to be responsive and flexible to the unpredictable nature of patients, colleagues and the environment.

Given this interpretation of the context, there are many reproductions of a situation in which the care bundle is intended for use. Decision-making is infrequently done in isolation; if it were to be so, this would contradict the rhetoric of healthcare professions' pledge for patient-centred holistic care. Thus, a multitude of sociocultural factors are lost when considering the view that adherence to a linear process drives decision- making and intervention.

Berg (1999a) commented that in his 1997 paper 'Of Forms, Containers and the Electronic Medical Record: Some Tools for a Sociology of the Formal', he had built upon both ANT and ethnographic and theoretical computer-supported cooperative work (CSCW) to investigate the generative power of formal tools. In that conceptual paper, Berg (1997a) focussed on two routes to follow the development and use of a formal tool. The first was the historical development of the tool and how it was shaped by work practices. The second took a sociological perspective on the real-time working of the tool in use. This research draws on the second aspect of Berg's analysis to understand what happened when sepsis screening tools and the Sepsis Six were implemented and in use. The next section introduces the key concepts from Berg's (1997a) paper which have been used in the theoretical framework in this research.

3.4 The map and terrain

Berg (1997a) used the analogy of the map and terrain to conceptualise the formal tool (map) and the empirical world (terrain). When formal tools are implemented, the gap between the representation (map) and represented (terrain) had to be crossed. Using the example of the electronic medical record, Berg (1997a) argued that the gap must be crossed in the form of data being input to the formal tool and the conclusions drawn from the output data being applied to the empirical world. For naïve formalists, this is not considered a problem: formal tools are accurate representations of the empirical world. For their opponents, bridging the gap is a problem. The output data require interpretation in the realm of the empirical. Bridging the

gap requires human skilful work. The opponents consider that formal tools work because of the flexibility and creativity of intelligent human performance. Berg (1997a) argues that rather than the dichotomous argument, the generative power of the configuration 'tool and human' lies in the interrelation of the formal (map) with the empirical (terrain). The distance between the representation and represented is crossed by a chain of re-representations that interlock the formal (map) with the empirical (terrain). It is this interrelation that results in the generative power and change in work practices. Figure 5 is a simple diagram of the map and terrain (Berg, 1997a: 407).

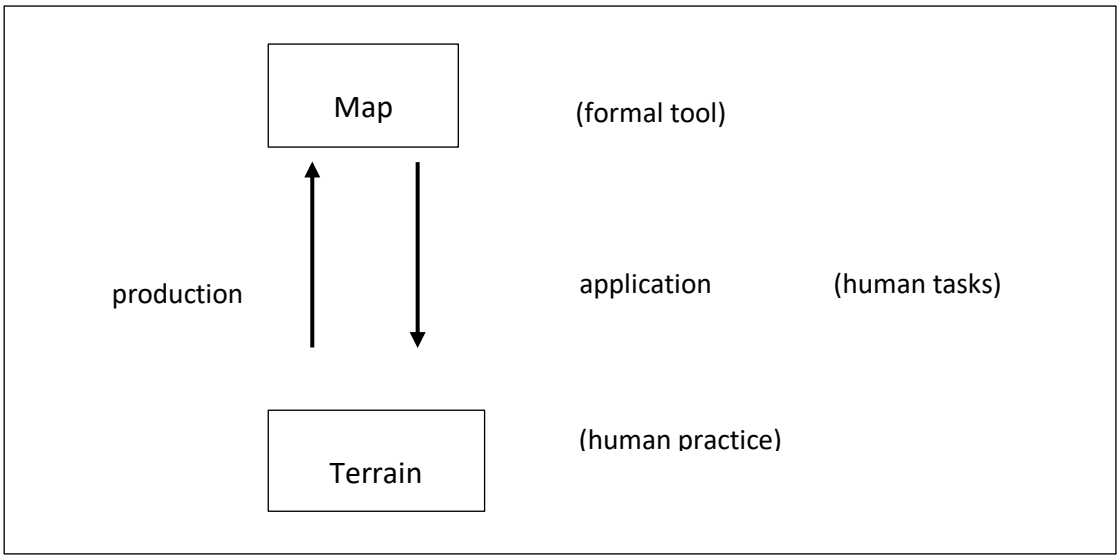


Figure 5. A simple diagram of the map and terrain (Berg, 1997a: 407)

3.5 Distribution

Berg's (1999a: 376) approach to conceptualising technology was intended to generate a better understanding of how distributed and interrelated entities can create new forms of activity. His analysis decentres the human as the

locus of control and oversight, and 'distributes the capabilities over assemblies of entities: other humans, but also organisational routines, and artefacts such as information technologies'. Using the case of the electronic medical record, Berg (1997a) zooms in on the interwoven practices of this tool in use and argues that the gap between the formal representation (the tool) and the actual sphere of work (work of implementation and clinical practice) is not crossed in one step.

As described by Star (1989), there is a chain of re-representations that condense, elaborate and transform work practices until they match the abstract level of the tool. This is highly distributed across a range of heterogeneous entities, and the change in work practices results from the generative power of the tool and the humans using them, not one or the other. A component of the electronic medical record that Berg (1997a) paid particular attention to was the patient's fluid balance. Berg uses the fluid balance as an empirical example of how the patient becomes represented on a formal tool through a chain of re-representations (Berg, 1997a). In the medical records Berg studied, the patient's fluid balance was recorded using a computer-based abstract tool with predefined and fixed criteria; healthcare workers inputted data and drew conclusions from the data that, as the description below will show, had been condensed to meet the abstract level of the tool.

The fluid balance was the record kept of the volume and type of fluid a patient takes in, such as water and/or intravenous fluid intake, and the volume and type of fluid output, such as urine. The overall balance should be zero, indicating that the volume of fluid in the body is stable. Healthcare workers calculated the fluid balance (input and output, as described below), a number, and treatment decisions were made accordingly. To produce the number documented in the record there were a number of distinct steps. Nurses performed intricate routines which involved the patient, cups, tubes, containers and paperwork, all materially heterogeneous entities, to produce a series of numbers. The nurses then inputted these numbers to the computer,

which then calculated the input and output totals and gave the cumulative balance. Berg (1997a) observed that to cross the gap between the map (formal tool, in this case the fluid balance) and terrain (empirical world, in this case the patient and artefacts), a chain of re- representations were performed. These included dynamic subtasks of measuring the volume of urine that had been collected in the catheter, calculating how much intravenous fluid the patient had received and how many millilitres of fluid had been consumed. According to Berg (1997a), the urine bag, intravenous fluid bag, cup and jug all played a part in crossing the gap between the map and terrain. These artefacts performed the first re-representation; the nurses performed the second as they transferred the numbers produced by the artefacts to the record.

By paying close attention to the gap between the map and terrain, the distributed nature of the tasks comes into view. Examining the interwoven practices and recognising the chain of re-representations provides a more realistic picture of what happens in the work practices associated with the implementation of the tools. The measurement and recording of a patient's fluid balance was a distributed activity; that is, a whole series of entities came into play, and their ongoing interactions enabled and affected each other. The fluid balance documented on the computer was a mediating artefact that interrelated with several other entities as a whole to perform the activity of recording a patient's fluid balance which according to Berg (1999a,:383) is 'a phenomenon that only exists at the level of the whole hybrid.'

3.6 Drift

Berg (1997a) argues that formal tools cannot function by themselves within the complex empirical world. There is a widespread view that an insistence on the use of tools deskills those who use them. Berg portrays a system where the workflow is set as a series of tasks and rules, which results in effective organisation, control and application of labour. Berg (1997a: 420) comments that the subtasks which cross the gap between the map and terrain, as

described above in the case of the fluid balance, do not function according to preset rules that reflect the 'instrumental rationality of Taylorism'. For example, when viewing the fluid balance tool, with its predefined criteria, in the abstract, outside the context of its actual application an illusion of readymade instrumental reason may be given, and the smooth functioning of the tool may be taken for granted. In Latour's terms, the tool has become an efficient machine, 'where borrowed forces keep one another in check so that none can fly apart from the group' (1987: 129). However, when the tool is viewed in actual use, as described above in the case of the fluid balance, the notions of a heterogeneous network of smooth and efficient subtasks are readily seen to be ideal images. Efficiency is not an *a priori* asset of the technology: it is the heterogeneous network that produces the effect of efficiency (Bowker, 1994).

Berg (1997a) argues that what can happen is a process known as drift. The actors are tied up in other intersecting networks, and do more than their specific position in the network. Using the simple example of the cup used to measure the amount of fluid a patient has taken in, it is acknowledged that the patient or a family member may have used the cup for drinks the nurse was not aware of. As a result, this 'overflows their definition as standardised input measurement' (Berg, 1997a: 422). Therefore, the balancing acts performed by the actors results in a network that is in constant motion and has the potential to fall apart and behave unexpectedly – not a network that functions smoothly, with a tool in which instrumental rationality reigns – as the heterogeneous entities themselves are in constant motion (Berg, 1997a). As a result, in the specific example considered here, there is a risk that an accurate fluid balance is not recorded, which results in drift from the original intention of the formal tool, the fluid balance chart.

Allen (2012) draws on the notion of drift in her paper on the development of integrated care pathways to explore how a technology is used differently from the originators' intent. Integrated care pathways are intended to be used by a multi-professional team to lineate workflow and record care delivered. Allen

(2012) found that in the development process a new network was created each time the changes were made to deal with complaints, implement improvements, and update in line with new evidence. When a pathway was in use, workarounds or routines were created to fix tensions but could also produce new problems. These activities are not seen as the human against the formal, but are directed at mending the drift in all juxtaposed elements, a balancing act between the formal and work practices (Allen, 2012). Drift is a useful way of thinking about translation when the technology is used differently from the designer's intention; the technology may be used in unanticipated ways or the technology may give rise to a competing script, which makes it a failure from a design viewpoint (Allen, 2012).

Table 3 provides a summary of the concepts from ANT and technology-in-practice that comprise the theoretical framework used in this study to explore the implementation of standardised tools.

Table 3. Potentially valuable contributions of the STS approach in a study exploring the implementation of standardised tools (adapted from Cresswell et al., 2010: 9)

Key notion	Valuable contributions of this notion	Implications for this study
Translations	Detailed insight into the complexity of different forces at play when artefacts are introduced in a new context.	Provides insights into how the tools were integrated (or not) into the healthcare environment.
Networks	Agency and action are understood not just as purely human processes, but as processes facilitated or enabled by heterogeneous networks composed of human and non-human elements (Fox, 2000). The central idea of ANT is to investigate and theorise about how networks come into being, to trace what associations exist, how they move, how actors are enrolled into a network, how parts of a network form a whole network and how networks achieve temporary stability (or conversely why new connections may form networks that are unstable).	Helps trace and describe the multiple human and non-human actors that are involved in the implementation of sepsis tools and to illuminate the impact of missing items of equipment or a busy clinical setting can have on sepsis recognition and treatment despite the presence of the tools and their intention.
Enrolment	Involves persuading other actors they share a common interest or problem. The significance of an actor in a network is determined by its ability to enrol other actors into programmes of action (Latour, 2005). Enrolment is a stage in translation.	Helps to explain if a healthcare worker is or is not engaged in use of the tools.
Scripts	The technologies embody diverse scripts.	Provides insight into how healthcare workers view the tools and what the designers intend the tools to represent.
Map and terrain	Map: Formal – representation – symbolic, clean, abstract, homogeneous – medical record or protocol that models medical work. Terrain: Empirical – represented – messy, concrete, heterogeneous – work as it is actually performed in clinical settings.	Describes the tool in its fixed state compared with the unpredictable and inconsistent nature of patients, healthcare workers and clinical pressures.
Naïve formalist and opponents	'Naïve formalist' as described by Star (1989: 16) believes in the *a priori* superiority of the formal tool in decision-making over the human. A naïve formalist has faith in the power of the formal tool as a representation of practice (Star, 1989). Their opponents believe that humans save the day and fix the inadequacies of the tools.	Helps to recognise that, for their proponents, tools will address failings of the healthcare worker in the recognition and treatment of sepsis and for some (opponents) reliance on tools encourages a 'tick-box' approach.
Chain of re-representations	In working with formal systems, the gap between the representation and represented must be crossed. The gap between representation (map)	Provides insight into the work practices involved in completing the tools in order to recognise and treat sepsis.

	and represented (terrain) must be crossed, representations must be produced and conclusions drawn by the formal tool and applied (Star, 1989).	
Distribution	Only as part of a concrete work practice does a tool come to life. Organisational routines, instruments, and specific forms: all have to be in circulation, interlocking with the tool for it to work (Berg, 1997a). This is highly distributed across a range of heterogeneous entities.	Highlights the multiple actors that are required to recognise and treat sepsis and how they can be spread across a clinical setting and what influences how spread apart they can become.
Drift	Berg argues that the notions of heterogeneous elements keeping each other in check, or of a network of smoothly and efficiently interlocking subtasks, are ideal images (Berg, 1997a). They downplay the processes of internal corrosion, of drift, which characterise the dynamics of these hybrids. The different points in the network, the different intermediaries aligned, themselves tend to drift apart from each other (Dodier, 1995).	Explains how the complexities of clinical practice can contribute towards the tools not being used as intended by the designers and the local implementation teams.

As presented in this chapter, this research takes the position that the generative power of the tools arises from the interrelation of the tool and the healthcare worker, not one or the other. When tools are implemented in existing social practice, the change in work practices does not arise from 'the purity of their logic' (Berg, 1997a: 407); rather, it is generated through the interrelation of often complex sociotechnical relations. By adopting a sociotechnical approach, this research challenges the linear cause-and-effect perspective ('if we put a tool in place, a course of action will occur'). The adopted approach focusses on the dynamic interactions between humans and tool, rather than assuming the tool is the cause of a specific effect. Examining the sepsis screening tools and sepsis care bundle as a set of formal tools allows examination of them as technologies-in-use. Tracing the actors enrolled in the actor-networks of implementation and use of the tools, and zooming in on the gap between the tools and clinical practice will contribute

towards understanding what happens when standardised tools are put into use.

3.7 Conclusion

This overview of ANT and technology-in-practice has shown that, when applied together, they provide a useful and interesting theoretical perspective that has the potential to explain the implementation of tools associated with sepsis improvement. Applying the chosen theoretical lens emphasises the performative nature of quality improvement, bringing to the fore the ways in which quality improvement emerges or fails to emerge as a result of a contingent series of interactions between various human and non-human actors (bureaucratic documents, policies, targets, technologies). Initiatives to improve quality and safety in healthcare all too frequently result in limited changes for the better or no meaningful changes at all, and the few that are successful are often hard to sustain or to replicate in new contexts. Many of the difficulties of securing improvement lie in the enormous complexity of healthcare delivery systems, including their challenging technical, social, institutional and political contexts. However, some challenges can be attributed to the persistent failure to take full advantage of informal and formal theory in planning and executing improvement efforts. There is a growing recognition of the potential contribution of social science concepts and perspectives in developing the theoretical basis for improvement efforts (Waring et al., 2016).

Drawing on the work of Latour (1987), Allen recently argued that everyday technologies should be treated as actors that do things in healthcare processes, rather than as inanimate objects (Allen, 2017). What technology might do and how it accomplishes something remain open to empirical question (Timmermans and Berg, 2003). According to Allen (2017: 1):

> popularity of these everyday tools has not been matched by their systematic and critical analysis. There is a pressing need for mundane technologies to be taken seriously in improvement initiatives.

So far as I have been able to discern, the notion of 'distribution' (see Table 3) has not been applied as Berg (1997a, 1998) did to understand the implementation of the electronic patient record. Therefore, to build upon Berg's work and in response to Allen's recent call, this research systematically and critically examines the role that everyday technologies have in organisational life. It aims to contribute towards the body of knowledge that explores tools as having the ability to transform work practices as much as the healthcare worker using them. It considers the workings and failings of tools at the different phases of implementation, between the executive board and the clinical frontline.

This research will therefore focus on developing a better understanding of how organisations interpret and manage externally competing pressures to implement sepsis screening tools and the Sepsis Six care bundle. It will trace the networks involved in implementation to understand what elements constitute the network and how their relationships help or hinder implementation of the tools. The degree of distribution and drift will be explored. Specifically, what factors result in increasing or decreasing the distribution of heterogeneous entities in the network required for sepsis care and what factors results in drift from the original intention of the tools. This research had two main aims:

1. To ascertain how secondary-care organisations interpret and implement external drivers associated with standardised tools.
2. To ascertain how standardised tools are used in clinical practice.

To address these aims, investigation was required at all levels of the organisation involved in the implementation of the standardised tools. Sepsis care improvement in the NHS provided the ideal setting, as it was under the influence of external drivers that had to be interpreted and operationalised at a local level. Chapter 2 described the complexities of translating evidence into practice and the implementation of guidelines, and then specifically sepsis guidelines, screening tools and the Sepsis Six care bundle.

3.7.1 The research questions

On the basis of the literature review and the theoretical framework, to explore the implementation of standardised tools I have looked specifically at care bundles in the healthcare setting. To do this three precise research questions could be framed:

1. How did the case sites interpret externally driven standardised tools?
2. How did the case sites implement externally driven standardised tools?
3. What happened when the tools were used in clinical practice in secondary care?

The methodology and research design will be set out in detail in Chapter 4.

Chapter 4: Methodology and research design

4.1 Introduction

The purpose of this chapter is to demonstrate the reasoning and coherency of the methodological approach and research design taken in this study. The value of a coherent approach is to develop a study that is detailed, has a clear rationale, a solid analytical process and findings that make a theoretical contribution. Duberley et al. (2012: 15) consider that:

> methodological engagement inevitably articulates, and is constituted by, an attachment to particular philosophical or metatheoretical commitments that have implications for research design and as such are a key part of the methodology within which our methods of data collection and analysis are located.

The chapter begins by presenting an explanation of the research paradigm and the qualitative methodology, specifically ethnography, which underpins the research design and the theoretical foundations of the study outlined in Chapter 3. The case study method will then be described. The chapter proceeds with a description of the steps taken to address quality issues in qualitative research, as well as the ethical considerations.

4.2 Research paradigm

Qualitative research constitutes a method of enquiry that aims to understand, explain and interpret people's behaviour, which is constructed in the context of the everyday realities of their lives (Gill and Johnson, 2010). The qualitative research paradigm is grounded in certain assumptions regarding ontology, epistemology and methodology (Lee and Lings, 2008). Ontologically, qualitative research acknowledges multiple social realities and epistemologically it places emphasis on the subjective rather than objective perspective. Methodologically, it favours an emergent and inductive approach, with the aim of constructing the story through the data as they are

generated and analysed to build theoretical observations (Cresswell, 2013). Conversely, the positivist epistemological commitment asserts that it is possible objectively or neutrally to observe the social world in order to test a hypothesis. As such, the approach reduces phenomena to simple cause-and-effect relationships, with little relation to the specific context (Silverman, 2013). This can lead to human behaviour being understood using quantitative measures that impose an external, researcher-derived logic upon its subject matter (Gill and Johnson, 2010).

From a review of the literature and professional experience as a practising acute care nurse with over 20 years of experience in the NHS, I knew that the healthcare policy landscape and the organisational and clinical settings were complex. As such, I considered that assuming a more linear and casual approach to the implementation of standardised tools and using research approaches aimed at discovering the absolute truth would not capture the complex and dynamic nature of healthcare. I was interested in using methods that would enable me to make sense of the world by exploring the interactions of actors involved and to appreciate the complexity and fluidity of reality. Qualitative research and an interpretative approach were adopted which allowed for dimensions of the social world and the significance of the meanings they generated to be explored (Waring, 2013). As such, I adopted a constructivist position to the production of knowledge; this ontological stance aligned with my prior experience and theoretical position.

In this research, I have explored how key stakeholders at each case site interpreted external guidelines and financial incentives related to sepsis care improvement in secondary care and what happened when the tools were used in clinical practice. This involved observing key actors in meetings and when they delivered implementation plans, as well as observing how clinical staff used the tools in the clinical setting. Therefore, an inductive approach enabled an openness to the multiple and overlapping worlds of actors involved in the recognition and treatment of sepsis. The next section presents a critique of ANT and technology-in-practice. The intention is to show how the

concepts and ideas from ANT and technology-in-practice were mobilised practically and used as a strategy to sensitise me to the data. The data analysis (section 4.6) in this chapter will show how an inductive approach was maintained when there is a clear conceptual framework in place.

4.2.1 Critique of ANT and technology-in-practice

ANT and technology-in-practice had been broadly applied to the investigation of information technology (IT) in healthcare (Berg 1997a, b, c; Berg and Bowker 1997; Berg et al., 1998; Berg 1999a, b; Mol, 2002; Allen, 2009; Cresswell et al., 2010; 2011; Vezyridis and Timmons, 2014). The literature showed that concepts from ANT and technology-in-practice were useful in explaining that the implementation of tools in an established workplace required sensitivity to established work practices. Resistance to clinical guidelines was often associated with professional boundaries, culture, leadership and wider systems issues, behaviours and processes that have the potential to change. As advocated by Allen (2017: 1), and attended to by ANT, everyday technologies should be treated as 'actors' that do things in healthcare processes rather than inanimate objects, and their use requires systematic and critical analysis.

Experience of working in the busy setting of acute secondary care in a clinical role and also in a service improvement role told me that the context was erratic, disordered and not linear. I knew that healthcare workers possessed different levels of experience and how the busy clinical setting might have an impact on the recognition and treatment of sepsis. Equipment was required to measure and record physiological observations and give intravenous antibiotics; if that equipment was missing or not working, that would have an impact on the flow of work practices. ANT provided a different perspective to the social science focus upon a dualist conception of subjects and objects by directing attention to heterogenous assemblages in which humans and non-humans are inextricably mixed up together (Callon, 1986). By tracing the complex interrelations between the heterogenous assemblages and rendering

visible the multiple interrelations, ANT studies assert that agency is not the property solely of humans (Law, 1986). Accordingly, by treating humans and non-humans in similar terms, ANT allowed me to dispense with a conventional social approach that would distinguish which elements involved in the implementation and use of sepsis improvement tools were human and social, and were, therefore regarded as agents of change (Callon, 1986). Informed by my professional experience, I was able to understand the entanglement of humans and non-humans at each stage of the implementation of the sepsis care bundle. Therefore, by taking an ANT approach I was able empirically to explore the role humans and non-humans had in the implementation of sepsis improvement tools.

From the review of the academic and grey literature, it was apparent that implementation of the sepsis tools was under the influence of international and national guidelines and, in England, a financial incentive (NHS England, 2015, 2016a). I was interested in how different organisations interpreted external drivers and the processes involved in translating them into practice, from the executive board to the clinical frontline. ANT allowed the networks involved in interpreting external guidelines and devising implementation plans to be traced, and similarly the networks involved in the use of the tools in clinical practice. This enabled a deeper insight into the processes involved and focussed the data collection. In the case of sepsis tools, this meant tracing how the sepsis tools were developed and had evolved over time. ANT has been criticised and faces epistemological and ontological challenges, as summarised in Table 2 (section 3.2); Table 4 expands on Table 2 by outlining the potential implications for this research and the steps taken to address those challenges.

Table 4. Limitations of the ANT approach, implications for this research and the steps taken (adapted from Cresswell et al., 2011)

Methodological issue	Limitations of ANT	Potential implications for this research and steps taken
The role of wider social factors	ANT pays little attention to wider macro-environmental factors.	Broader contextual factors such as evidence-based medicine and political influences and local factors such as quality improvement infrastructure were considered when examining implementation and use of the sepsis tools.
Going beyond description	ANT can help to describe how relationships between actors change but has limited explanatory power.	The intention of this research is to contribute towards the theory of implementation science, and so caution has been applied not to get lost in the detail of description, which may prevent practical suggestions for improvement. The case study method enabled me to go beyond description to explanation by attending to 'how' and 'why' questions.
The problem of defining the networks	There is difficulty determining where the network boundaries are, as the number of actors in any given network is indefinite.	Two case sites and embedded units of analysis have been selected. The research questions guided rigorous and pragmatic decisions on where to start and when to stop data collection.
The role of the researcher	The role of the researcher in influencing and shaping the network is not accounted for.	Field notes and a reflexive diary were kept throughout data collection to demonstrate reflectivity as a practice.

In the literature on the implementation of standardised tools, there is a narrative that quality improvement tools seemingly encourage healthcare workers to take a tick-box approach, at the expense of application of their clinical judgement (Kocman et al., 2019). With reference to the literature on the use of medical technology, this narrative reflects the strong form of technological determinism, where technology is a super-actor stifling all other interactions (Timmermans and Berg, 2003). This differs from the view taken by the advocates of social essentialism where technologies are viewed as passive, non-communicable devices. Prout (1996:203), comments that 'medical work is constructed as done on and through machines but not by them.' Accordingly, to be rendered meaningful social interpretations of the

technology are required, and what technology does exactly and how that is accomplished are open to empirical examination. Drawing from social constructivism, technology-in-practice views technology not as a blank slate to be interpreted or a super-actor, because technology itself coordinates clinical and organisational aspects of healthcare (Pinch and Bijker, 2012).

As identified in section 3.3, this research draws on Berg's analysis of what happened when formal tools are put into use. The following section also provides a rationale for applying Berg's concepts as a way of addressing the criticisms of ANT.

The role of wider social factors is considered to be neglected in ANT as a result of its focus on micro-contexts (McLean and Hassard, 2004). In an attempt to address this criticism, Berg (1997a, 1999a) investigated the implementation of the electronic health record and took into account wider social structures and processes. As highlighted in this thesis (section 3.3), he studied how healthcare workers integrated the electronic health record into working practices and provided useful insights into how this collaborative work was structured. Berg (1997a, 1999a) queried how formal tools actually work in practice by observing the intertwinement of a formal tool and practice in real time. He used the notions of distribution and drift to gain an 'analytical grasp of the workings (and failings) of formal tools in work practices' by explaining what the interrelation between the tool and practice looked like (Berg, 1997a: 428).

Within ANT, tracing associations between actors can lead to a rich account of the network of humans and non-human actors and their interactions (Callon, 1986). However, this raises the problem of defining the networks, and more specifically can lead to difficulties in determining the boundary of the network under study (Law and Hassard, 1999). Berg (1997a, 1999a) conducted an ethnography of the implementation of the electronic patient record in one ICU; therefore, the network was well defined. Nevertheless, the focus on elements of the record, such as ordering blood tests, meant that the network

was extended outside the ICU to the laboratory. Tracing the actors in this particular aspect of the record enabled Berg to determine the boundary of the network and provide a parsimonious account. Moreover, ANT has been used previously in multi-site ethnography. Bruni (2005) conducted a multi-site ethnography of the electronic clinical record in an Italian hospital. Using ANT helped to define and focus the ethnographic space by tracing the actors and their relationships over time. ANT therefore served as a roadmap to identify the components of a network by tracing relationships.

ANT views the role of the researcher as detached. Thus, in qualitative research the humans are the informants who generate data through interview accounts and the interpreter traces components and associations in the network (Cresswell et al., 2010). Although a key task of ANT is to trace the network, the researcher has an influence on which actors and informants are included (McLean and Hassard, 2004). Therefore, Callon (1986) considers that, in order to not privilege a point of view or to censor an interpretation, the researcher should be agnostic. However, it is argued that the researcher is part of the network and it is not possible for them to be detached (Hine, 2007). In the present research, field notes and a reflexive diary were kept throughout data collection to demonstrate reflexivity as a practice. In addition, reflections on my journey from nurse to doctoral researcher are provided in Appendix I. Reflexivity will be discussed in more detail later in section of 4.2.3. of this chapter.

The equal positioning of human and non-human actors in ANT has resulted in debate. The notion of general symmetry refers to the symmetrical treatment of humans and non-humans, the social and the technical (McLean and Hassard, 2004). It is not the intention of this thesis to delve into this debate; the aim is to develop a pragmatic application of concepts from ANT and Berg's development of aspects of the theory to help understand the implementation of formal tools and formal tools in use. Berg (1997a, 1999a) acknowledged that it was a challenge to:

> conceptualise what it is such tools do in a relational way: without exclusively attributing this activity to either the tool or to the humans working with it. (Berg, 1999a: 373)

Drawing on Berg's development of ANT concepts in this research and viewing humans and non-humans as equally important actors in the networks have prevented an underestimation of the influence of material objects on working practices and have thus provided a lens through which to view the sepsis tools from a relational perspective.

The intention of this research is to offer a contribution to implementation science, and so caution has been applied so as not to get lost in the detail of description, which may prevent practical suggestions for improvement. It is beyond the scope of this research to capture everything about the complexities of the relationships in the field; therefore, the research questions (section 3.7.1.), and study design have provided focus and boundaries to the field of study. Cresswell et al. (2010) recommend focusing on an aspect of a network that is particularly relevant to health services research at the time of the study. Within the field of implementation science, as highlighted in section 2.3, implementation of guidelines has been a long-standing issue; additionally, there has been a call to examine the role that tools and technologies have as actors that 'do things' (Allen, 2017: 1). Empirically, the timely recognition and treatment of sepsis has been of high profile internationally and nationally in relation to evidence-based medicine, healthcare delivery, financial incentives, politics and public awareness. Tragically, lives are still lost due to lack of recognition and timely treatment of sepsis (UK Sepsis Trust, 2018). To investigate the relationships between technology and social settings that provide theoretical robustness and practical applicability, sociotechnical lenses are seen as a fruitful approach (Greenhalgh et al., 2008). Therefore, combining ANT with concepts from technology-in-practice has aided explanation of the phenomena under study.

The intention of the study design was to gain a holistic and pragmatic understanding of the complex setting for the implementation of the quality-

improvement tools, which includes the external influences identified in sections 2.3 and 2.4. Accordingly, in line with the ontological and epistemological commitments underpinning this study, to explore implementation of the tools from the perspective of staff and to closely observe the tools in use, the methodological approach of ethnography was selected.

4.2.2 Ethnography

Ethnography is rooted in an anthropological tradition and may be viewed as having three features: a methodology, a method and an account (Hammersley and Atkinson, 2007). Waring and Jones (2016: 556) comment that 'ethnographic field methods must be capable of bringing to light the social and cultural organisation of everyday life'. However, caution should be taken not to decouple ethnographic methods from the methodological underlying principles. For example, ethnography is designed to explore cultural phenomena where the researcher observes society from the perspective of the subject of the study and, reflexively, examines their own contribution to the understanding and portrayal of the social world being studied (O'Reilly, 2005). As such, ethnography is well suited to studying sociocultural and sociotechnical dynamics, where measurement is not easy and issues are multifaceted (Dixon-Woods, 2003). However, extended periods of observation do not necessarily equate to an ethnographic study unless local practices are undertaken and a contextual understanding of local meanings has been sought. In the absence of such attention, the ultimate goal of developing an ethnographic account may be undermined (Waring and Jones, 2016).

Through its consideration of everyday action or interaction and wider cultural formations, as well as its emphasis on context, ethnography makes links between the macro and micro (Savage, 2006). Fieldwork may focus on a single, bounded community or explore the connection and relationships between different sites (Hammersley and Atkinson, 2007). Ethnography provides a subtle understanding of the roles, rules and ways of being,

meanings and action, rituals, customs and symbols, structures and processes. These features include recasting everyday understandings and practices that are taken for granted, or turning the familiar into the strange (Dixon-Woods, 2003). Therefore, by observing daily life, as the researcher, I established the rules, norms and the social structures, and inductively explored how participants interpreted, understood and represented aspects of their lives (Finn and Waring, 2005). Dixon-Woods (2003) has highlighted how ethnography is well suited to studying quality and safety in healthcare, particularly where these are rooted in organisational dynamics or interactions between staff and technology, where measurement is not easy and issues are multifaceted.

Ethnography is characterised by an iterative process of continuous data collection, analysis and reflection (Savage, 2006). Concepts from ANT and technology-in-practice guided the iterative process of the ethnography. As the researcher, I became an inherent part of the social world and, therefore, do not make a claim of objectivity, in that this research offers an interpretation, not objective truth (Hammersley and Atkinson, 2007). I viewed reality as a whole, and individual phenomena were viewed in relation to that whole. The social cultures of the case sites were considered to be complex totalities; therefore, as will be explained in the next section, I initially took a wide view of the field to avoid reductionism. As a result, universal laws could not easily be applied, despite the presence of universal features in the field. There was no universal or objective truth, only a subjective understanding. To address this, the chapters 5 and 6 will provide rich, thick descriptions of the social context. The intention is to convey some sort of feeling of what it was like to be part of that social situation (Geertz, 1973). While intention is not to generalise to other contexts (Hammersley and Atkinson, 2007), the account presented in ethnographic writing should provide sufficient detail to communicate local meanings and practices from which theoretical explanations can be developed (Finn and Waring, 2005).

Whilst taking this approach, there was not an objective way for the me to disentangle myself from the research; subjective research was co-constituted, a joint product of the participants, researcher and their relationship (Finlay, 2002). Hammersley and Atkinson (2007) suggest rather than endeavouring to mitigate the effects of the ethnographer, researchers should be reflexive in trying to understand data and findings contextually. Reflexivity is a process of self-awareness and scrutiny whereby the researcher develops a more self-conscious awareness, thinking about experiences and questioning ways of doing (Hibbert et al., 2010). Cunliffe (2004: 414) considers the distinction to be related to the nature of reality: a reflective analysis draws on traditional assumptions that there is an objective reality that we can analyse using logic and theory, whereas reflexivity draws on social constructionist assumptions to highlight subjective, multiple constructed realities. Reflexivity, therefore, requires the researcher to operate on many levels and acknowledges that the researcher is intimately involved in both the processes and the product of the research endeavour (Horsburgh, 2003).

4.2.3 Reflections on developing the project

Reflexivity forms part of a larger epistemological debate in social science. ANT views the researcher as detached or agnostic; however, my presence in the networks meant I could never have been a truly detached observer. Cresswell et al. (2010: 8) argue that the researcher:

> always comes from a particular position in time and space and thus must play an active role in eliciting and constructing ANT accounts.

In section 4.2 I indicated that my professional background had resulted in my having experienced first-hand the complexity of healthcare organisations and clinical settings. This section presents my past and professional experiences in more detail and a reflexive account on the research process to make my frame of reference explicit to the reader. Moving into the role of the researcher as an experienced reflective practitioner, it is important for me to distinguish between reflexivity and reflection.

When I started the project, I found it very challenging to draw myself away from my deeply embedded conceptions of why healthcare workers are receptive or resistant to change. Given that I had many years of experience in acute and critical care I was confident that I understood the factors influencing the implementation of the sepsis care bundle, and which aspects I was most interested in exploring more. With supervision, over time I began to develop a reflexive awareness of the multiple constructed realities of the stakeholders who were fundamental to its implementation. The idea that quality improvement technologies may have interpretative flexibility (Pinch and Bijker, 2012), thereby influencing their implementation, formed the basis of my research questions. I began to question if this was the case for the sepsis care bundle and other quality improvement technologies I encountered as a Practice Development Nurse and used as a bank nurse.

Given my background there was the risk that my own interpretations would influence my understanding of the quality improvement technologies. Therefore, I needed to be aware of how such *a priori* understandings might silently influence the research work by making conscious and consistent efforts to avoid privileging a single favoured angle and vocabulary (Alvesson, 2003). As I developed a reflexive awareness and embraced the idea of multiple realities, increased awareness brought new challenges as I continued on the journey to a new dual identity of nurse and doctoral researcher.

In designing the study, I considered my dual practitioner–researcher identity. Allen (2004) highlights how nurses' individual professional identities confer upon them moral responsibilities that may be in tension with the norms of the social groups they are trying to access and understand. Manias and Street (2001) describe how reflexivity challenged them to identify and acknowledge their own taken-for-granted values and to think about how those values impinged upon their judgements of those nurses in their study whose values were very different.

As a nurse and organisational researcher, I am researching aspects of organisational life I have experienced; effectively, I am both the subject and object of the research. Haynes (2009) suggests that working between the dualities of private lived experience and public social knowledge can create a tension, being both the subject and object of the research. My career history adds a further challenge, as a previous role in quality improvement has provided me with experiences that are different from my current experience as a bank nurse at the frontline. Both lived experiences are close to the phenomena under study, but provide different perspectives. Hammersley and Atkinson (2007) highlight the importance of filtering what is heard through the lens of your own experience, but also to maintain separation between my, and the participants experiences.

Prior to commencing fieldwork, I undertook engagement visits and preparatory work with key stakeholders. Negotiating access was straightforward; I knew the topic well and understood the nuanced reactions of the key stakeholders. In negotiating access, I chose to disclose my career history. Revealing that I am a nurse had an impact on the reactions to me; value was placed on my 'still-in-practice' identity. I felt that it gave confidence that I would understand the experiences of acute hospital staff, and increased their, and my, level of comfort as well as rapport (Allen, 2004). I was acutely aware that my insider position carried the risk of blurring boundaries, imposing my own values, beliefs and perceptions, and the projection of biases. Indeed, given my status, it could be assumed that I would be familiar with the realities of the hospital, and so staff might withhold information, resulting in the potential for certain aspects of their experience to be overlooked (Woodward, 2008). Being so close to the phenomena under study, in order not to compromise my researcher perspective, developing such sensitivity to personal disclosure was essential.

Woodward (2008) discusses the tension between the insider/outsider position and argues that this tension invokes another tension, namely that between objectivity and subjectivity. Insider participation may facilitate

greater insights; however, the researcher could be implicated in excessive subjectivity and in privileging their position. Because of this insider position, I needed to be constantly alert and rigorously reflect on how my presence shaped the conversation, whilst still being aware that my experience is different from others and my purpose is to learn from their experiences. My epistemological stance was to observe and document actions and practices in the context of the workplace, rather than to access research participants' experiences by attempting to stand in their shoes. I entered the field knowing about theses and how they might affect my insider–outsider position (Allen, 2004).

4.3 Research design

Ethnography as a methodology allowed for the application of the ontological and epistemological commitments underpinning the study to the theoretically selected case sites. Accordingly, immersion into the setting of the two secondary-care organisations enabled an interpretative exploration of the implementation of sepsis improvement tools. The multi-site case study method enabled me to undertake a close and in-depth investigation of contemporary real-life phenomena as the tools were implemented. The case study design guided rigorous and pragmatic decisions on how to identify the actors and networks and where and when to bound the data collection.

4.3.1 Case study method

The NHS is under constant change; the case study approach allowed this change to be observed in different settings (Yin, 2018). From the literature review it was apparent that the implementation of standardisation, specifically sepsis care improvement, was influenced by external drivers which were updated in response to developments in evidence-based medicine and had to be interpreted by organisations in their local implementation strategies. Case study research was a useful method as it lends itself to the complex and dynamic conditions of organisations and provides an intensive unit (or multiple units) of analysis (Fitzgerald and Dopson, 2009). By taking a

qualitative case study approach I was able to undertake a rigorous, extensive and in-depth exploration of the implementation of sepsis care improvement tools in different contexts using a variety of data sources.

Within case study research there are a number of approaches. Yin (2018) and Stake (1995) have different philosophical orientations, rooted in positivism and constructivism respectively. Yin's approach does allow for philosophical versatility. Some case study approaches are either quantitatively or qualitatively orientated, whilst others encompass both quantitative and qualitative aims and methods (Creswell, 2013). As a novice researcher, I found that Yin's approach offered a more structured approach to case study research than Stake's. The logical sequence of case study design helped to connect the stages of the research process, from the empirical data to the research questions and through to the conclusion.

The goal of Yin's (2018) approach to case study research is to conduct an in-depth analysis of an issue, within its context, with a view to understanding the issue from the perspective of its participants. The integration of different perspectives on the context or interaction means that case study designs can build up very detailed, in-depth understanding. I was interested in tracing the actor-networks involved in the implementation of the tools and closely examining the interactions between healthcare workers, equipment and the tools in clinical settings. These are intricate relationships, and case study research acknowledges that such complex conditions are related to the phenomenon under study (implementation of the tools) and are, consequently, integral to understanding the case (Yin, 2018). Therefore, the approach is appropriate for this study as it allows for certain identified areas to be addressed in-depth whilst also allowing for new themes to emerge from the data. Yin (2018: 15) defines a case study as:

> An empirical method that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context, especially when the boundaries between phenomenon and context may not clearly be evident.

According to Yin (2018: 11), a case study design should be considered when:

1) the focus of the study is to answer 'how' and 'why' questions
2) you have little or no control over behavioural events
3) the focus of your study is a contemporary phenomenon, a 'case'.

There is a need to go beyond description and to offer a contribution to implementation science, and the case study method enabled me to address 'how' and 'why' questions concerning the implementation of sepsis care improvement tools in secondary care. As indicated in this research, the study conforms to Yins' criteria for considering a case study design. The implementation of evidence-based interventions has been a persistent issue in healthcare. In addition, reflecting the philosophical approach underpinning the research, the intention was not to control behavioural events. Yin (2018: 31) states that the 'desired case should be a real-world phenomenon that has some concrete manifestation of an abstraction; the case cannot simply be an abstraction.' Focusing on the abstract concepts from ANT and technology-in-practice would not produce grounds for a case study. Implementation of sepsis care improvement tools in secondary care was a contemporary concrete case to be studied, with research questions posed in relation to the concepts from ANT and technology-in-practice.

In case study research, five components of the research design are especially important (Yin, 2018: 27):

> a case study's questions; its propositions (if any); its case; the logic linking the data to the propositions; and the criteria for interpreting the findings.

Prior to data collection, a literature review was undertaken. The literature and my experience narrowed my interest and helped to design the research questions and the conceptual framework. Propositions were not defined, as, by taking an ANT and technology-in-practice approach, I intended to trace the networks involved in the implementation of sepsis care improvement tools as they emerged through the fieldwork. Taking an inductive approach, I was

mindful of the sensitising concepts from the theoretical and empirical literature to keep a purpose for the fieldwork. The research questions guided rigorous and pragmatic decisions on where to start and where to stop data collection. This also helped when bounding the case.

As highlighted in section 2.3, the implementation of guidelines is a complex issue that is influenced by the context. Sepsis can occur prior to presentation to the ED or can develop in acute inpatient settings. From a theoretical perspective, ANT requires the researcher to trace the actors in networks. Therefore, a multi-site case study with embedded units of analysis lends itself to a variety of complex organisational situations that, according to the literature, from both a theoretical and an empirical perspective, are likely to occur when exploring the implementation of sepsis care improvement tools. Yin (2018) argues that analytic conclusions independently arising from two cases will be more powerful than those from a single case. The research design was supported by a study protocol.

The case sites were carefully selected on the basis of the findings of the contextual and theoretical literature reviews (Chapters 2 and 3). In line with Yin's (2018) replication logic, the case sites were selected because they predicted similar results (literal replication) and contrasting results for anticipated reasons (theoretical replication). The organisations selected operated within the same national guidelines, regulatory regimes and employed professionals trained and regulated under the same systems. However, they were different in terms of size, diversity of services delivered, Care Quality Commission (CQC) rating and stability of board membership. Considering the literature presented in Chapter 2, this provided an interesting comparison that offered the potential to yield contrasting results.

The ED and acute inpatient settings were selected as within case embedded units of analysis as they predicted contrasting results despite being in the same organisation. They were also selected as across case embedded units of

analysis as they predicted similar results due to the nature of working practices in these clinical settings despite being in different organisations.

From a theoretical perspective, the focus on embedded units of analysis allowed actors and associations to be traced within more than one network in the organisation. Berg (1997a) applied the concepts of distribution and drift to the implementation of the electronic medical record in just one ICU. Applying the concepts to more than one clinical setting, where the work practices are different in some respects but the same in others, offers an extension to Berg's approach, and allows the theoretical framework to be developed, whilst also yielding contrasting and useful findings. Figure 6 shows the case study design.

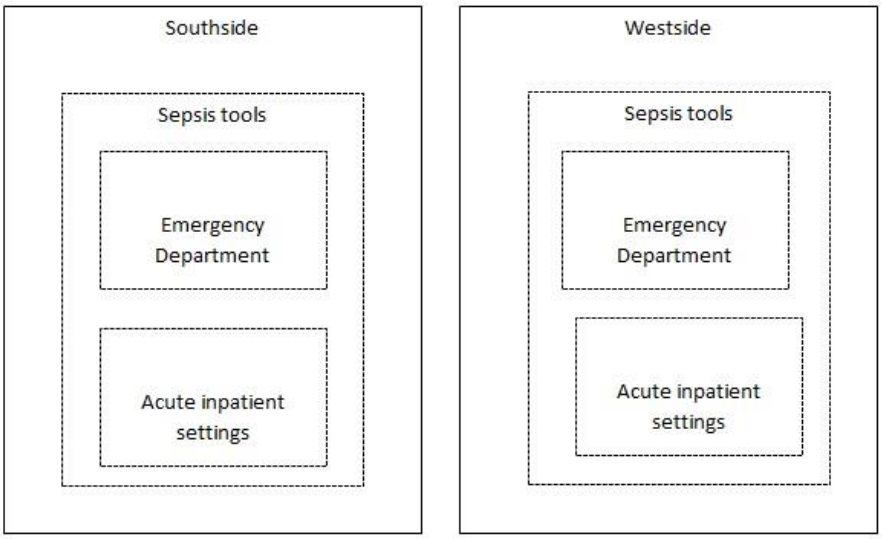


Figure 6. Type 4 case study design (multisite with embedded units of analysis) (adapted from Yin, 2018: 48)

4.4 Case selection

As I developed the research questions, it became clear that to study the implementation of evidence-based interventions as an abstract concept would limit the production of meaningful findings that would impact on the field of implementation science. Therefore, the intention of the case study selection was to maximise the utility and richness of the information content (Yin, 2018). This study sought out diverse organisations, tools and healthcare workers within each case in order to gain multiple perceptions of practice. Purposively, two secondary-care trusts were selected which represent a range of acute care services, in different regions of England. The locations are appropriate because of their inherent interprofessional representation, and current and past experiences of designing and implementing the evidence-based interventions.

4.4.1 Case site selection and rationale

Of fundamental theoretical importance in this research is how the tools associated with evidence-based interventions interacted with healthcare workers within the existing sociotechnical arrangements of secondary care. This comprises quality improvement initiatives that hinge on introducing novel material and symbolic artefacts into established social practices and forms of social organisation, often on the premise that it will bring about behavioural or cultural change (Allen, 2009). The NHS trusts selected offer case sites that describe the complexities of the quality improvement agenda and associated external assurance processes. Sites and participants have been given pseudonyms in the thesis to protect their identity.

Both case sites have past and current experiences of designing and implementing care bundles, and specifically the sepsis care bundle. However, they offer comparison in terms of:

- different administrative regions in England
- size

- range of medical specialties
- Care Quality Commission rating.

Given the rapidly changing landscape of the NHS, it is inevitable that every organisation will be undergoing an element of change. Southside Hospitals NHS Foundation Trust had recently appointed a new Chairman and Chief Executive and was at the beginning of talks with a view towards merger with a nearby larger organisation, Northside Teaching Hospitals Foundation Trust. Westside University Hospitals NHS Trust had recently entered into a long-term partnership with Eastside Hospitals. Therefore, both organisations were in a period of transition; this would contribute towards understanding what impact the wider context has on the implementation of quality improvement initiatives.

Southside Hospitals NHS Foundation Trust is the principal provider of acute hospital services for the residents of Southside and surrounding areas including Southside, Southwest and Southnorth. The trust serves a population of approximately 360,000. In addition to the acute hospital, the trust includes two community hospitals (in Southey and Southness) and a treatment centre, based on the Royal Hospital Southside site. The amount of patient care delivered in a typical year across all sites is over 47,000 planned and emergency operations, more than 70,000 ED attendances and approximately 13,000 day-case procedures. Following the Keogh report (Keogh, 2013), the trust had been judged by the CQC as 'requires improvement' and was in special measures. Following a CQC review at the start of data collection, the trust was no longer in special measures but the 'requires improvement' status remained.

Westside University Hospitals NHS Trust is one of the biggest and busiest acute trusts in England, providing services to over 2.5 million residents of Westside and its surrounding communities. The trust also provides specialist services to a further 3–4 million people from neighbouring counties each year. The trust is made up of the Westside Hospital (the emergency care site),

Westside Royal Infirmary (where the cancer centre, cardiac centre and stoke services are based and where the focus is on planned care and the care of patients with long-term conditions) and Westside House (where a range of outpatient services are provided). The trust has a national and international reputation for many of its specialist services, including stroke, renal, neurosciences, cancer services and trauma. The trust is judged as 'good' by the CQC. Figure 7 depicts the field of study.

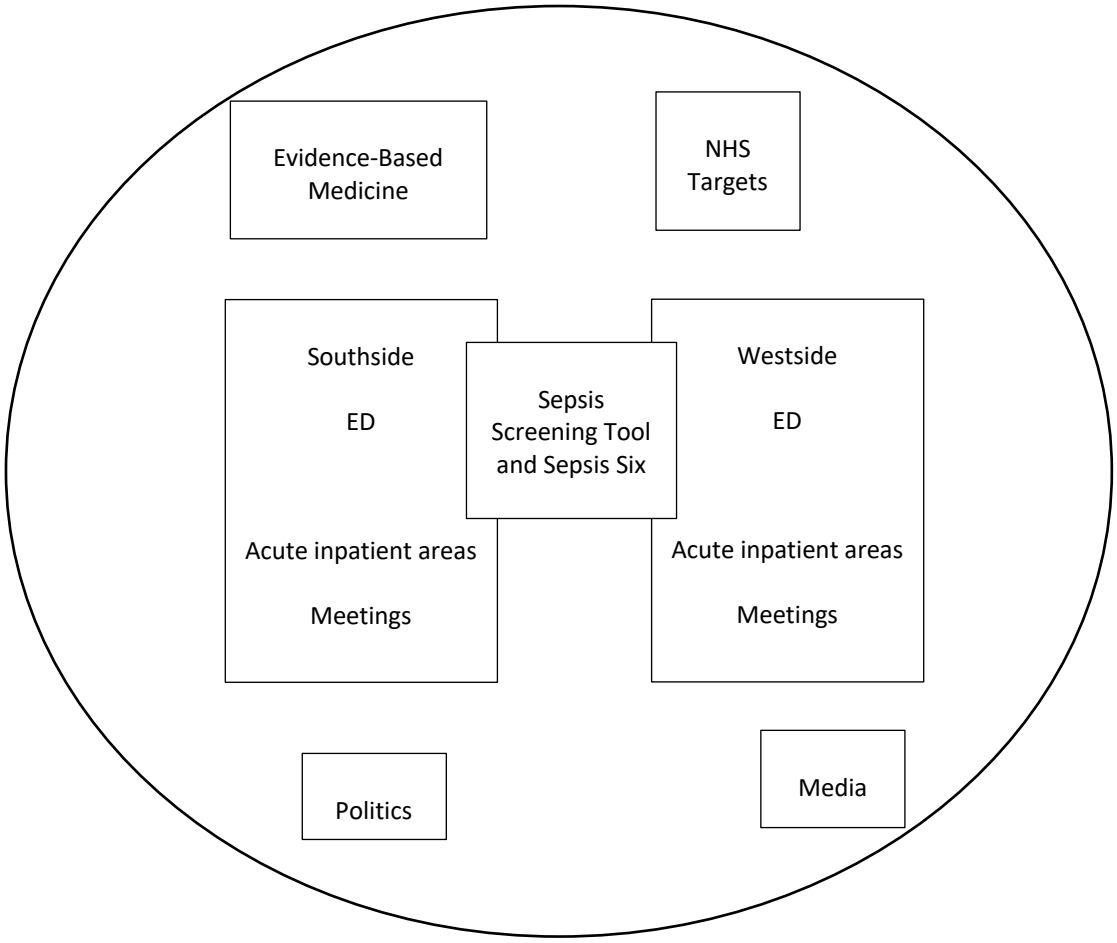


Figure 7. The field of study

4.4.2 Access

As the organisational context for this research is the NHS, along with University Ethical Approval (Appendix II), NHS Research and Development approval was required at the case study sites before data collection could begin. Approval required negotiation with proposed sites as the protocol was developed and submitted for relevant approvals. Favourable approval was gained for Southside Hospitals NHS Foundation Trust in November 2015 and for Westside University Hospitals in December 2015.

Access to both case study sites was initiated via key informants in senior quality and safety roles whom I had met through my previous roles in the NHS. At Southside Trust I met with the key informant, who advised that I should meet with the Chief Nurse. The key informant briefed the Chief Nurse about my research prior to my meeting with him and she accompanied me to the meeting. After detailed questioning from the Chief Nurse, support for the research was given along with access to the Assistant Director of Nursing and Quality. It was agreed that the Assistant Director of Nursing and Quality would be my point of contact and whilst in the trust I would be accountable to her and, if necessary, raise any issues of concern with her.

The focus of the study was on how staff interacted with the sepsis care improvement tools. However, it was plausible that certain clinical issues might be discussed or could have occurred during the fieldwork. In the event that negligent practice or illegal behaviour was revealed, or a clinical emergency arose, as a Nursing and Midwifery Council registered nurse I am legally, professionally and morally bound to adhere to the correct policies and practice guidelines. The Assistant Director of Nursing and Quality was aware of my professional registration. It was agreed that, in the event of any issues encountered in the field that were beyond the scope of my role as a researcher, I would discuss them with her. My dual identity was also discussed in supervisory meetings. From this point at Southside, the Assistant Director of Nursing and Quality identified gatekeepers of the relevant clinical

areas and relevant service development roles within each trust. These gatekeepers were contacted and access was successfully negotiated. Following preparatory work in December 2015, fieldwork commenced February 2016, starting in the ED, where I undertook observations, interviews and collected documents for analysis.

At Westside University Hospitals NHS Trust the process differed slightly. Once I had met with the key informant, he provided me with names of staff in relevant roles and this enabled me to seek their permission. This did not extend to the Chief Nurse. I contacted individuals directly and met with the Assistant Director of Nursing and the Head of Nursing and Midwifery Research, both of whom extended support and gave permission for me to study quality improvement implementation within the organisation. In this trust, in the event of any issues encountered in the field that were beyond the scope of my role as a researcher, I would discuss the issues with the Head of Nursing and Midwifery Research. The Clinical Lead for Sepsis, a consultant in critical care and acute medicine, was identified by the key informant due to the focus of my study, and he identified the majority of gatekeepers at the trust. Following our meeting he linked me via email with a consultant in ED and a consultant in medicine who was also the Deputy Director for Medical Education. Both consultants offered support for my study and via email linked me with the relevant nursing gatekeepers. These gatekeepers were contacted and access was successfully negotiated. Following preparatory work in January 2016, fieldwork commenced in August 2016.

4.5 Data collection

A hallmark of a case study is the use of multiple data sources (Yin, 2018). Accordingly, documents, observations and interviews were collected. In keeping with the ethnographic methodology, the data collection methods were interpretative, in order to describe, interpret and explain the phenomenon. There would have been no advantage in controlling and attempting to measure the situation or just conducting interviews, as doing so

would risk reducing the phenomenon to parts rather than understanding the whole. In addition, rich contextual data are unlikely to be generated, which would lead to a neglection of the real-life context and potentially a failure to contribute towards knowledge of the social world (Yin, 2018). The next sections will present the rationale and description of the document collection and the observations and interviews undertaken in the study.

4.5.1 Documents

Interviews and observations of meetings and clinical practice were the main sources of data, but documents were a useful supplement that helped to develop understanding and discover insights into the international, national and local drivers of sepsis care improvement (Merriam, 1988). The NHS generates many internal and external documents, which are an integral feature of working life. Documents were very much part of the social setting, and so were taken account of as a source of data. They provided information that informed, corroborated and challenged information gained from the observations and interviews (Hammersley and Atkinson, 2007). The intention of collecting documents was:

- to enable and trace the formation of external and internal networks related to sepsis care improvement
- to explore the connections between external guidelines and financial incentives and local interpretation and implementation plans
- to gain insight into working practices as indicated by trust policy.

The documents provided a means of tracking change and development in care sepsis improvement and were the main data source for identifying how sepsis improvement evolved externally to the case sites (Yin, 2018). The documents were carefully selected to determine their relevance to the research questions, and to provide background information and historical insights. Publicly available and site-specific documents were collected from both case study sites. Publicly available documents included national policy documents and clinical guidelines related to sepsis and the wider quality improvement

agenda. Site-specific documents included publicly available strategies and annual reports. Permission to access additional documents relating to the quality improvement agenda was also sought. The documents sourced served an investigative purpose by providing information that generated insights and ideas before, and whilst, I was in the field (Hammersley and Atkinson, 2007). Access to and treatment of documents were in line with the confidentiality guidelines outlined in the study protocol. All documents collected are detailed in Table 5.

Table 5. Documents collected for analysis

	Name of Document	**Date of Document**
National Documents	Keogh Review	July 2013
	CQUIN 2015/16 guidance	March 2015
	CQUIN 2016/17 guidance	March 2016
	The Parliamentary and Health Service Ombudsman - *Time to Act Severe Sepsis: Rapid Diagnosis and Treatment Saves Lives*	2013
	National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) – *Just Say Sepsis! A Review of the Processes of Care Received by Patients with Sepsis*	Nov 2015
	The National Centre for Health and Care Excellence (NICE) – Draft guidelines for consultation. Sepsis: the recognition, diagnosis, and management of severe sepsis	Nov 2015
Southside Hospitals NHS Foundation Trust	Southside Quality Strategy 2013-15	April 2013
	Operational Plan 2014-19	April 2014
	Strategic Plan 2014-19	April 2014
	CQC Report	Oct 2015
	Adult nursing quick reference safety guide	2015
	Chemotherapy helpline alert card	Unknown
	Management of sepsis in pregnancy and the postpartum period policy	2011
	Sepsis Screening Flowchart and Sepsis Six V1	2012
	Sepsis Screening Flowchart and Sepsis Six V2	2016
	Sepsis Screening Flowchart and Sepsis Six V3	2016
	Modified Early Warning Observation and fluid balance chart - adult	Unknown
	Clinical guidelines for the treatment of suspected sepsis	Jan 2015
	Track and trigger observation chart - adult	Unknown
Westside University Hospitals NHS Trust	Patient Safety information for patient leaflet	Oct 2013
	Annual report	2014
	ED observation chart/escalation plan	Unknown
	Adult observation chart	Unknown
	Handover sheet Adult/Children	April 2014
	Fluid balance chart	Jan 2015
	Nursing and Midwifery Strategy 2014-2017	April 2014
	CQC Report	Dec 2015
	ED Sepsis Initial Assessment Tool	2015

4.5.2 Observations

Observing daily activities in the context in which they occur will potentially expose practices, rules and behaviour that may not be revealed by other forms of data collection, such as interviews (Allen, 2010). Observations of interactions between healthcare workers and between managers in the clinical setting and at meetings revealed deeper attitudes, beliefs and interpretations of the tools and the implementation processes (Allen, 2010). Two hundred hours of observations were completed in the ED, acute inpatient settings and relevant meetings.

Observations within and across the case sites from the executive board to the clinical settings focussed on tracing the formation of actor-networks and what resulted in stable and unstable networks. Implementation of the sepsis tools was under the influence of external drivers, in particular evidence-based medicine and financial incentives. As such, tracing the networks involved in implementation from the executive board the clinical frontline offered key information as to how external drivers were interpreted and operationalised at a local level. The aim of observations undertaken at meetings was firstly to understand the broader organisational context and secondly the quality improvement infrastructure and governance arrangements related to sepsis care improvement.

Attention was given to the roles of the people attending, the interactions between attendees as they interpreted external sepsis guidelines and financial incentives, and how implementation strategies were developed and enacted. Attention was given to who was leading the interpretation of external sepsis guidelines and the financial incentives and what seemed to drive and govern them. To trace the networks, I examined how implementation strategies were devised and operationalised, and what role (if any) relevant staff in corporate and executive roles had. I examined the strategies used by those leading the sepsis care improvement work to mobilise staff to deliver operational plans. I then observed the sepsis teams

delivering the plans and the strategies they used to engage clinical staff. At both case sites I shadowed the nurses responsible for sepsis care improvement as they delivered teaching sessions and undertook audits. Observations in clinical practice focussed on the translation of actor-networks and zoomed in on the actors and the work practices involved in screening and treating a patient for sepsis.

Observations in the Emergency Department

Data collection regarding how staff interacted with the sepsis care bundle took place within the ED, as this is where the majority of patients present with sepsis. The healthcare staff involved in the care of patients with sepsis in this context were diverse and included doctors, nurses and nursing assistants. The EDs in both case sites were split into different areas, depending on the severity of injury or illness. The areas were minor injuries, major injuries and resuscitation. The ED at Westside also had an initial assessment area. The initial focus of observations in the ED was on the work undertaken in each of the different areas, how patients entered the ED and journeyed through the department, who cared for them and what equipment and tools those healthcare staff used. This included specific environmental features, how busy the department was and how many different tasks the healthcare workers were managing.

Following this initial period of scene-setting, observations zoomed in on healthcare staff undertaking the specific work practices involved in screening and treating a patient for sepsis. Observations encompassed who was involved and if their work was linear or if it was disturbed, and if so by whom and/or what (humans and non-humans), and to do what other work. I documented the stages of the screening and treatment processes. The time taken for the tasks to be undertaken was also noted, to establish if there were occasions when delivery of the tasks drifted from the intention of the tool's designers. I observed whether the sepsis tools were used and what equipment was required to undertake the tasks. I observed what happened if

the sepsis tools were not used and what impact missing or broken equipment had on the work. As well as physical work of healthcare staff I examined the mental work of different staff members in the different areas in the ED. This included how staff interacted and supported each other and prioritisation of workload. Attention was given to the impact the number of patients in the department had on the routine, flow through the ED and work practices.

Observations in the acute inpatient setting

To observe the work practices and explore the similarities and differences, observations were initially conducted in the Medical Assessment Unit and a Healthcare of the Elderly ward at each case site. The purpose was to set the scene outside of the ED setting. Observations were focussed as described above: initially, a wide view of the clinical setting was taken before focusing in on working practices relevant to sepsis recognition and treatment. It was apparent in the preliminary observations at each case site and from the literature that the incidence of sepsis in the acute inpatient setting was lower than in the ED. As such, I shadowed healthcare workers whose role it was to review deteriorating patients: a Foundation Year 1 doctor on call, a Medical Registrar on call, the Hospital at Night teams and the Critical Care Outreach Team (CCOT).[1] The rationale for shadowing was maximise exposure to patients being treated with the sepsis care bundle, which might not occur if observations were restricted a single ward or assessment area other than the ED or ICU. On these occasions I examined the scope of their work practices, how patients were referred to them and how they prioritised their workload across time and the environmental boundaries they worked within. By taking this approach to observations outside of the ED, the study was able to encompass specialist nurses, doctors, nurses and nursing assistants.

[1] A 'Foundation Year 1' doctor will be in the first year of a two-year programme for doctors who have just graduated from medical school. A 'Medical Registrar' is a doctor mid-way through postgraduate training whose role it is to manage those presenting with acute medical illness, as a competent decision-maker. A 'Hospital at Night team' comprises the most senior nurses on duty overnight; they will be responsible for supporting the ward teams with deteriorating patients and for the on-site management of the hospital at night.

Setting the scene at Southside and Westside

I spent a month at each case site meeting stakeholders and undertaking preliminary observations to 'set the scene' of the individual settings before returning and spending five consecutive months at each site. This process of setting the scene reflected Yin's (2018: 106) recommendation that 'a pilot case study helps you to refine your data collection plans with respect to the content of the data and the procedures to be followed'. Observations were completed during the day and night, in the week and at the weekend, generally across three days in a week. For each observation episode, I reflected throughout the observations and in order not to lose key details I took regular 'time out' to alternate periods of observation with time away from the clinical setting for note taking and reflection. I allocated time at the end of each session for deeper reflection and more detailed and richer accounts (Emerson et al., 2001). The note taking was informed by the research questions and conceptual framework, but I also took note of emergent themes. An example of field notes used to record data is given in Table 6. All field notes were anonymised and pseudonyms were given. Field note data have been used in Chapters 5 and 6 as snapshots to provide a rich description of observations for the reader.

Table 6. Example of field notes from Southside ED, March 2016

Scenario	Description of events	Comments
A patient is brought to the ED with suspected sepsis.	The nurse approached the patient at 7.30pm to record the first set of observations. She was unable to record the observations as he was shaking and putting his coat hood up. The nurse was then asked to check some drugs with another nurse. Returning to the patient she was able to record the observations on her second attempt. The nurse then attempted to take bloods and insert an intravenous cannula. The nurse was unsuccessful in her attempt so asked a colleague to try. The second nurse was successful. The time is 8.45pm.	Empirical – The patient's condition presented the nurse with difficulties in measuring and recording physiological observations, taking blood tests and inserting an intravenous cannula. All of which are vital in order to recognise and treat sepsis. Theoretical – The nurse was caught up in cross-cutting actor-networks which distracted her from her patient. Completing the tasks was widely distributed across a range of heterogeneous entities in a network that was in constant motion. The result was a drift from the intention of evidence-based medicine and CQUIN.

Observations at meetings

The meetings observed were all ones scheduled by the organisation. As set out in the research protocol, meeting attendees were informed via email, with supporting information, that I would be observing. My contact details were provided and the option not to be included in the observations was offered; this did not occur. The periods of observations are detailed below in Table 7.

Table 7. Periods of observation

Site	Setting	Total time spent (hours)	Sessions
Southside	ED	26	5
Southside	Healthcare of the Elderly ward	4	3
Southside	Medical Admissions Unit	9	3
Southside	Shadow Critical Care Outreach Team	15	3
Southside	Shadow medical Foundation	5	1
Southside	Shadow the Hospital at Night Team	5	1
Southside	Shadow Medical Registrar on call	9	2
Southside	Shadow the Quality Support Nurse	5	1
Southside	Quality Nurse delivering sepsis training	4	4
Southside	Quality and Safety Group	8	4
Southside	Quality Committee	3	2
Southside	Scrutiny meeting with the CCG	3	1
Southside	Acutely Unwell Strategic Planning Forum	2	1
Southside	ED staff meeting	1	1
Southside	Matrons' Forum	1	1
Southside	Senior Sisters' meeting	1	1
Westside	ED	18	5
Westside	Shadow Advanced Clinical Practitioner ED	5	1
Westside	Healthcare of the Elderly ward	2	2
Westside	Medical Admissions Unit	17	5
Westside	Shadow Critical Care Outreach Team	12	3
Westside	Shadow Hospital at Night Team	6	1
Westside	Shadow FY1 on call	5	1
Westside	Shadow sepsis nurse	4	1
Westside	Blood Culture Process Map meeting ED	1	1
Westside	Patient Safety Board	6	3
Westside	Identify and Treat meeting	8	4
Westside	Sepsis group	6	3
Westside	Quality Committee	6	2
Westside	Scrutiny meeting with the CCG	3	1
Westside	Matrons' meeting	1	1

Typology of participant observer roles

Gold (1958) describes a typology of participant observer roles: complete participation, participant as observer, observer as participant and complete observer. I took the role of observer as participant; my ethical stance was not to be covert, as I was explicitly there in the capacity of researcher, albeit in a clinical setting with which I was familiar. Despite being an experienced nurse, an identity I did reveal when asked, I limited my participation in the work to occasionally cleaning trollies in between patients in the ED and medical assessment settings. Throughout data collection I was surprised at how little attention was paid to me by staff. When the clinical settings were not busy, staff questioned why I was there and seemed to accept my explanation readily, and frequently offered their views on sepsis care improvement. At busier times, clinical work took precedence and after I had been in the setting a number of times my presence seemed to be unremarked.

I took the opportunity for informal conversations as they arose between clinical work and at the end of meetings. These conversations allowed me to clarify observations and probe staff about the decisions I had witnessed them making, how they dealt with times of overcrowding in the ED or how they coped when receiving multiple patient referrals. I used the opportunity to ask about working practices related to sepsis care improvement, to compare them in the busy clinical setting to what was displayed on and in the fixed screening tools and the Sepsis Six. The informal conversations in real time ensured that the moment was not missed. This process was important, and it prompted me not to make assumptions about what I observed based on my own extensive clinical experience.

Berger (2015) discusses how a constant, deliberate effort to maintain the separation between her own experiences and others was required through examination of herself and by documenting reactions. This view reflects the belief that individuals can engage reflexively with conceptual or emotional information stored in memory or in-the-moment experience. As an

experienced practitioner, I have transferrable skills of reflection-in-action, the ability to 'think on my feet', making decisions and judging their impact, at the same time as conducting an activity and/or conversation (Schon, 1987). Allen (2004) emphasises the importance of how, in field notes, we clearly distinguish our personal emotional responses to relationships in the field from the social interactions that prompted them, by explicating the relationship between the two. To assist with this process in my field notes, I separated the narrative of the field with the narrative of self.

4.5.3 Interviews

Yin (2018: 118) considers that interviews are an essential source of case study evidence: 'interviews can especially help by suggesting explanations (i.e., the "hows" and "whys") of key events, as well as reflecting participants' perspectives'. Forty-seven semi-structured interviews with executive board members, corporate nurses, doctors and nurses in management roles and frontline doctors, nurses and support staff were undertaken. Interviews were anonymised and pseudonyms were given. Qualitative interviews may be considered to be a 'conversation with a purpose' that enables exploration of how participants interpret their experiences associated with the artefacts of quality improvement in secondary care (Mason, 2002: 62). The case studies examined the networks and work practices involved in sepsis care improvement to determine why and how these factors influenced the implementation of the care bundle. My aim with the semi-structured interviews was to discuss with healthcare and corporate staff their experiences, perceptions and assumptions about how and why they interpreted and operationalised external drivers and, if relevant, did or did not use the tools in practice (Bryman, 2008).

To clarify and unpack points from the observations, interviews at both case sites with executive and corporate staff aimed to understand how and why external drivers related to sepsis were translated and what influenced the development and execution of implementation strategies. To enable a general

insight into the organisations, executive staff (e.g. the Chair) and nurses and doctors in senior positions (e.g. the Chief Nurse and Medical Director and their deputies) were interviewed. Interviews with corporate staff were targeted towards those who were responsible for delivering sepsis care improvement plans. The aim was to understand specifically their perspectives on and experiences of developing and delivering implementation plans.

Sample size was determined by the number of stakeholders involved in the implementation of sepsis care improvement at each site. Participants were identified using chain referral sampling, a form of non-probability sampling, which allowed for individual invitations to potential participants to be made with the aim of increasing the response rate (Heckathorn, 1997). In addition, the sampling strategy allowed for participants to identify and refer others who had experienced the implementation of the sepsis care improvement tools (Penrod et al., 2003). The sampling strategy allowed for staff in the network to be traced as fieldwork evolved. Recruitment occurred without issue.

Interviews with clinical staff were targeted at all levels of nurses and doctors who were working in clinical settings where the sepsis tools had been or were being implemented. The aim of the interviews was, again, to clarify and unpack points raised in the observations, with a focus on healthcare workers' experiences and perceptions of sepsis care improvement plans and how and why the nature of work in the clinical setting influenced their practice. Recruitment for interview of all groups of staff occurred without issue. I was flexible, and for clinical staff was available at times which were generally quieter in the clinical setting. Information sheets and posters regarding the study were made available in clinical areas and staffrooms but I did not receive any response via this method. Clinical staff were all recruited via informal conversations that occurred when observations took place. By taking this approach I was able to become familiar with the routine of the clinical settings and on occasion was able to interview staff on the same day as making the request.

As part of the research protocol and ethical approval procedure, a topic guide was developed (Appendix III). Unlike a structured interview schedule, the topic guide was not followed in sequence, allowing for a natural, fluid discussion to take place. The relative lack of structure allowed interviewees to be free to express new perspectives. However, there is a risk that this would have resulted in variation (and drift from the research questions) that could present a challenge in the analysis of the interview data (Alvesson and Ashcraft, 2012). To mitigate this, throughout the interviews I kept an awareness of my research agenda and maintained some control. The use of different modes of questioning, such as directive and non-directive, and listening for cues in the interviewee's responses, enabled transition between topic areas, thereby distinguishing the interview from a naturally occurring conversation (Hammersley and Atkinson, 2007).

During the interviews, so not to interrupt the flow, I made a note if the participant mentioned key terms I thought warranted further questioning. This was important, as it meant I did not make assumptions about the meaning behind the knowledge being shared and did not miss opportunities to explore important data (Thomson and Gunter, 2011). It required me to be reflexive in order to maintain an awareness of my response to what was being shared, whilst also keeping focus on what the participant was saying and the interview topic guide.

The interviews were undertaken in offices and other private spaces. Interviews were all recorded on a Dictaphone after gaining formal consent. Following each interview, I reflected on what had been discussed and made short notes which were then transcribed. Tables 8 and 9 show details of the interviews at both sites (job role and gender of participants and length of interviews).

Table 8. Interview participants – Southside

Job role	Gender	Interview length (minutes)
ED Sister	Female	46
Quality Nurse	Female	78
Practice Development Nurse ED	Male	55
Head Nurse Medicine	Female	50
Matron ED	Female	58
Newly Qualified Nurse ED	Female	62
Critical Care Outreach Lead Nurse	Female	56
Quality Nurse	Female	45
Staff Nurse ED	Female	43
Associate Medical Director for Quality and Safety	Male	41
Clinical Director ED and Trust Sepsis Lead	Male	80
Senior Quality Improvement Nurse	Female	61
Divisional Medical Director	Male	39
Deputy Medical Director	Male	42
Medical Director	Male	54
Foundation Year One	Male	43
FY1	Male	47
FY1	Male	49
Medical Registrar	Female	38
Cardiology Consultant	Male	42
Senior Surgical Sister	Female	39
Ward Manager	Female	55
Ward Manager	Female	58
Non-Executive Director	Male	49
Assistant Director of Nursing Quality	Female	64
Senior Staff Nurse	Female	35
Chief Nurse	Female	46
Staff Nurse	Female	37

Table 9. Interview participants – Westside

Job role	Gender	Interview length (minutes)
Sepsis Clinical Lead	Male	82
Critical Care Outreach Nurse	Male	48
Lead Advanced Clinical Practitioner ED	Male	62
Emergency Department Assistant	Female	41
Ward Manager	Female	42
Deputy Chief Nurse	Female	58
Critical Care Consultant and chair of Identify and Save meeting	Female	79
Practice Development Nurse	Male	46
Head of Patient Safety	Male	72
Clinical Director ED	Female	51
Consultant Anaesthetist	Male	40
Acute Care Pathway Lead	Female	36
Critical Care Outreach Lead Nurse	Female	61
Staff Nurse	Male	39
Staff Nurse	Female	36
Healthcare Assistant	Female	35
Consultant Physician	Male	41
Medical Registrar	Female	39
Chair	Female	63

Methodological implications of interviewing elites

A number of participants were in senior positions (referred to as elites) in the organisation, which presented unique methodological challenges (Mikecz, 2012). Interviewing elites was important to the study, as I was interested in their views on the interpretation of external drivers and wished to explore further points I had observed in meetings they attended and often chaired. Gaining access to the elites was without issue. If contact had not been made earlier, when gaining access to the organisation, I approached them at the end of the meetings I was observing. I waited to approach them until I had been in the trust for a few months. I did this so that I would be a familiar face and to develop an understanding of their role within the organisation. It was important to demonstrate that I was knowledgeable and credible, and to build rapport and trust (Welch et al., 2012). Sepsis was a high-profile healthcare issue and the implementation financial incentives captured the interest of the elite participants. My positionality as a University of

Nottingham PhD student sponsored by The Health Foundation and a registered nurse also gave credibility and acceptance.

In my previous roles in the NHS I had worked with Chief Nurses and Medical Directors and their deputies, so I was able to approach the interviews with an understanding of their role and conduct a meaningful and informed conversation. As such, I did not feel the presence of a status imbalance (Mikecz, 2012). The participants spoke easily, were candid about their views and commented that the interview felt like a safe space in which to speak of their experiences. As Welch et al. (2012: 622) found when interviewing corporate elites:

> interviews with entrepreneurs sometimes resemble therapy sessions, with respondents clearly appreciating the presence of an attentive and sympathetic listener.

I perceived there to be more of a hierarchical gap between myself and the Chair and Non-Executive Director. I had observed them at meetings. They were both clearly accustomed to engaging in complex discussions; they were professional communicators and practised in fielding questions (Welch et al., 2002). The Chair was very experienced and well respected. I felt in the interview that I needed to demonstrate a knowledge of her role and responsibilities and the quality improvement agenda at her level in the organisation. I also felt restricted by the bounds of etiquette I perceived, which resulted in a status imbalance (Mikecz, 2012). At times in the interview I felt observed by the Chair and was corrected by her on my interpretation of an observation from a meeting when I attempted to explore it with her. This presented ethical, validity and reliability concerns, in that I might be accepting responses because of the perceived power dynamic (Welch et al., 2002). I reflected on the relationships and dynamics after each interview by using a diary and referred to the diary notes when analysing the transcripts (Young, 2011). After the interview with the Chair, I realised that my intention to demonstrate a knowledge of her role and responsibilities and the quality

improvement agenda at her level was outside of my scope. The diary entries allowed me later to analyse her transcript reflexively.

The next section describes the overall approach taken to data analysis. Drawing on Yin's approach (2018), detail about each component of analysis in the order undertaken will then be provided.

4.6 Data analysis

Yin (2018: 174) proposes that a general analytical strategy is required to link the case study data to important concepts of interest and for the concepts to give a sense of direction in analysing the data. In this research, the principles of Yin's (2018) analytical techniques of chronological sequence, explanation building, and cross-case synthesis were used (Table 10). As a novice researcher inductively analysing and synthesising a large dataset, I found the guided approach to analysis useful. Within-case analysis was conducted. This enabled an in-depth understanding and description of the uniqueness of each case regarding the implementation of the tools within the organisation and the embedded units of analysis: the ED and acute inpatient settings. Cross-case synthesis was then conducted to look for similarities and contrasts across the case sites (Yin, 2018).

Table 10. Yin's (2018) analytical techniques used in this research

Technique	Description
Chronological sequence	Traces events over time. The procedure has a descriptive and analytic purpose that offers explanatory value.
Explanation building	Explains in the narrative form how and/or why the phenomenon happened. Iterative process that builds an explanation about the case
Cross-case synthesis	Technique for the analysis of multiple cases. Individual case sites are analysed separately and then explanations from each case are compared.

The one-to-one semi-structured interview audio recordings were transcribed verbatim by a transcribing service approved by the University of Nottingham. I

transcribed all other data from field and interview notes. Protecting respondents' anonymity was important. Participants were informed that the data would be anonymised and that pseudonyms would be used. The pseudonyms were used by the transcription service.

In line with the epistemological and ontological assumptions established for this study, an interpretative, reflexive approach was taken to analyse the data. The conceptual framework gave a sense of direction when analysing the data (Yin, 2018). I maintained an awareness throughout data analysis that the conceptual framework had the potential to limit the inductive approach when exploring the phenomenon being studied. I kept a journal on my thoughts; the entries were discussed at supervision sessions to debate if my thinking had become too driven by the framework (Baxter and Jack, 2010).

The next section provides the detail of and rationale for each analytical step, examples from all the stages of analysis are given in Appendices V to VIII. Data analysis was underpinned by Lincoln and Guba's (1985) approach and guided by the four criteria of trustworthiness, as presented in section 4.7.1.

4.6.1 Documentary analysis

The documents were not coded in the same way as the interview and ethnographic observation data, which will be detailed in section 4.6.2 and 4.6.3. Initially, the documents were read thoroughly, to develop an understanding of the external and internal networks. I considered the original purpose of the document, the reason it was produced and the target audience. When analysing internal documents such as annual reports, Yin (2018) advises that caution is taken, as they are usually written for a specific purpose. As such, it was essential that the contents of the documents were critically analysed. Traceable connections were key to the description of the empirical data to show to the reader how the actor-networks were established. The overall aim of the research was to ascertain how secondary-care organisations interpret and implement external drivers associated with care bundles and how care bundles are used in clinical practice. Therefore, a

starting point prior to fieldwork was to understand pertinent national policy and any publicly available local documents.

Internal documents and, crucially, the tools (which were not publicly available) were accessed once NHS Research and Development approval had been gained at each case site. The internal documents helped me to explore and unravel the human and non-human actors related to sepsis improvement within both case sites. This ranged from documents related to the reporting of sepsis care improvement to documents related to the clinical tasks and equipment required to recognise and treat a patient for sepsis. Throughout the course of fieldwork, external sepsis guidelines and financial incentives changed. Such changes were important to the analysis and creation of the narrative, as they influenced local implementation of the sepsis tools. Focusing on key events permitted the creation of timelines (see Figures 4, 8 and 13) and enabled me to visualise connections which could be further explored through observations and interviews.

The analysis was iterative. I went back to the documents following observations and interviews to clarify and refine how the external and internal events influenced the formation of networks to produce the timeline which supported the production of the narratives that underpinned data Chapters 5 and 6.

4.6.2 Within-case analysis

Within-case analysis allowed me to focus inductively on the data within the case that answered the research questions and was most salient to the conceptual framework (Yin, 2018). Data generated at Southside were initially analysed as a whole. Then focus was narrowed to the embedded units, namely the ED and acute inpatient settings. The codes and categories identified where then applied to analysing the data at Westside, although additional codes were allowed to emerge. The same process of analysing the data as a whole and then the data specific to the embedded units was

followed. Data were firstly subjected to open coding, then axial coding and finally selective coding.

Step 1: open coding

The first step was to become familiar with the data. This commenced whilst data collection was still taking place, but once all the data had been collected and transcribed, in-depth reading was done and I began to organise the data (Hammersley and Atkinson, 2007). Open coding was used as the first stage of qualitative data analysis. It involved breaking down, examining, comparing, conceptualising and categorising data and relied upon my interpretative and epistemological thinking (Strauss and Corbin, 2007). At this stage in the open coding, the aim was to understand what the key themes in the implementation of the care bundle sepsis were. I immersed myself in the data and started to look for potential links between the actors involved in the implementation of the tools. The intention was to trace the formation of actor-networks. To aid this process the actor-networks were traced visually, an example is given in Appendix IV. The intention was also to examine the work practices when the tools were used in clinical practice.

All coding was completed manually, as this permitted a closeness to the data. The transcripts and field notes were carefully read to look for distinct first-level codes and categories in the data. Codes were written on the printed transcripts and on transcribed field notes in differently coloured felt-tip pen (see Appendix V for examples) and a master list of codes was compiled in a Word document. Once I had coded all the transcripts, I grouped together the first-level codes and then applied categories to each group. I kept a note of how I defined the categories and codes. The analytical process of open coding helped to show commonalities by grouping excerpts of data together that were describing similar and related excerpts (Strauss and Corbin, 2007).

The volume of raw data was vast, and so needed to be organised to enable me to have the building blocks for analysis and interpretation. Practically, I needed to be able to move through my data, to search, retrieve and cross-reference (Mason, 2018). To support interpretation and explanation of the phenomenon, a holistic approach to organising and assembling the data was taken. According to Mason (2018: 206), this practice is guided by a search for both the 'particular and the processual in context'. As such, engaging in this coding and indexing process helped me to describe what was going on in the data. The concepts provided, as described by Mason (2018: 196), analytical 'handles' on the data, which, through an inductive and iterative process, helped to focus the analysis and to develop explanations and arguments.

All documents were stored on a University-supplied password-protected laptop. Hard copies of the transcripts were printed for coding and kept locked in a filing cabinet at the University of Nottingham.

Analysis of interview and fieldwork data enabled me to build upon the timelines developed following documentary analysis. Drawing on the principles of chronological sequence, compilation of events enabled me to understand and describe the sequence of events in sepsis care improvement nationally and locally. This helped me to understand the external actor-networks before compiling the chronological sequence of internal events. This process played an important analytical purpose, as it highlighted important key events in internal sepsis care improvement, who led them and if they were in response to external drivers. Plotting the events in chronological sequence also helped to trigger investigation into the how and why questions about the relationships between events over time (Yin, 2018).

Step 2 – axial coding

Through open coding and the compilation of chronological sequences, it was clear that there were significant events that initiated sepsis care improvement

externally and internally that had an impact on the implementation of the tools. To look for relationships between open codes, axial coding was undertaken (Table 11). Axial coding involved relating the data together to construct linkages by comparing emergent themes to identify central phenomena in the data (Strauss and Corbin, 2007). The process involved exploring, reading and re-reading the data to reveal insights into relationships between themes and categories. Combining the data from the documents, observations and interviews, I was able to seek out and explore the stories that were told (Mason, 2018). The conceptual framework provided sensitising concepts to explore the story in relation to theory. For example, I was able to make links between the notion of drift and the use of tacit knowledge to identify deteriorating patients.

Table 11. Example of axial coding

Theme	Category	Description	Example quote
Knowledge	Tacit	Use of tacit knowledge to recognise and treat sepsis can help to align the actor-network in times of increased service delivery pressures and reduce drift from the original intention of the tools.	Band 5 Staff Nurse, ED: 'I think just, looking at the patient, if you, like, observe the patient from the end of the bed, you know if they're sweaty, pale, clammy. And then obviously their observations will also follow that. But then the first look at the patient you can … you think "Oh, you don't look very well, I'll go to you".'

After identifying the influence of external and internal events on sepsis care improvement in the first stage of coding and the compilation of chronological sequences, by drawing on ANT I was able to build upon this analysis by tracing the actor-networks at both case sites. The process involved assembling the data in new ways after open coding in order to make the connections between categories. To do this, I created spider diagrams as a visual display of

the concepts and categories. Through an iterative and interpretative process, I examined the diagrams for themes and reduced the numbers of concepts and categories when similarities were identified. The codes and categories were then grouped into themes and tabulated using Word with corresponding quotes (see Appendix VI for examples).

The principles of Yin's (2018) explanation building were used to answer the research questions. This was done by explaining how and why the case sites interpreted and implemented an externally driven care bundle and what happened when the care bundle was used in clinical practice in secondary care.

This analytical technique became a mechanism for moving back and forth between the literature, data and research questions. The intention was to analyse the events at each site and then explain them using the conceptual framework. I examined the interactions between the tools and healthcare workers and how they varied across the data, over time and across settings, at each point redefining the characteristics of the phenomenon of interest in light of similarities and differences. For example, using the insights from STS included in the conceptual framework, it was possible to explain, in narrative form, how and why distribution occurred.

The differences served as important analytical points as they provided insights into how the actor-networks were formed and how the tools were used in the different clinical settings. I was looking for how and why events occurred or did not occur, comparing if patterns in the data were interrelated, if the data were similar within and across the embedded units of analysis, and if they reflected the ANT and technology-in-practice literature.

At this stage in analysis, the first iteration of a descriptive narrative for each of the case sites was written. Writing the narrative acted as a methodological device to explore and develop my interpretations of the data (Mason, 2018).

The process of ethnographic data collection and explanation building refined ideas and yielded thick descriptions of the social settings, to provide an understanding of the roles, rules, structures and processes in each organisation. To ensure the description was thick, a broad perspective was taken firstly, and then, as themes became apparent, the focus increasingly narrowed, in order to provide a coherent, theoretically informed narrative (Gold, 1958). The timelines supported the rich description.

Step 3: selective coding

The third phase of coding used in this research was selective coding. The intention was to begin to apply theory to the concepts and categories, and to generate theory from the data (Price, 2010). By undertaking selective coding, I was able to refine the concepts and categories identified through open and axial coding (Strauss and Corbin, 1998). The process was the final integration of themes and categories, to make sense of what was happening in the field (Boeije, 2010). The conceptual framework was used to guide the process and supported articulation of the core concepts in empirically grounded theoretical terms to explain the implementation of the care bundle (Price, 2010).

To take a step back and work with the concepts rather than the data, I found diagrams (see Appendix VII) useful to help sort out the relationships between concepts and apply theory to the concepts and categories. I found the process helped me to think logically about relationships and supported the production of the next iteration of a more integrated narrative (Strauss and Corbin, 1998). The diagrams also supported discussion about the nature of relationships among concepts at supervisory sessions. An example of selective coding is given in Table 12.

Table 12. Example of selective coding

Concept from coding	**Category**	**Technology-in-practice concept**	**Illustrative quote**
Knowledge	Standardisation	Naïve formalist	Quality Nurse 3: 'It means saving a life…. I think people hate tools in general and they feel like they're being spoon-fed but I think in the state of the NHS as it is and the amount of pressures that are being put on staff nursing has evolved…. And I think people do need additional tools to use to help them in their roles so that they're knowing that they're not missing anything.'
	Tacit	Opponent	Practice Development Matron: 'It [the tool] takes away that clinical judgement again, which is sort of where we need to swing back to now because it's gone too far. It's back to that expertise of people in their areas looking at their types of patients and making decisions based upon what they know from previous experiences. And they know what works and what doesn't. Because they've done it. It's not a piece of paper that's generic for every single patient in the whole trust. Because everyone is different. I can see why it happened but I feel like it went too far [laughs] and now we're in the position we're in where new nurses are coming out and they're very task orientated and very tick-box orientated and they're not a problem-solver.'

The selective open coding allowed for the identification of critical contrasts and comparisons that yielded the rich descriptions and explanations that are presented in the data chapters (Yin, 2018). The final stage of analysis was cross-case synthesis, which will now be presented.

4.6.3 Cross-case synthesis

A case-based approach to cross-case synthesis was undertaken. The goal was to retain the integrity of each case in its entirety and to compare any within-case findings across the cases (Yin, 2018). The cross-case synthesis was conducted from an inductive perspective and helped cross-case patterns to be 'elevated to a higher conceptual plane' (Yin, 2018: 197). The use of theory in the cross-case synthesis allowed for explanation of the similarities and differences between the cases. Within-case analysis explored the translation of actor-networks related to sepsis care improvement in one organisation. Cross-case synthesis permitted elevation to exploring how differences in two organisations (selected for theoretical replication) influenced the translation of actor-networks related to implementation of the care bundle.

The different stages of translation were compared across the two cases by looking at the corporate level in both organisations and then the embedded units of analysis (the ED and acute inpatient settings). For example, a key finding was the difference in the problematisation stage of translation between Southside and Westside. The focal actor at Southside problematised compliance with the CQUIN, whilst at Westside the focal actor problematised variation in sepsis recognition and treatment. The difference in focus influenced implementation strategies in the organisations. As such, cross-case synthesis enabled me to think upward conceptually to understand the phenomena holistically in their real-world setting and the conceptual framework provided the structure for the cross-case synthesis (see Appendix VIII for an example). A narrative was then built to explain the similarities and differences (Yin, 2018).

4.7 Quality

4.7.1 Trustworthiness of the data

The multiple realities that made up the networks studied in this research have been considered holistically, rather than as variables, since they were

interconnected in such a way that they influenced each other and were influenced by the networks in which they were situated (Latour, 2005). Lincoln and Guba (1985) refer to four criteria of trustworthiness: credibility, transferability, dependability and confirmability (or the degree of neutrality). Table 13 presents the steps taken in this research in response to the four criteria.

Table 13. Steps taken in response to the trustworthiness criteria proposed by Lincoln and Guba (1985)

Criteria	Purpose	Steps taken in this research
Credibility	To demonstrate truth value in the findings and to ensure the account is a credible reflection of the multiple realties investigated.	Multiple sources of empirical evidence have been used and presented to ensure a credible account of both case sites. To ensure sufficient time was spent in the field whilst balancing the timeframe of a PhD, six months was spent in each case site. In this time, relationships, rapport and trust were developed with key stakeholders.
Transferability	To show that the findings have applicability in other settings.	Thick descriptions of the case studies are provided in Chapters 5 and 6 to allow the reader to understand the setting in which the findings are presented. Chapter 7 provides a cross- case comparison of the findings.
Dependability	To show that the findings are consistent and could be repeated.	In an attempt to show consistency and dependability this research has been positioned in a particular frame of reference. This research focussed on two case sites under the influence of the same external drivers over the course of 12 months. Being secondary care, they were broadly similar contexts. Each stage of data analysis was shared with the supervisory team in order to examine the process and products of analysis.
Confirmability	To demonstrate the extent to which the findings are shaped by the respondents and not researcher bias and motivation.	To demonstrate true neutrality is near impossible. As with demonstrating dependability, each stage of data analysis was shared with the supervisory team. Reflexive accounts are presented below.

4.8 Ethical considerations

Whilst considering my role in the research, I also reflected on the responsibility of collecting data from healthcare workers and the associated ethical considerations (Yin, 2018). Constructing the study protocol and

applying for University ethical approval and NHS Research and Development approval at each case site contributed towards sensitising me to potential ethical issues and helped me to reflect on why and how I planned to carry out the study. I was aware that the participants placed a great deal of trust in me when disclosing potentially sensitive information, for example criticisms of senior healthcare staff and management (Munro et al., 2004). In line with my interpretivist position, ensuring my findings reflected participants' voices was an important responsibility (Lee and Lings, 2008).

4.8.1 Consent

An important ethical consideration is to ensure that when consenting to take part participants are provided with enough information about the study to make an informed decision. Interviews and observations were voluntary and interviews were conducted at a time convenient for the participant. The details of the study were explained and a participant information sheet was provided (Appendix IX). All participants were required to provide written informed consent (Appendix X) before the commencement of their first interview. Where possible, the information was sent ahead of the interview to allow each participant time to consider participation. My contact details were provided to allow questions to be asked.

Whist gaining written informed consent is feasible for interviews, the issue of consent for observation was more problematic. The clinical areas selected in each of the trusts for the purpose of the study employed at least 30 staff, with doctors, allied health professionals and others also entering the field of observation at some point. A poster was displayed in the relevant clinical areas to raise awareness of the study and to introduce myself as the study researcher. When I observed at meetings, there were a significant number of attendees in diverse roles internal and external to the trust. Gaining written informed consent from all the individuals within both contexts was not feasible. Consequently, verbal consent was obtained for observation from individuals at the start of each observed shift or meeting; this was continued

on an iterative basis over the course of the study. The participant information sheet was also sent out with the meeting agenda. If consent had not been given in either setting, notes would not have been taken about those who did not give consent. However, this situation did not arise throughout the course of fieldwork.

4.8.2 Confidentiality and anonymity

The protection of case site identity and the participants' anonymity were important ethical considerations. Each participant was assigned a study identity code, consisting of a site reference name, stakeholder description (e.g. manager, service development role, clinician), participant's initials and a number to identify multiple stakeholders of the same description. Recorded and transcribed data and documents accessed for analysis were kept in a locked password-protected computer and locked filling cabinet in an office at the University of Nottingham. In addition, the case sites and participants were given pseudonyms. The names used in the quotes in this thesis are pseudonyms.

4.8.3 Non-maleficence

Whilst the study did not present any obvious source of harm for participants, it would be naïve to assume that participating would be free of risk. There was the possibility that participants may become offended, worried or upset through the course of observations and/or an interview (Hammersley and Atkinson, 2007). I was in the field at each case site for six months so there was a chance that participants could form relationships with me. The role of reflexive analysis to support managing and processing these complex relationships has been discussed earlier in section 4.2.3. Furthermore, in the event of harm or even potential harm, a referral process was in place to a key stakeholder in both case sites and to my supervisory team in the university setting.

4.9 Conclusion

This chapter has served a number of purposes. Firstly, it has provided an explanation of the philosophical assumptions that underpinned the study design. Secondly, it has shown the rationale for selecting ethnography and the case study method. The chapter has also provided a description of the steps taken to address quality issues in qualitative research. Thirdly, by describing the reflexive account I hope that I have given the reader an appreciation of my position and influence throughout the research process – being explicit about my situatedness as an experienced healthcare professional undertaking research in a healthcare setting is critical.

This research describes what happens when material objects such as the sepsis care improvement tools are implemented in complex settings. There is an argument in implementation science that advocates that attention is paid to material objects rather than just people and processes (Allen, 2016, 2017). Therefore, this research has taken a qualitative sociotechnical approach. ANT sensitises us to the notions of networks and scripts that have been applied in this research, however, there is a critique of ANT that has been outlined in this chapter. In response to this critique I have drawn on the work of Berg and his development of ANT and technology-in-practice. By taking a multiple case study approach with embedded units of analysis I have paid attention to structure and the organisation but have complemented this approach by tracing the actors as they moved through the networks.

The next three chapters will present the study findings in detail and will include a cross-case comparison which found similarities and differences between the case sites. The discussion and conclusion will follow, where the empirical findings from the case sites and the cross-case comparison are discussed within the context of ANT, technology-in-practice and implementation science literature.

Chapter 5: Southside Hospitals NHS Foundation Trust

5.1 Introduction

This chapter presents a historical narrative of sepsis care improvement at Southside Hospitals NHS Foundation Trust. A preliminary observation was that implementation of the sepsis screening tool and Sepsis Six care bundle was largely influenced by external forces that shaped the actions and responses of local actors. Specifically, implementation was conditioned by the use of financial incentives, which resulted in the screening tools being reconstructed less as an improvement tool and more as a ritual to verify compliance with financial targets. At the same time, they were predicated on an evidence base and model of patient assessment and care delivery (UK Sepsis Trust, 2018), meaning that the tools were interpreted and used differently by different staff from the executive board to the clinical frontline. Throughout the chapter, examples from the data will be related to concepts (see Table 3 in Chapter 3) used in this research to show a dialogue between the evidence that was obtained during fieldwork and the theoretical stance of ANT and technology-in-practice.

The chapter will be structured in the in the following way. Firstly, in the chronological sequence in which it occurred, a historical narrative of how Southside interpreted external drivers and developed implementation strategies will be presented. To demonstrate a dialogue with ANT the stages of translation at the corporate level and the clinical frontline will be described. The intention is to build an understanding of how the human and non-human elements came together (or not) to form actor-networks. Secondly, what happened when the sepsis screening tool and Sepsis Six care bundle were used in clinical practice will be illustrated. To demonstrate a dialogue with ANT and technology-in-practice, the tools will be portrayed as formal tools and whether the stance of naïve formalists taken by the implementation team

influenced implementation strategies. The formal tools will be portrayed as a map and a representation of evidence-based medicine. Data generated from the ethnographic fieldwork will then describe clinical practice as the terrain and will highlight the gap between the tools and the clinical practice and the chains of re-representations that occurred when the gap was crossed.

5.2 Historical narrative of sepsis improvement

Sepsis improvement work commenced in 2011 (Figure 8), when a newly appointed ED Consultant identified that Southside did not have a formal process or protocol for the identification of patients with potential sepsis and resulting treatment. The ED Consultant problematised the lack of a standardised approach to sepsis recognition and treatment at Southside. He sought guidance from the UK Sepsis Trust Chief Executive, who advised a programme of improvement which included implementation of the sepsis screening tool and Sepsis Six. By initiating the improvement work and taking the lead, the ED Consultant became the focal actor. As such, the tools were established as the Obligatory Passage Points (OPPs) (for definitions see Table 3 in Chapter 1).

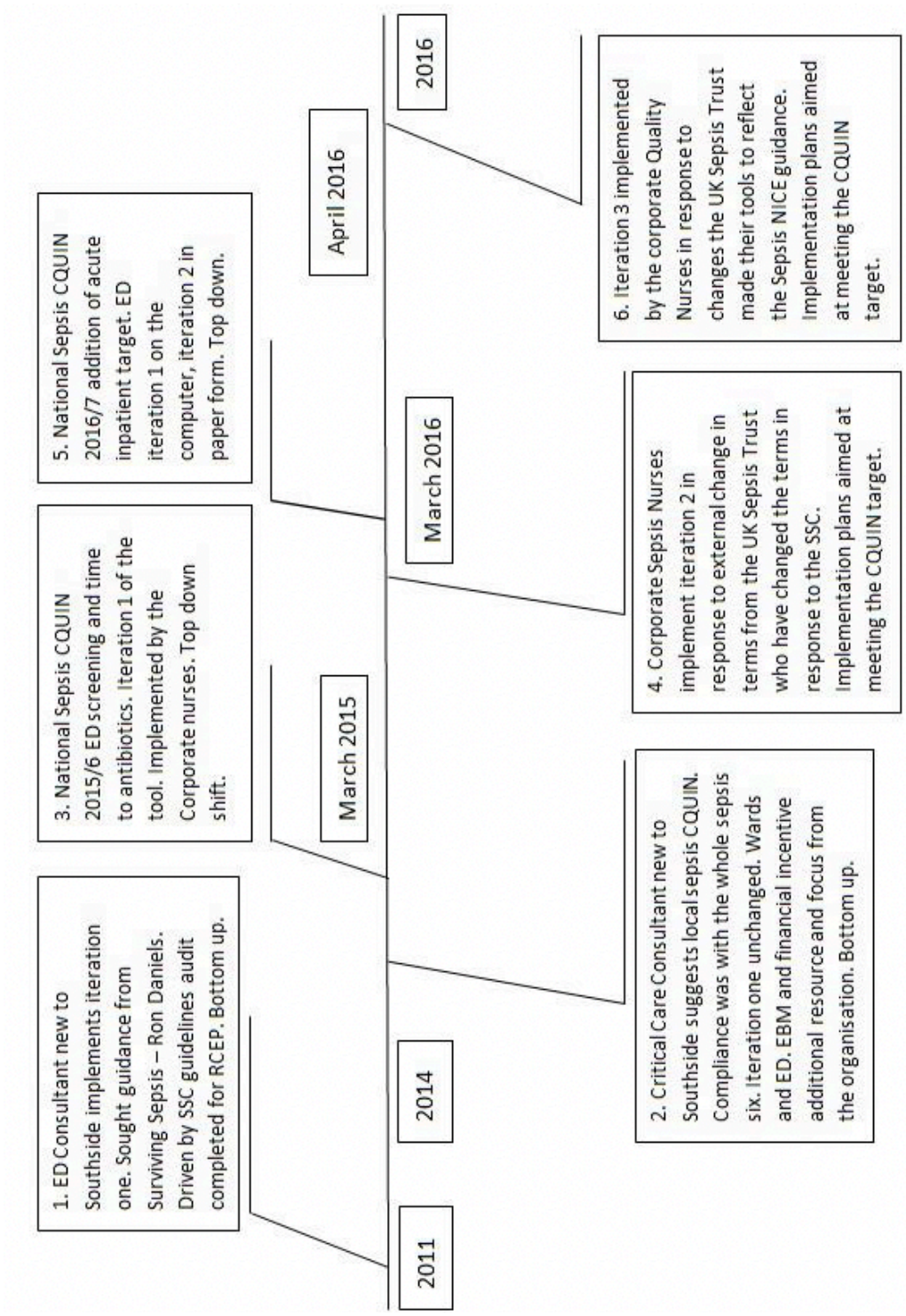


Figure 8. Southside timeline of sepsis improvement

The Consultant then sought to involve ED staff, whose identities and responsibilities contributed to the configuration of a problem-solving actor-network. *Interessement* was through training and audit to convince ED staff to use the tools by moderating their alignments and behaviours such that they would be consistent with the OPP. All actors had to agree (or not) to journey through this point to result in a stable (or unstable) network (Callon, 1986). Doctors and nurses in the ED passed through the OPPs, were enrolled and mobilised and an actor-network was stabilised. This was evidenced through compliance with the Sepsis Six, which was measured by a Royal College of Emergency Medicine audit (Royal College of Emergency Medicine, 2016).

> I was appointed as a consultant here in November 2010 and then in 2011 I quickly realised we didn't have any formal process or protocol in the trust for identification of patients with potential sepsis and resulting treatment. So on the basis of that I got in contact with Ron Daniels, who then shared a sepsis screening tool and the Sepsis Six care bundle. And put that into the ED. I did audits for the Royal College of Emergency Medicine around the care of patients with sepsis in this department we were in the top quartile of the country. At the start it was mainly ED. What we then started to do was to teach the nurses and the doctors on the wards around identification, treatment and escalation.
>
> **ED Consultant and Trust Sepsis Lead**

In 2013, a Critical Care Consultant new to the organisation brought in ideas about sepsis improvement. At his previous trust he had been involved in developing and delivering a local CQUIN for sepsis. He problematised that, at Southside, sepsis care improvement needed to widen its scope outside of the ED. To gain financial and executive input, the ED Consultant, with the support of a senior Critical Care Consultant, the Critical Care Consultant and Senior Quality Improvement Nurse, approached senior management at the trust. The ED Consultant enrolled and mobilised senior management, who, on his behalf, liaised with the CCG to agree a local CQUIN for sepsis in financial year of 2014/15. The local sepsis CQUIN became the solution to the problem of variation in sepsis care and an absence of sepsis care improvement activity

outside the ED. The additional resources that accompanied the CQUIN enabled the trust to employ a nurse to support sepsis care improvement.

> We [Senior Quality Improvement Nurse and ED Consultant] started work on sepsis and one of the ICU Consultants wanted to make it into a local CQUIN because they wanted to get sepsis rolled out into the trust and they thought that would be a good way of doing it; there might be some money and a bit more input from senior people because it was a CQUIN.
>
> **Senior Quality Improvement Nurse**

At this time, corporate engagement in sepsis care improvement also became part of Southside's Quality Strategy 2013–2015. The strategy made reference to sepsis care improvement as one of four actions to achieve the overall goal of having no avoidable deaths. A key point of the strategy states that the trust will:

> Make greater use of patient care bundles to ensure that patients receive timely and consistent treatment such as ensuring the administration of appropriate antibiotics for patients with sepsis within an hour of admission.

The financial investment, corporate engagement and requirement to report on performance that accompanied the CQUIN created an incentive for the formation of an interdisciplinary team consisting of the ED Lead Consultant, Critical Care Consultant, Senior Quality Improvement Nurse and Sepsis Nurse. The team developed a training programme for staff within the acute inpatient setting that aimed to raise awareness about sepsis and introduced the screening tool and the Sepsis Six care bundle. Teaching for nurses and the doctors included identification, treatment and escalation of sepsis.

> At the start it was mainly ED. What we then started to do was to teach the nurses and the doctors on the wards around identification, treatment and escalation. A lot of that was mainly done by nurses. Dr Swan [Critical Care Consultant] and I have also taught non-ED doctors as well, usually at Foundation Year 1 and 2, SHO-type grade, with lecture-based facilitation.
>
> **ED Consultant and Trust Sepsis Lead**

The CQUIN target required audit against the whole Sepsis Six care bundle, which reflected the Royal College of Emergency Medicine audit. As such, the tools remained as the OPPs and the training programme and audit were *interessement* strategies to enrol and mobilise clinical staff outside of the ED.

5.2.1 External influences on sepsis care improvement

In the financial year 2015/16, a national CQUIN for sepsis was introduced. The CQUIN sought to incentivise trusts to screen patients for sepsis in emergency admission areas and the administration of antibiotics within an hour from the recognition of severe sepsis. Without consultation with the established sepsis team, the Chief Nurse and Lead Nurse for CQUINs negotiated and agreed the terms of the sepsis CQUIN with the CCG.

> I don't know what the process is to negotiate CQUINs. I think [the] Lead Nurse for CQUINs would have been involved at some point. And there's the Chief Nurse; she has a role in that. Each of their individual roles, I don't know what it is, I don't know the process that they had to go through.
>
> **Senior Quality Improvement Nurse**

The Chief Nurse and Lead Nurse for CQUINs delegated the management of the CQUIN to the Assistant Director of Nursing Quality (ADNQ). This resulted in the ED Consultant no longer being the focal actor. For the purpose of clarity, in terms of implementation of the CQUIN, rather than the Chief Nurse or Lead Nurse for CQUINs being portrayed as the focal actor, the ADNQ will be portrayed in this role, as it is from her perspective that it makes the most sense to describe the internal translation stages (Law, 1992). Due to the focus of the CQUIN being in the ED, the Chief Nurse and Lead Nurse for CQUINs invited the ED Consultant to become the Sepsis Clinical Lead. By agreeing to this, he enrolled into the actor-network and was mobilised as an ally of the new focal actor, the ADNQ.

The ADNQ problematised achieving compliance with the CQUIN, so directed resources to solve this problem. The local sepsis CQUIN, which included trust-wide training, stopped. The Royal College of Emergency Medicine (2016)

database was no longer populated; the ED Consultant cited the shift in focus towards the national CQUIN as being the reason for this. As a result, there was not a source of feedback for total sepsis care in the ED or acute inpatient areas.

> The database then wasn't being populated; the focus shifted onto another question which the CQUIN was trying to answer. So we didn't get that feedback of total care. It was a slightly regressive step in where we were in our journey with sepsis; it [CQUIN] overruled our local review because it shifted the focus. We've had to take a few steps back, at the behest of actually going forwards with our good work that we've shown over the last four to five years. We don't have any dictation at all that's from national bodies. So that'll come through presumably NHS England after discussion with the National Sepsis Committee and then we centrally get told that's what you're going to be doing. So we have no ability to question or influence.
>
> **ED Consultant and Trust Sepsis Lead**

The ED Consultant's view gives the impression of a sense of acceptance that external bodies and the ADNQ as focal actor had to be adhered to, despite his expertise, professional judgement and evidence that local initiatives had improved sepsis care. As will be shown in section 5.2.2, despite agreeing to take on the role of Sepsis Clinical Lead, actions taken by the ED Consultant differed from the actions taken by the Quality Nurses.

The 2015/16 CQUIN monies enabled more investment into sepsis care improvement, and an additional Band 6 nurse was appointed. The ADNQ changed the job title from Sepsis Nurse to Quality Nurse. The two Quality Nurses were managed by the Senior Quality Improvement Nurse, who reported to the ADNQ.

> We had a urology nurse, a continence nurse as part of the CQUIN but as soon as it wasn't a CQUIN the post went. We need that post. There was money attached to it; it attracts a resource but it's only a temporary one. So there's an assumption that you're going to get whatever it is embedded within 12 months and then you won't need the resource anymore.... Well that's just flawed logic. You just can't operate like that. So we've employed them as a quality nurse.... We

> don't need an expert in sepsis: we need an expert in getting people to adhere to a new care bundle ... so the skills are really quality improvement skills, engagement, stakeholder management, whatever you want to call it. We don't need an expert with a narrow focus.
>
> **Assistant Director of Nursing Quality**

To solve the organisational problem of achieving compliance with the CQUIN (specifically completion of the screening tools and administration of antibiotics within an hour from recognition of severe sepsis), the ADNQ took a behaviour change approach. She aligned her workforce to enable her to be responsive to the changes in the focus of national CQUINs. In the enrolment process she sought to define and coordinate the roles of the other actors. In her role as line manager to the Senior Quality Improvement Nurse she delegated the development and delivery of training, which acted as *interessement* strategies, to enrol and mobilise ED staff. The Senior Quality Improvement Nurse then delegated this work to the Quality Nurses.

The team was employed specifically to implement the CQUIN, and so were enrolled into the actor-network. The ADNQ's intention was for the Quality Nurses to be experts in 'getting people to adhere to a new care bundle' not an expert in sepsis; she perceived this to be 'a narrow focus'. Therefore, being a clinical expert was not a priority for her as the clinical focus of the CQUIN might change but the need for 'getting people to adhere' to activity at the clinical frontline to meet the targets would remain. Despite the ADNQ's view that an expert in 'quality improvement skills, engagement, stakeholder management' was needed, the Quality Nurses had not received any formal quality improvement training. Her actions were, however, driven by a need to create a stable actor-network to meet the external targets with the internal resources available to her.

Acting on behalf of the focal actor, the Quality Nurses devised implementation plans, delivered training and collected audit data for the CQUIN, which acted as *interessement* strategies. However, the Quality Nurses expressed concern that their interests were at odds with the emerging work,

which had the potential to challenge stability of the network. Quality Nurses directly informed nurses in training that their involvement the CQUIN was necessary because the evidence base proved that the tools saved lives:

> Your motivation is to reduce the mortality rates, not money. However, audit's got a place because it identifies areas where you're failing or where you need improvements. So they do go hand in hand and that's why I feel okay with doing audit.
>
> **Quality Nurse 3**

The quotation shows that the Quality Nurse expressed the view that the tool was adequate for the purpose of accounting for care, which enabled her to reconcile the tension between undertaking audit to meet the requirements of the financial incentive and her motivation to reduce mortality (Allen, 2012).

5.2.2 The stages of translation at a corporate level

As part of the Quality Nurses' role they attended a monthly sepsis meeting chaired by the ED Consultant in his role as Sepsis Clinical Lead. The intention of the meeting was to operationalise the CQUIN. Despite this intention, the meeting was not part of formal internal governance reporting structures Through translation of an actor-network as focal actor and spokesperson, the ADNQ mobilised the ED Consultant and Quality Nurses to act on her behalf (Law, 1986). She did not attend and worked away from the clinical frontline. The group met twice in the six months I was undertaking fieldwork, although I was unable to attend either meeting. In addition to the meeting not having a formal reporting mechanism in place, minutes were not taken.

> We have held the meeting every month and the attendees would be I, as the Clinical Lead, a representative from Critical Care, the two sepsis CQUIN nurses and then other people who are invited from Paediatrics, from Obs. and Gynae., from other streams that we feel that are relevant to the CQUIN. There isn't any upward mechanism that I'm expected to report into, Quality Committee or the Trust Management Committee. That may change. But at the moment it's very much, if there are any issues I'll bring that up to relevant divisional boards,

> whether that be Medicine, Surgery, Emergency Medicine or whatever, and go from there.
>
> **ED Consultant and Trust Sepsis Lead**

Fieldwork showed that despite the existence of the sepsis meeting, the corporate nursing team shouldered the responsibility for the CQUIN. Throughout fieldwork, as shown in the quotation below, communication between the ED Consultant and Quality Nurses was fragmented.

> It may be that, as the Lead for the sepsis group, he reports in directly to the Board, but I don't know about that. I could do with asking actually. It's very, very difficult to get meetings with him. It's just that he is so busy; it's hard to get everybody together. We've called down [to ED] on an *ad hoc* basis to try and see him. Sometimes it works and sometimes it doesn't. He just doesn't have time to see us. So we're just cracking on with the CQUIN at the moment.
>
> **Senior Quality Improvement Nurse**

Compliance with the CQUIN was measured through audit undertaken by the Quality Nurses. The data were detached from the local context, abstracted and manipulated by the Quality Nurses to compare the percentage compliance from month to month and between clinical areas (Berg and Goorman, 1999). The data were then escalated through the nursing hierarchy as a representation of performance to the Senior Quality Improvement Nurse and then to the ADNQ and the Lead Nurse for CQUINs, who presented the performance figures to the Quality and Safety Group. The aim of the Quality and Safety Group was for corporate services and the divisions to present their reports on quality and safety. The monthly meeting was chaired by the Chief Nurse and attended predominantly by senior nurses and midwives. Attendance by medical staff was infrequent. The Medical Director, who had been in post at Southside for only six months, reflected on this relationship:

> It seems it's very nurse-heavy. Not that ... you know, no criticism of nursing, the criticism is there's not enough medics there to actually put the right medical input into that meeting as well. If you look round

> the table, the last time I went I was the only doctor in the room. It's nurses and the doctors ... and whether it's cultural, whether it's just because operationally they're delivering and delivering and delivering, it [the quality agenda] is very much ... driven by nurses and allied healthcare professionals to a lesser degree.
>
> **Medical Director**

The Quality and Safety Group reported to the Quality Committee (a meeting of the board). The Chief Nurse was also required to report the CQUIN performance figures every quarter to the commissioners at the Scrutiny Committee.

The next section will show how the CQUIN focus of sepsis care improvement impacted upon implementation of the tools at Southside. Particular attention will be given to the roles the ED Consultant (as Clinical Sepsis Lead) and Quality Nurses played through interpretation of implementation of the tools and the CQUIN.

Between 2011 and 2016, in response to changes in international and national guidelines, Southside implemented three iterations of the sepsis screening tool. The Sepsis Six care bundle remained unchanged, which reflected the national picture. The Quality Nurses relied upon the UK Sepsis Trust's interpretation of national and international guidance on screening tools and the Sepsis Six care bundle in their implementation at Southside. This resulted in periods of uncertainty for the Quality Nurses as they waited for the UK Sepsis Trust to release new tools.

> We know Systemic Inflammatory Response Syndrome [as a stage in progression of severity of sepsis], is going, but we don't know what's going to replace it yet. They're saying that there's a possibility it could be the National Early Warning Score of ... and I don't know whether it's 5 or more or what the score is, plus a suspicion of infection. I don't know what it's going to be. Nobody knows. Nothing has been leaked [laughs]. Now some trusts, I do know because I'm part of the Sepsis Nurse Forum, some trusts have already taken out the Systemic Inflammatory Response Syndrome (SIRS) criteria and put in National

> Early Warning Score or equivalent. They've actually taken it upon themselves to do that. And there's nothing to say that nobody can do that. I suppose I've pushed that we go with the UK Sepsis Trust because the UK Sepsis Trust wants it standardised throughout the country. We're in their hands.
>
> **Senior Quality Improvement Nurse**

Once the UK Sepsis Trust had published the new tools, in March 2016, the Quality Nurses introduced the second iteration of the sepsis screening tool and Sepsis Six. The Sepsis Clinical Lead was not aware that iteration 2 (iteration 2 will be described in section 5.3) had been implemented in the ED.

> So we haven't used this [iteration2] yet. This is not the one we've got in at the moment but this incorporates some red flag sepsis data as well, which essentially are these ones in the red box. There was a drive at the back end in 2015 to look more at red flag sepsis which is identifying patients with severe sepsis-type symptoms. At the moment, we're in this flux of waiting for the international consensus guidance to be ratified and also the NICE guidance to be published in its entirety. I can't tell you exactly what studies the red flag sepsis came from. This is not local guidance, this is national guidance. This has probably come out from the UK Sepsis Trust, again based upon some evidence-based medicine.
>
> **ED Consultant and Sepsis Lead**

The quotation highlights a fragmented approach to the decision-making process within Southside's sepsis team in response to changes in external guidelines and subsequent implementation which was evident throughout fieldwork. The next section will describe how a fragmented approach at corporate level translated into delivery of implementation strategies firstly in the ED and then the acute inpatient setting.

5.2.3 The stages of translation in the Emergency Department

At the start of fieldwork, the CQUIN was targeted towards the ED only. The Quality Nurses negotiated with the ED Matron to enrol her into the actor-network and align her behaviour with the sepsis screening tool and Sepsis Six

(the OPPs). As with the Quality Nurses, despite the OPPs not completely aligning with her interests, the Matron was enrolled into the actor-network.

> In respect of the sepsis screening flowcharts, I think they're great for people who might not be as clinically experienced and actually they're quite simple and easy to follow. You do need to have some level of clinical experience behind it and that's the thing sometimes with flowcharts and tick boxes – if flowcharts and tick boxes are followed to the T, without that clinical knowledge, experience and insight, there is a risk that they can become detrimental to a patient because other signs aren't spotted or other questions aren't asked because people are very focussed on this thing that's in front of them. I think we probably need to be more careful about what we're putting onto a flowchart or a tick box because it can almost get a bit like medicine by numbers. People lose the ability to think.
>
> **Matron, ED**

The incentive created by the ADNQ, was for the ED to meet the CQUIN target, and this was delivered by the Quality Nurses. As an *interessement* strategy this was successful: the Matron took a detour from her charted path and was enrolled and mobilised to support implementation of the tools in the ED (Sarker et al., 2006). The implementation strategy for the ED was negotiated between the Quality Nurses and the ED Matron, and other ED staff were not included. Therefore, the Matron was speaking on their behalf. Essentially, the tools were implemented without consent or discussion. As a result, not all the nurses abided by the agreement and completed the tools, which resulted in occasions when translation failed, and the actor-network became unstable. However, CQUIN compliance data indicated that nurses in the ED were mobilised to pass through the OPP and completed the screening tools. Newly Qualified Nurses in particular found that the tools aligned with their interests.

> If you are newly qualified and you think 'Oh my God, what I do if they've scored all of the things? Not sure what to do now.' Then you can just follow the pathway there. And it does tell you.
>
> **Newly Qualified Nurse**

The phases of translation in the ED were not sequential, but overlapped. This was shown through changes in the Quality Nurses' CQUIN audit. In response, the Quality Nurses and ED Matron devised strategies aimed at changing the behaviour of ED staff in order to increase compliance. The ADNQ's behaviour change approach was reflected in these *interessement* strategies. The strategies were directed towards individual staff and staff groups. When compliance dipped, the Quality Nurses liaised with the ED Matron:

> If ED don't do so well one week, I will email Matron and say, 'Just to let you know your compliance was, say, 70% this week'. And she'll say to me, 'Can you tell me the members of staff who should have screened and didn't screen?' And she'll just have, like, a little word with them to say, 'Look, can you stay on it?'
>
> **Quality Nurse 1**

As highlighted by the quote above, action taken by the Matron legitimised the problem identified by the focal actor and was used as an *interessement* strategy to convince staff to pass through the OPPs by moderating their behaviour. Strategies aimed at staff groups were designed to prompt and force behaviour change to complete the tools. To serve as a prompt, the screening tools were to be completed for every patient in 'majors' (major injuries) and 'resus' (the resuscitation room). For the nurses, this meant the tools were attached to the initial assessment paperwork; the screening tool was also part of the nurses' computer assessment. For the doctors to force behaviour change, the screening tool on the computer was made a mandatory screen that had to be completed in order to admit patients to the hospital or discharge them from the ED. Throughout fieldwork, no doctor was seen to complete a paper copy of the tool.

> Our compliance rate [with screening for the CQUIN] has been 100%. I think it's because there's a mixture now, like I say, there's three ways really of almost like attacking sepsis because obviously you've got the paper copy and we've got all the receptionists on board making sure the patients' names, hospital numbers were all on the screening tools. So, literally, if it wasn't applicable, all the nurse had to do was circle 'no' and then it was filed in the notes and that was it. So you've got

> the paper copy, you've also got the electronic copy but then also as a failsafe the doctors are doing it before the patient's either discharged or transferred.
>
> **Quality Nurse 1**

The steps taken by the Quality Nurses and ED Matron acted as *interessement* strategies attempting to translate the actor-network by enrolling all staff in the ED. In terms of compliance with the CQUIN, the strategies were successful in solving the focal actor's defined problem of achieving compliance with the CQUIN. However, they contradicted the CQUIN guidance document, which stated:

> The intention is not for all emergency patients to be screened for sepsis. There are clinical reasons why screening is unnecessary or misleading in some patient groups. (NHS England, 2015: 11)

To maintain *interessement* of ED nurses, implementation of iteration 2 of the screening tool in the ED was achieved through the Quality Nurses delivering update sessions. There was an absence of updates for medical staff on how to use the tools and how they related to the CQUIN. The Sepsis Clinical Lead did not take part in formal training of ED medical staff.

The focus here is to describe the update sessions as the *interessement* strategy the Quality Nurses devised to enrol nursing staff and mobilise them to use iteration 2 of the tool. The Quality Nurses decided to stagger introduction of the tool to the ED. As highlighted in section 5.2.2, central to the changes was the introduction of the term 'Red Flag Sepsis', which replaced 'high-risk factors.' The plan was to raise the profile of 'high-risk factors' and then introduce the change to 'Red Flag Sepsis'.

> I sort of did it on a slow process. So beforehand we had it on the back of the chart as in partial areas of the red flag sepsis, but it was known as high-risk factors. So the ones that were on there I took out and produced posters saying 'high-risk factors' and sort of slowly introduced the idea. So put the posters around and gave out cards to staff so they could get their head round the fact that ... high-risk

> factors. And then we changed it to then red flag sepsis; these are what they are.
>
> **Quality Nurse 1**

I observed the Quality Nurse when she 'gave out cards to staff so they could get their head round the fact that ... high-risk factors'. The interaction with ED nurses also included the introduction of iteration 2 of the tool and Red Flag Sepsis. The Quality Nurse approached nurses whilst they were on duty in the clinical area and asked if they had received an update. The Quality Nurse told the nurses that 'high-risk sepsis' would be removed and replaced with Red Flag Sepsis and that there was a new screening tool now in use in the ED. The Quality Nurse gave the nurses the credit-card-sized card with that information on, to keep and, in her own words, 'to use as a prompt', to remind them what to do when screening a patient for sepsis. The process took approximately five minutes. After an opportunity for questions, the nurses were asked to sign a form to confirm they had received training. The Quality Nurse commented that the signature was to be used as evidence for the CQUIN that ED staff had received training on the sepsis screening tool.

The Quality Nurse's training included the narrative that using the screening tool and the Sepsis Six was 'quick and easy' and would 'save lives'. The Quality Nurses were naïve formalists, according the description provided by Berg (1997). They had faith in the power of the tool and exhibited a belief in the *a priori* superiority of the tool over the decision-making of healthcare staff. The time taken for the update, and that it took place between clinical activities, did not allow for explanation of the underpinning evidence that informed the changes. This approach, therefore, reinforced the message that the tool was 'quick and easy'. In the ED, sepsis training for doctors took the form of informal case-based discussion and was *ad hoc*, depending on the patients in the department and whether junior doctors sought guidance from senior doctors. The screening tool did not appear to be a focus in the discussions observed.

> ‘This [Sepsis Six] has been out obviously for a long time from Rivers’ work which was intensive care-based which has then been pared back to the person who comes into an undefined area such as an ED. So if you look, that’s been 2004 and a lot of people now that we’re working with as FY1s, FY2s, would have qualified in 2014. So this is ten years on from then. So they have grown up with this as part of their teaching and training, so they’ve all heard of it.
>
> **ED Consultant and Sepsis Lead**

Evidence-based standardisation of care was viewed by the ED Consultant as a familiar practice for doctors. The relationship of the tool to a financial driver was absent from the doctor’s training.

5.2.4 The stages of translation in the acute inpatient setting

As the financial year 2015/16 came to a close, attention was directed towards the 2016/17 CQUIN. At the beginning of the financial year the ED Consultant stepped down from his role as Sepsis Clinical Lead.

> We still haven’t got a formalised plan, although we’re into May [laughs], about seven weeks into the CQUIN now. What he’s [ED Consultant] said before is that he’s happy to still lead on the CQUIN but because we’re going into the inpatient areas, we’ve got to have a lead for Surgery and a lead for Medicine, and they’ve got to take ownership in their own divisions and organise training. I don’t know how it’s going to work. We’ve got no meeting to discuss it and we haven’t been able to see ... we haven’t seen him since the introduction of the new CQUIN.
>
> **Senior Quality Improvement Nurse**

As the quote highlights, there was an absence of formal and consistent medical involvement in implementation of the sepsis CQUIN. Informal discussions with the Lead Nurse for CQUINs revealed that she had made an offer to consultants of professional activity sessions, which would result in additional payment and allow time in their contract to lead the sepsis work. As fieldwork came to a close into the third quarter in 2016/17, neither a trust-wide nor divisional Clinical Lead had been appointed. A Quality Nurse commented on the situation:

> It's the lack of engagement. We aren't in the loop; we don't know what is going on. If there is a medical lead, how and when it will happen. But it [the CQUIN] won't work without medical engagement. The Medical Director sent out the NICE guidance saying we need to get behind implementation. We [Quality Nurses] were downhearted. Why does it take NICE guidance to get a response? We have been working on this for a long time, asking for engagement and support and not had any. We just aren't kept in the loop. But, I'm motivated, passionate about sepsis. I won't give in.
>
> **Quality Nurse 1**

From the Quality Nurse's perspective there was a lack of medical engagement with sepsis. In the quote below, the Medical Director offered a different perspective.

> I don't know whether it's a cultural thing here. So if I give an example, NICE had injury guidelines in ED and in my previous existence I didn't have to talk to a single one of my consultants about it because they all knew it was coming out, they all read it, they all worked out what needed to be done and it was done. I didn't think about it. Am I convinced that happens here? So we've got National Sepsis Guidelines, we've got NICE. I sent NICE [guidelines] round the day they came out. Do I think our clinicians are that sighted? No, I don't, I don't at all.
>
> **Medical Director**

The quotations provide evidence that there was 'silo working' in sepsis care improvement in respect of the CQUIN and implementing external guidance. As focal actor, the ADNQ identified the problem as achieving compliance with the CQUIN and targeted *interessement* to those whose behaviours could be moderated and aligned such that they were consistent with the OPPs (Callon, 1986). As such, *interessement* was directed towards nursing staff. The Medical Director was unaware of the work the Quality Nurses were doing; thus, the *interessement* of the medical staff was limited. The CQUIN compliance audit feedback was through the nursing hierarchy. There was no consequence if medical staff did not complete the screening tool.

The focus of the 2016/17 CQUIN was on screening for sepsis in acute inpatient areas and administration of antibiotics within 90 minutes. The target remained in place and unchanged in the ED. In response to the shift in focus, the ADNQ mobilised the Quality Nurses to create actor-networks in the inpatient setting. As the result of this additional problem (i.e. attainment of compliance with the CQUIN in the inpatient setting), the Quality Nurses targeted a new group of staff with *interessement* strategies. Acute inpatient staff had not received sepsis training since the local CQUIN in 2014/15.

> So for inpatient areas, in the two years that we've been doing sepsis work, there's been no training for inpatient areas. There hasn't been time because it has been ... we have had to satisfy the requirements of the CQUIN first and foremost and then any additional work on top of that is a bonus for us. But there's just been such a heavy workload that we haven't been able to do it.
>
> **Senior Quality Improvement Nurse**

The Quality Nurses' training, as in the ED, assumed that the tools were logical and would result in sepsis recognition and treatment because they were 'quick and easy' to use and 'saved lives'. The Quality Nurses attended each ward to deliver a 20-minute teaching session on sepsis screening and the Sepsis Six, with printed PowerPoint slides in a folder. They returned to the ward several times until all of the nurses and nursing assistants had been trained. I observed them on four different occasions. Each time there were only two members of the ward staff and the session took place in the ward dayroom. Observation of the Quality Nurses' training showed that content was directed towards the Quality Nurses' perceived level of knowledge of the audience.

> You've got your reasons to screen a patient, then you're looking for a specific infection. So we're saying to the NAs [Nursing Assistants], if you're working with a patient who's suddenly giving you lots of green tissues or you're working with a patient and their wound starts smelling, trying to explain things at that level... if you're talking to your nurses, obviously you don't need that level of explanation. You're then telling them that we're not medically trained so if you're not sure if

> there's an infection somewhere, you've got a bit of a get-out-of-jail-free card for the top box there. So you could tick it to say 'yes', you think there's an infection but you're unclear of the source.
>
> **Quality Nurse 3**

The scientific evidence underpinning the screening tool indicated that administration of the Sepsis Six care bundle should be triggered if patient's physiological observations met the Red Flag criteria, in the presence of an infection. As such, the message from the Quality Nurses promoted a tick-box approach rather than using clinical judgement to inform decision-making. Observation of the training sessions showed that nurses and nursing assistants identified with the problem that patients may develop sepsis and that the tools would help them to recognise sepsis and get doctors to listen to them. Using the tools to pass through the OPP aligned with their interests.

> If you look at all these [Red Flag criteria], it sort of highlights that they [patients] are really deteriorating and that you need to do something about it, like now. It prompts you to, sort of, when you hand over to the doctor, explaining like all this sort of thing, like as a way of handing over to the doctor. Obviously, saying that you've sepsis-screened them and this is what you've found, sort of thing. So sort of highlighting that it's quite important for them to come and review the patient.
>
> **Southside Staff Nurse**

The Quality Nurses trained only nursing staff until the Senior Quality Improvement Nurse started to train doctors halfway through the financial year. Taking this action was viewed as 'a case of having to get on with it':

> Kim has managed to secure some doctor training but unfortunately she's going to have to deliver it to them, which starts the week after next I think it is... So they are being targeted... And I suppose it was kind of just having to do it regardless, to move on with it.
>
> **Quality Nurse 3**

Training for doctors comprised a presentation during the August junior doctors' induction day and an overview of the sepsis screening tool and the Sepsis Six care bundle. The nursing quality team did not deliver any training to

other grades of doctor until late August, when the Senior Quality Improvement Nurse attended the doctors' audit meetings.

> If I noticed that somebody was septic, and from checking their bloods and saw that they'd hit the SIRS criteria and had a source of infection and sepsis, I wouldn't go back and retrospectively fill out one of those flowcharts because they are a document to be filled in. I wouldn't go back and retrospectively fill one out because they're there to help recognise it…. I would clearly document, and I have done over this past weekend, patient meeting SIRS criteria and then this one, this one, this one. So white cell count, temperature and blood pressure…. Possible source of infection and I'd put that down and then…. So although I won't fill out the chart, I will still follow the flowchart. And I have a similar process when clerking patients.
>
> **Foundation Year 1 Doctor 01**

In the absence of training for medical staff, there were different perspectives on the problem of completing the screening tools. The quote below highlights how the problem, as identified by the spokesperson (ADNQ), did not align with medical staff's interests and challenged her perspective of the legitimacy of the OPPs (Callon, 1986). Here, the doctor used clinical knowledge to recognise and treat sepsis and did not complete the screening tool.

> I don't actually look at the screening tool but I sort of know the criteria and I sort of follow it. I think it's generally filled out in either A&E or in [the] Acute Assessment Area, I've never actually filled one out…. I have sort of you know … not me but I have seen people diagnosed with sepsis and I've started and done the Sepsis Six but I've never filled that out. I don't know if they're a good thing or it's a bad thing. But I don't … maybe they've been available but I've never looked for them. I have seen them filled, so I imagine they're filled in A&E or [the] Acute Assessment Area or something…. But I've never filled one out on a ward. Yeah, I suppose it makes sense. But if it was just this on its own though, everyone would be septic.
>
> **Foundation Year 1 Doctor 02**

The lack of medical engagement and evidence of silo working emphasised the absence of a corporate strategy that was inclusive of nursing and medical

staff. Associations between the professional groups in relation to the CQUIN were not evident.

> From a doctor's point of view, I haven't really had much experience on how it [the screening tool] is interpreted or how it's changed a doctor's practice. It tends to be more medical staff will train the medical staff and the nursing staff will train the nursing staff.
>
> **Quality Nurse 1**

Similarly, the CQUIN did not align with the interests of the Critical Care Outreach Team (CCOT). As with the medical staff, they felt able to recognise and treat sepsis with the Sepsis Six:

> As an outreach practitioner we're looking at patients with this approach in mind all the time. Yes, we do implement this, but do I get the sheet out of a drawer and follow it down as I'm doing that? I don't feel that my team and I, I don't think we need to do that because it's engrained as part of our routine approach to assessing patients. We're looking for the key signs of sepsis at all points and we're making a full physiological assessment. And if it is that we pick up on any of the key points, then we'll act on those as the guidance says. So do we use this specifically? It's a bit of a yes and no answer really….. We use the elements of it but would I pull out a chart and tick the boxes? Maybe not. I'd write in my assessment 'Sepsis suspected, fluids and oxygen given as per the guidance'.
>
> **Lead Outreach Nurse, Southside**

The Quality Nurses did not include the CCOT in their training. There was a misalignment of interests with staff who used clinical experience and judgement to recognise and treat sepsis. As such, the focus of sepsis care improvement on achieving the CQUIN meant not all members of healthcare staff were enrolled and mobilised into the actor-network by the Quality Nurses.

The next section introduces to the reader the sepsis screening tool and the Sepsis Six care bundle and demonstrates a dialogue between technology-in-practice and the data. The sepsis screening tool and Sepsis Six care bundle were viewed as maps which contained multiple components, such as

physiological observations, blood tests, insertion of an intravenous cannula and administration of treatment. The clinical settings were viewed as the terrain. Before presenting a detailed account of the ethnographic data generated when observing the tools in use in clinical practice, to enable the reader to understand the multiple components of the sepsis screening tools and Sepsis Six care bundle, the following section is a briefly describes of key aspects of the tool, and gives a brief rationale for their inclusion and a narrative of the working practices associated with completing them. Key differences in how the components were implemented between the ED and inpatient setting will also be introduced.

5.3 The maps – screening tool and Sepsis Six

The changes to international and national evidence-based sepsis guidelines were presented in Chapter 2, and the local interpretation was described earlier in this chapter in section 5.2. The intention of this section is to focus on the aspects of the tools that relate to the theoretical analysis. The remainder of the chapter will then build upon these aspects of data analysis by zooming in to provide a more detailed analysis of what happened when the tools were used in clinical practice at Southside. The sepsis screening tool and Sepsis Six care bundle can be seen as examples of what Berg (1997a) described as symbolic and abstract maps in a fixed state. The tools were designed by the UK Sepsis Trust to be a representation of its interpretation of the SSC guidelines. This section has three aims:

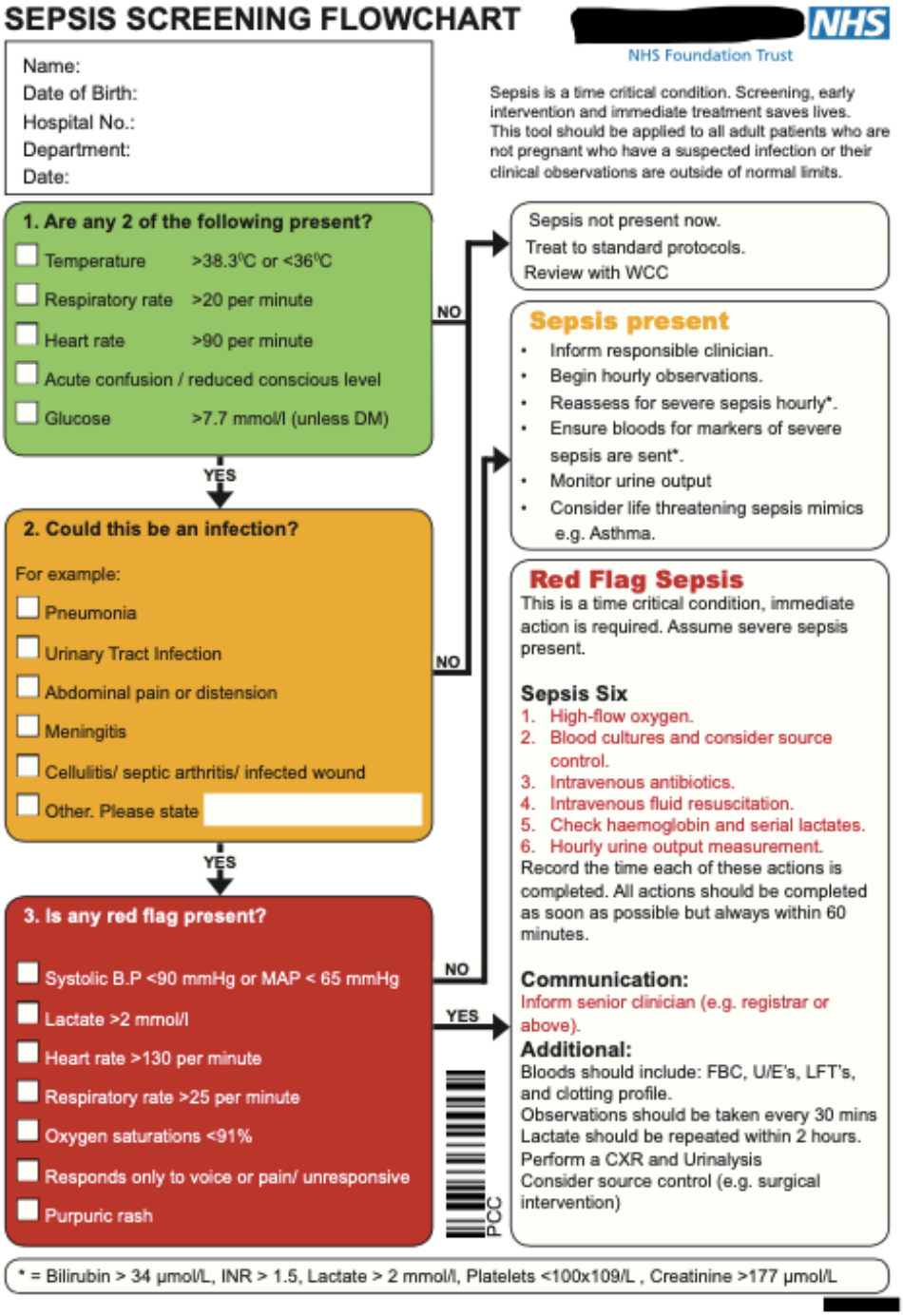
1. To show the fixed and abstract nature of the maps – the sepsis screening tools and Sepsis Six used at Southside.
2. To introduce the complex and messy terrain of the ED and the acute inpatient setting at Southside.
3. To introduce the differences in work practices between the ED and the acute inpatient setting.

Throughout fieldwork it was observed that each of the tasks presented in the screening tool and Sepsis Six required the translation of an actor-network and alignment of heterogenous entities. Observations in the ED and the acute inpatient settings (terrains) at Southside showed that there was a difference in the chain of re-representations that crossed the gap between the map and terrain, despite the tool (map) being the same in all clinical settings. As will be shown below, the differences resulted the heterogenous entities (healthcare staff with expertise, the patient and equipment) being more widely distributed in acute inpatient settings than in the ED. As such, this introduced the potential of drift from the original intention of the tools, namely the timely identification and treatment of sepsis. Throughout the fieldwork, iteration 2 of the screening tool was mostly in use, so will be referenced here to illustrate aspects of the map that best relate to the theoretical analysis.

5.3.1 Measuring and recording physiological observations

The tool was presented as a step-by-step flowchart (Figure 9). Each step in the screening tool was represented by the colours of a traffic light – green, amber and red – that drew attention to the increasing importance of each step in relation to risk to the patient. The measurement and recording of physiological observations were fundamental to screening a patient for sepsis. Physiological observations were blood pressure, heart rate, temperature, respiratory rate, oxygen saturation and level of consciousness. In the ED at Southside, the policy was that physiological observations should be measured and recorded on admission and at least hourly, dependent on the patient's condition. In acute inpatient areas the frequency of physiological observations was dependent on the patient's condition and was commonly carried out very four or six hours (NICE, 2007).

Figure 9. Southside sepsis screening tool iteration 2



Fieldwork showed that physiological observations in the ED were predominantly measured and recorded by nurses and in acute inpatient areas by nursing assistants. The policy was that nurses had to complete the sepsis screening tool, not nursing assistants. Once physiological observations had been measured and recorded on the observations chart, the screening tool could be completed. In the acute inpatient setting, the nursing assistant would have to recognise and escalate to the nurse any 'deranged' observations. The nurse would then use the screening tool. This introduced a difference between crossing the gap between the map and terrain between the ED and acute inpatient settings.

5.3.2 Identification of the presence of an infection

The next step in the pathway was for the healthcare worker to decide if the patient's condition was likely to be due to an infection. Examples of sources of infection were given (Figure 10). Taking pneumonia as an example, the data highlighted that, rather than the examples of infection being a simple prompt, the level of the healthcare worker's experience influenced interpretation of the terms.

> So pneumonia, so, you know, it starts off. Is it a cough, is it a cold, is it progressing, is it getting worse? It's already on a continuum isn't it, pneumonia? It's chest infection at one end and it's pneumonia at the other perhaps. I mean I'm happy with pneumonia but then again I've been here a long time so I should be good at it, whereas the junior staff I think will probably not want to commit themselves to that.
>
> **Nurse Educator ED**

> You wouldn't naturally know it's pneumonia unless that's diagnosed. You'd need a chest X-ray, you know. If they come in straight from an ambulance you wouldn't say 'Oh, they've got pneumonia you know'. At the end of the day, you are still only a nurse you know, you're not going to know that just by looking at them. So I wouldn't tick that. I wouldn't be confident in ticking that because that, to me, is saying that you've just diagnosed that patient.
>
> **Newly Qualified Nurse ED**

The quotations introduce the notion that despite the fixed and abstract nature of the tools (maps), rather than being 'quick and easy' to complete, interpretation and use may differ depending on the healthcare worker. To trigger the Sepsis Six, the patient's condition had now to meet one of the red flags in the red box. If a red flag was present, the patient was considered to have 'red flag sepsis' and the Sepsis Six was triggered (Figure 11).

Figure 10. Sources of infection

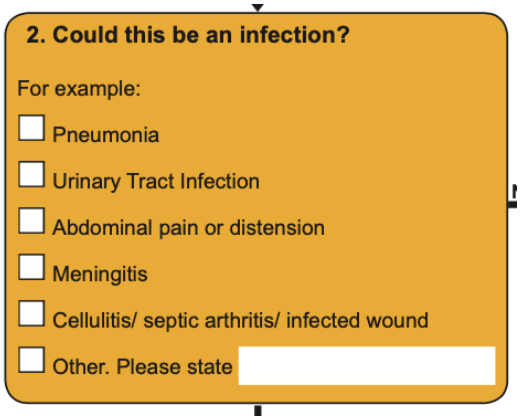
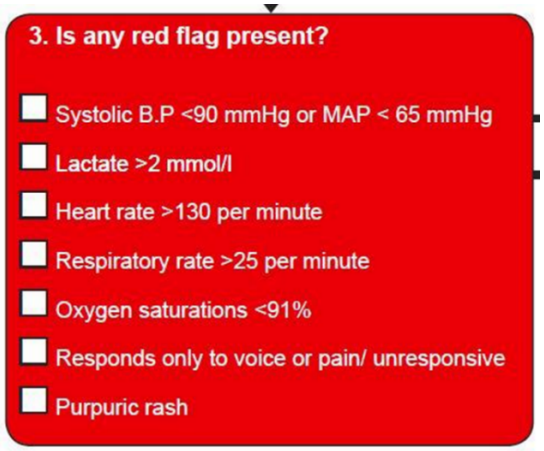


Figure 11. 'Red flag' sepsis criteria

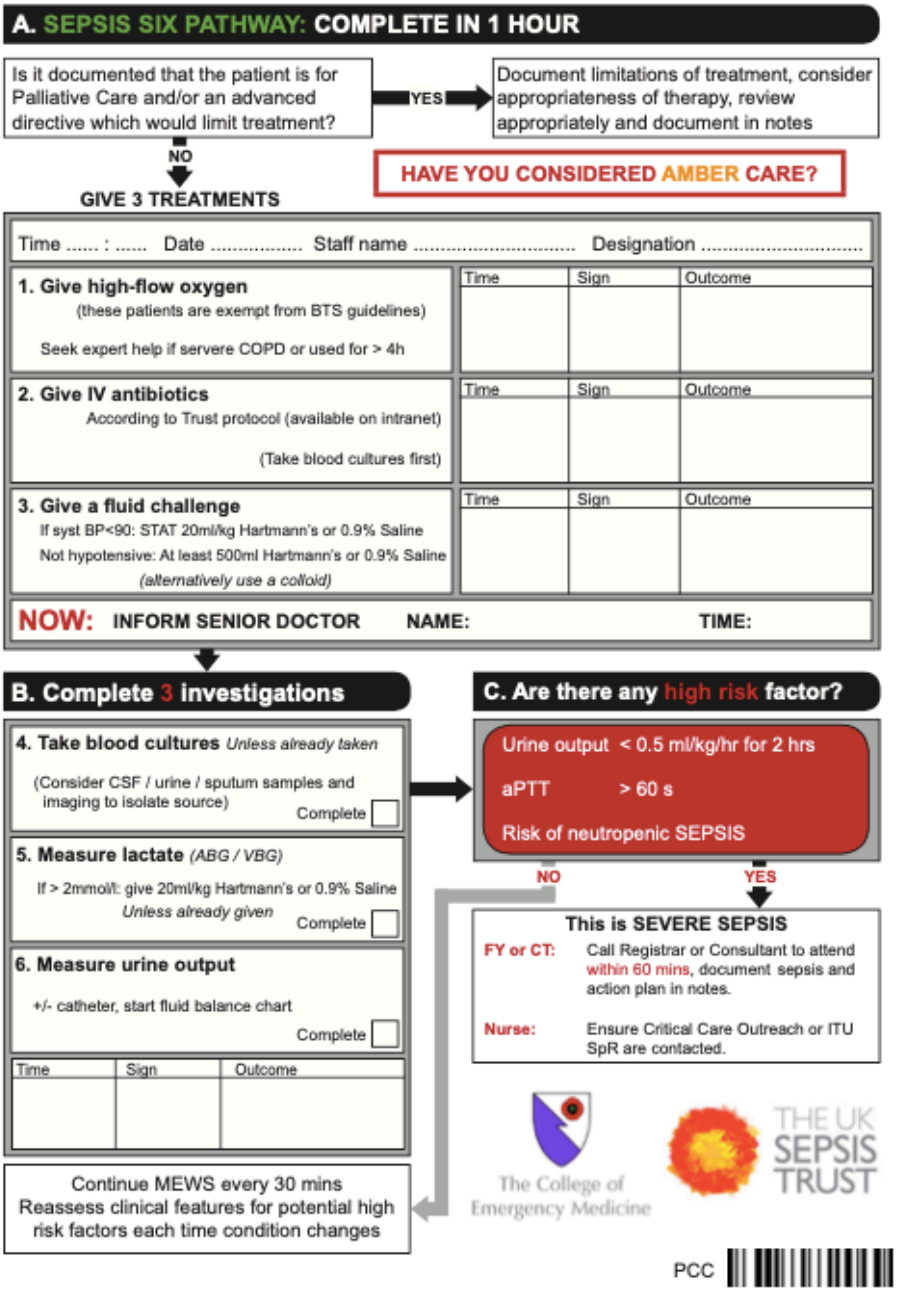


5.3.3 The Sepsis Six Care Bundle

The components of the Sepsis Six care bundle (Figure 12) remained unchanged throughout fieldwork. All interventions in the Sepsis Six were to be completed within an hour, including informing a senior clinician. Therefore, administration was time critical and required action by healthcare workers. When applied in practice, differences in work practices between ED and acute inpatient areas introduced the potential for variation in the time taken for a doctor to review the patient. In the ED, doctors and nurses worked side by side; in acute inpatient areas, nurses were based on wards and doctors worked across several wards and had to be contacted via the internal bleep system.

If the Sepsis Six care bundle was triggered, referral to a senior doctor to review the patient and to prescribe treatment was required. In the ED, doctors (ranging from junior doctors to consultants) and nurses worked side by side; on the wards, junior doctors and the CCOT were the first point of contact for nurses. Both groups of staff worked across the organisation and had to be contacted via the internal bleep system. The impact of these different ways of working will be discussed later in section 5.4.

Figure 12. Sepsis Six care bundle



Embedded within the Sepsis Six care bundle were tasks that required skills not all healthcare staff possessed. These included taking blood for tests and blood cultures[2], and the insertion of an intravenous cannula to allow for the administration of intravenous antibiotics and fluids. All doctors possessed both skills, and in the ED the majority of nurses did. In acute inpatient areas, the number of nurses who practised the skills varied from ward to ward and even shift to shift on the same ward, depending on who was on duty. When these interventions required the screening and treatment of a patient, a clinical support team, junior doctor or the CCOT had to be contacted via the internal bleep system. Each of these healthcare workers worked across several wards, meaning they were not necessarily readily available or at a convenient location. As such, the heterogenous entities (healthcare staff with expertise, the patient and equipment) required for the taking of blood and insertion of an intravenous cannula were more widely distributed in the acute inpatient setting than in the ED. In the absence of a skilled healthcare workers to undertake these tasks, the time taken to complete them varied and introduced a difference in the way the Sepsis Six care bundle was implemented.

The next section draws on concepts from ANT and technology-in-practice (Table 3, Chapter 3) to present the ethnographic data generated through observation of the tools used in the unpredictable and inconsistent nature of clinical practice. The setting was messy, concrete and heterogeneous, and several factors had an impact on the formation and stability of the actor-networks. Rather than the tool being 'quick and easy' to complete and a simple representation of best practice, implementation and use of the tool required translation into an actor-network and the alignment of heterogeneous entities in the complex settings of the ED and acute inpatient

[2] Blood culture is the culture of micro-organisms from a sample of blood for the laboratory diagnosis of bacteraemia and other conditions associated with pyrexia of unknown origin.

areas. A gap between the tools (map) and clinical practice (terrain) and the chain of re-representations that crossed the gap will be highlighted. The concepts of distribution and drift will be developed to show how the nature of work in the ED and acute inpatient settings influenced implementation and use of the care bundle, which at times was different from the intention of their designers.

5.4 Crossing the gap between the map and terrain

Work practices in the ED and acute inpatient areas will be presented in different sections. The purpose is to build upon the description of the differences in work practices presented above, to show that the networks, despite being in one building, were different in their practices, and to present what happened when the formal tools, as maps, were used in the terrain of clinical practice at Southside. Ethnographic fieldwork enabled observation of the map (representation) and the terrain (represented). Attention was paid to what happened in the 'gap' between the representation and the represented (Berg, 1997a: 406).

The next section presents data generated through the observation of a patient being admitted to the ED and the healthcare workers recording physiological observations, which revealed the complexities of the terrain. The purpose is to paint a picture of the healthcare workers, tools and equipment that made up the actor-network in the ED. A description of the terrain and work practices as observed in acute inpatient areas relevant to screening for sepsis and the Sepsis Six will follow.

5.4.1 When the formal tools were used as maps – the Emergency Department

Fieldwork in the ED showed that organisation of work in busy times was erratic due to the flow of patients through the department. The following extract from fieldnotes illustrates the dynamic nature of the terrain of the ED and how different human actors (healthcare workers and patients) entered

the terrain. Throughout fieldwork, the ED experienced episodes of overcrowding, when multiple patients were cared for in corridors and patients waited with ambulance crews to be booked in. The impact of overcrowding was significant to this study and will be explored in this section. One entry in the fieldnotes read:

> When a patient was brought into the ED by the ambulance crew, they presented to the nurses' station in 'majors'. The nurse in charge and a receptionist were based here. The ambulance crew would book the patient in with the receptionist following a handover of demographics. The nurse in charge took a clinical handover from the crew and allocated a bay in majors. If the bays were occupied the nurse might move a patient from a bay and place them in 'minors' or in the corridor to accommodate the new patient, or, depending on the nurses' judgement, the new patient would be placed in 'minors' or in the corridor. The patient might go straight to 'resus' if pre-alerted by the ambulance crew or if their condition had deteriorated en route or on arrival. The ambulance crew left the department once the handover and booking-in process had been completed. The nurses were allocated to work in an area of the ED. In 'majors', the nurses took four bays each. Patients in the corridor were allocated a corridor nurse if there was a sufficient number of staff rostered to the shift. When there were not enough nurses, a 'majors' nurse would be allocated to the 'corridor' patients. Patients in 'majors' and in the corridor then waited for a nurse to assess them.

On admission to 'majors', the first task was the measurement and recording of the patient's physiological observations. As shown in section 5.3.1, this task was a fundamental aspect of screening for sepsis. When patients arrived at 'majors' by ambulance, the target for observations to be completed was within 15 minutes of arrival. At busy times, the 15-minute target was not always achieved. Nurses measured and recorded the patient's physiological observations or nursing assistants undertook this task and informed the nurse of any abnormalities. Once physiological observations were made, representations of the patient's condition were produced and recorded on a paper-based observations chart as well as on the admissions screen on the computer. Information about the patient's presenting condition was also

added to the computer, which generated a category for the patient. The category indicated which order patients in the department should be assessed by the nurse and doctor.

If more than one patient was waiting to be admitted, the nurse did not always assess patients in the order indicated by the computer-generated category. Observations and the quote below show that nurses used observational skills to prioritise which patient they assessed first. This introduced the potential for variation, dependent on the nurse's experience, and shows how the erratic nature of the terrain could influence the healthcare worker using the sepsis screening tool (map).

> I think, just looking at the patient, if you, like, observe the patient from the end of the bed, they say, you know, like, if they're sweaty, pale, clammy. And then obviously their observations will also follow that. But then the first look at the patient you can ... you think 'Oh, you don't look very well. I'll go to you.'
>
> **Band 5 Staff Nurse, ED**

Initial assessment of the patient involved paperwork and completing screens on the computer. Doctors and nurses were observed taking both paperwork and a computer to the patient. Frequently there would not be a computer available, and in such cases they would just take the paperwork and complete the computer screens when a computer became free. Observations showed a chain of re-representations when the healthcare worker re-represented the patient from the paperwork to the assessment screens on the computer. As a result of distractions in the ED, such as overcrowding, a time delay between assessment of the patient and completion of the computer screens was observed.

Once the paper physiological observations charts, sepsis screening tool, medical notes and prescription charts had been completed they were placed into slots on the wall behind the nurses' station. This set of documents was accessed by nurses, nursing assistants, specialist nurses, physiotherapists, occupational therapists, ED doctors and specialist doctors. Sometimes they

would go missing and staff would have to spend time locating them before they were able to complete the required documentation. This would impact on the delivery of all aspects of care, such as fundamental aspects of sepsis screening (physiological observations) and sepsis treatment (prescription and administration of antibiotics). The written notes and the computers were actors in the network and an essential part of concrete working practices that had to be in circulation in the network for the team healthcare professionals to assess, document and treat patients. Observations showed that when this occurred, the work involved in communication between the healthcare team became more distributed, as the healthcare workers searched for the tools in the busy ED.

The policy in 'majors' was that, after the initial set of physiological observations had been measured and recorded, the subsequent frequency should be based upon the nurse's or doctor's assessment of the patient's condition, at a maximum of hourly. Completion of physiological observations relied on staff remembering when they were due or using strategies to remind themselves. The quotation below shows how completion was achieved as a result of a chain of re-representations which crossed the gap between the tool and clinical practice:

> I did bring in sticky notes, Post-It notes and stick them on the obs. chart and say when it was due but that just didn't work: the pieces of paper were flying off [laughs]. But people just ripped them out then and they'd get stuck on someone else's, so that didn't work. I try to leave them where I keep my obs. charts, so the time is in front of the slot, so I can see, rather than flicking through all the papers all the time. But again, the doctors pick them up and just put them back all willy-nilly. It's just a case of my memory's not very good and an hour flies by down there, 12 hours fly by down there, so it's hard but you've just got to do your best.
>
> **Newly Qualified Nurse, ED**

To screen for sepsis and comply with the CQUIN target, the healthcare worker had to perform an additional activity. The healthcare worker cross-referenced

the representation of the patient created from the data generated when the physiological observations were recorded by ticking (or not) boxes on the screening tool (on paper and/or computer). The purpose of this activity was to establish if the patient's condition was a representation of the pre-fixed criteria and if the patient had 'red flag sepsis' or not. If the patient did meet the criteria for 'red flag sepsis', then the Sepsis Six was triggered and each step was to be followed, and the boxes ticked as a confirmation that each step had been completed. In the quote below, a newly qualified nurse describes a cycle of care delivery moving between the patients she was responsible for. Screening for sepsis and delivery of the Sepsis Six were time-critical according to the evidence base; the tools were a map that provided healthcare staff with fixed instructions on what actions to take (Singer et al., 2016). However, the dynamic nature of the clinical setting potentially resulted in a delay in the screening tool being completed, or, if completed, the necessary actions being taken. The terrain was messy, complex and inconsistent. As illustrated in the quote below, to use the tool healthcare staff had to navigate the complex terrain.

> It is hard because sometimes they can all be due in one go or you just haven't got round to it by the time you've done and got them changed and their fluids, their pain relief and then the next one comes in and you need to take blood off them and need to ... and it's just that cycle. So it depends what poorly patients you've got. And if they come in all in one go, then it's hard.
>
> **Newly Qualified Nurse, ED**

The constant cycle of work described by the newly qualified nurse was observed in all areas of the department as staff worked in the complex terrain. This was particularly apparent in 'majors', where patient flow was dependent on the volume of patients and ranged from ordered and linear to hectic and messy. In the 'resus' room, work practices were organised to deal with life-threatening situations. Fieldwork showed there were differences and similarities when a patient was screened for sepsis and treated with the Sepsis Six in 'resus' and 'majors.' To show this difference, a snapshot from

'majors' and 'resus' will now be presented. The description will paint a picture of a complex and unpredictable terrain that often resulted in the misalignment of patients with healthcare workers, equipment and tools, which had an impact on stability of the actor-network.

Assessment and treatment processes appeared to be linear and efficient when the department was quiet, with sufficient numbers of healthcare staff and space to accommodate patients. When patient numbers exceeded capacity and staff and/or acuity, healthcare workers had to navigate the network using their clinical judgement to enable alignment of patients with healthcare workers, equipment and tools. The data presented elucidate the chains of re-representations that occurred as the healthcare workers crossed the gap between the tool and clinical practice. Rather than a linear process as portrayed by the tools, the measurement and recording of observations was messy and littered with complexities of the terrain that required the healthcare worker to reprioritise their work and undertake workarounds to fix tensions as they arose.

Snapshot – Sepsis screening and the Sepsis Six in 'majors'

> It's 7.00pm; the red phone rings. This phone was dedicated for the ambulance crew to pre-alert ED to patients that require assessment in the resuscitation room. The red phone was located at the nurses' station in majors. The nurse in charge took the call; the patient had suspected sepsis. She had to decide how to accommodate the new patient as the resus room was full. As she walked towards the resus room to inform the staff which patient to move out to prepare for the new patient, a patient waiting with an ambulance crew to be booked into majors suddenly deteriorated. The patient's family became distressed; a nurse led them to a relatives' room. This patient was taken to resus and occupied the space allocated to the red phone patient. The red phone patient arrived in the department and the ambulance crew headed for resus. The nurse in charge informed the ambulance crew that resus was full and allocated the trolley bay in majors which was nearest the nurses' station. The patient occupying this space was moved to the corridor.

> The nurse approached the patient at 7.30pm to record the first set of observations. She was unable to record the observations as he was shaking and putting his coat hood up. The nurse was then asked to check some drugs with another nurse. Returning to the patient, she was able to record the observations on her second attempt. The nurse then attempted to take bloods, blood cultures and insert an intravenous cannula. The nurse was unsuccessful in her attempt so asked a colleague to try. The second nurse was successful. I observed the nurse complete iteration 2 of the screening tool. The nurses had not communicated with a doctor at this point. The time was now 8.45pm. The nurse then started to document her assessment of the patient on the computer. A doctor arrived at the nurses' station; the nurse stopped documenting and handed the patient's notes to the doctor. The nurse informed the doctor that the patient was septic and that she had taken bloods, blood cultures and inserted a cannula. The doctor commented that 'handover is at 9pm but I will make a start on the patient'. Without a full examination of the patient, the doctor prescribed antibiotics. The patient had a penicillin allergy; before she prescribed the antibiotics she went to the computer and accessed penicillin allergy guidelines. The doctor commented 'he fits the criteria so I've prescribed even though I've not examined him first but I have got to go to handover'. The doctor left the department without speaking to a nurse. The nurse was attending to other patients. The patient was outside of the hour from identification of sepsis to administration of intravenous antibiotics. At 9.30pm she returned to the septic patient and discovered the antibiotic prescription. The nurse proceeded to prepare the antibiotic and second-checked the drug and prescription with another nurse. She administered the antibiotic at 9.45pm.

As the snapshot shows, the ED work setting was dynamic and in constant motion as new patients arrived. When the patient deteriorated, the nurse in charge had to respond to the unexpected event, which resulted in the sepsis patient having to be placed in 'majors' rather than 'resus' as the ambulance crew had intended. The network was in constant motion, and the timeline from the patient arriving at ED and the nurse first approaching the patient, to the administration of antibiotics, was littered with distractions. As such, the work was highly distributed across the heterogenous entities and, due to the nurse continually reprioritising her work, the patient did not receive

antibiotics within an hour from identification of sepsis meaning; this represented a drift from the original intention of sepsis screening and the Sepsis Six.

Snapshot – Sepsis screening and the Sepsis Six in 'resus'

> Recording the patient's temperature formed part of routine physiological observations and was an aspect of the sepsis screening. The nurses commented that there was only one thermometer in the department that worked properly. In resus, the thermometer worked intermittently. There were two patients in resus, one with a suspected stroke and one with suspected sepsis. The nurse caring for the sepsis patient completed the assessment screens on the computer. She added a temperature even though she was unable to take one; she did not use the temperature recording the ambulance crew had handed over. She made a judgement rather than check through the ambulance sheet as it was not to hand and she did not have time to find it. The nurse told me this as I watched her work. The nurse had completed the sepsis screening tool on paper and now completed the tool on the computer.
>
> The department was pre-alerted by the ambulance crew of the arrival of another patient with sepsis. The patient arrived in resus; the nurse and doctor worked together with minimal verbal communication. They received handover from the ambulance crew listening and attaching the patient to the monitor and oxygen simultaneously. I observed the Sepsis Six being administered. They were not referring to a sepsis screening tool or Sepsis Six care bundle. I asked the Registrar if he had used the screening tool. He replied, 'I was trained in the old way; sick patients come before paperwork'. Once the patient was stable the Registrar went to the computer to prescribe drugs, order a chest X-ray and document his assessment. The computers in resus were all in use. He went to majors and returned with a computer on wheels. He then re-presented the patient and treatment within the predefined categories within the computer.

Close observation in 'majors' and 'resus' showed the chains of re-representations which were generated as the nurse and doctor gathered and used the equipment to measure and record physiological observations and

prescribe and administer antibiotics. The snapshots show a contrast in the terrain of 'majors' and 'resus'. In 'resus', the work processes were aligned with identification and treatment of sepsis and the nurse and doctor were allocated to work side by side, whereas in 'majors' the work processes to recognise and treat sepsis were more distributed. The nurse and doctor had to navigate multiple distractions to prescribe and deliver antibiotics regardless of timely identification of sepsis. I observed the nurses and doctor complete the screening tools after they had assessed the patient, not to direct their work. Despite the working practices in 'resus', taking the view that the thermometer was an actor in the network, when it was not functioning this meant that the nurse used a workaround to enable her to navigate the required screens so she could progress with her work. As such, a drift from the original intention of the tool (an accurate recording of temperature) occurred.

Summary of when the formal tools were used as maps – the Emergency Department

In this section, differences have been highlighted between screening a patient for sepsis and administration of the Sepsis Six in 'resus' and 'majors' in the ED. The account showed an unstable actor-network as the heterogeneous entities were in constant motion in the complex terrain of the ED. The terrain was in contrast to the fixed and static screening tool and Sepsis Six – the maps. As such, translation of the actor-network as intended by the focal actor, the ADNQ, to change behaviour of ED staff to complete the screening tool and administer antibiotics within an hour of recognition of sepsis was threatened.

The observation of healthcare workers interacting with the tools for sepsis screening in acute inpatient areas was central to this study. The presentation of patients with sepsis in acute inpatient areas was less frequent than in the ED. Therefore, to increase the opportunity of observing staff complete the sepsis screening tool and administer the Sepsis Six care bundle, I shadowed

healthcare staff (medical and nursing teams) who were responsible for caring for acutely unwell patients across the trust. The data presented in the next section will provide the reader with an understanding of how different clinical settings (terrains) affected implementation of the tools (maps) within the same organisation.

5.4.2 When the formal tools were used as maps – the acute inpatient setting

The Quality Nurses had trained inpatient staff to complete the sepsis tool if they were concerned about a patient and/or the patient had scored 5 on the EWS. In the acute inpatient setting, observations showed that deteriorating patients were escalated to a clinical decision-maker, medical staff and/or the CCOT when they triggered on the EWS. The clinical decision-maker then reviewed the patient and, as highlighted earlier in section 5.2.4, used clinical knowledge (not a screening tool) to decide if sepsis was present and the Sepsis Six was required. As such, they did not complete the screening tool and translation of the actor-network intended to solve the problem of achieving compliance with the CQUIN did not occur.

As discussed earlier in section 5.3.1, measuring and recording physiological observations were central to the recognition of sepsis. In the acute inpatient setting, the activity was more widely distributed across heterogeneous entities than in the ED. Observations were routinely measured and recorded every four hours, although the frequency might be more or less, dependent on the patient's condition. This decision would mostly be made by the nurse caring for the patient. Nursing assistants predominantly measured and recorded observations and the task was part of the ward routine. The nursing assistants would be allocated to a group of patients and would undertake the task, working their way round each patient. Close observations showed that chains of re-representations were generated as healthcare staff gathered and used the equipment to measure and record physiological observations, and where necessary to escalate to a decision-maker prescribe and administer

treatment. Data will now be presented from an observation on an acute inpatient ward to demonstrate this.

Snapshot – physiological observations

> Staff were working at a fast pace, moving from one task to the next. The nurses' work was predominantly giving out medications, admitting and discharging patients and liaising with bed coordinators, physiotherapists and occupational therapists. The nursing assistants were providing the majority of direct patient care. I observed them assisting patients to the toilet, attending to patients' needs behind the bed space curtains and making and recording physiological clinical observations. The nurses' role was mostly the organisation and oversight of work. The staff worked as a team, communicating quickly between each other.
>
> A nursing assistant was performing the observations in one bay. She worked her way around the six patients in the bay. As she made the observations, she recorded the data on the observation chart kept on a clipboard at the end of each bed. She also completed other paperwork that was kept on the clipboard. At each patient, she responded to their requests; she assisted patients to the toilet, helped patients to take a drink, and supported her nursing assistant colleagues to change a patient's position. After measuring one set of observations, she asked colleagues if they knew where the nurse working with her was. I asked why she was looking for her. She said, 'Mr Smith has a low blood pressure and a high temperature, his EWS is 5 and I need to let the nurse know'. After several minutes of trying to locate her, she responded to a nurse call buzzer and assisted an elderly lady to the toilet. She returned to the bay after five minutes to a patient attempting to climb out of bed. She rushed over and prevented the patient from falling from the bed. She discovered that the patient had soiled herself. The nurse returned to the bay and assisted the nursing assistant with attending to the patient's needs. They were behind the curtain with the patient for around 10 minutes. Once the care was completed, the nurse was able to return to attend to Mr Smith with the low blood pressure and high temperature.

For the nursing assistant to complete the observations of Mr Smith, and escalate his care to the nurse, there were many distractions that delayed

communication between the two actors. The nursing assistant was aware of her role to inform the nurse, but the (other) patient's immediate needs meant she was constantly reprioritising her work. In contrast, much of the nurse's work was not directly with the patients. The work processes on the ward created a notable disconnect between the nurse and the patient. This disconnect was bridged by the nursing assistant, who, as shown in the snapshot above, navigated multiple competing tasks to make and record the physiological observations and escalate care if necessary. Critically, an EWS of 5 and a low blood pressure and high temperature were potentially signs of sepsis. Once informed of the patient's observations, the nurse might have possessed the knowledge to recognise that the patient could have sepsis, or she might have recognised that the sepsis screening tool could be used to assess the patient for sepsis. In either case, the seemingly linear task of a nursing assistant informing a nurse of 'deranged' observations was delayed for legitimate reasons.

In contrast, the quote below shows a more ordered sequence of events in the acute inpatient setting.

> We had a patient that had a chest infection which then developed into pneumonia. He was on EWS and he deteriorated quite quickly. And one of the nurses that was looking after him said 'Do you think we should do the sepsis screen?' So we got the chart out and we had a look at these and then we filled it in. And in the end we did actually treat him for sepsis. It sort of tells you what to do really ... tells the doctor what to do as well. It could have been due to pneumonia. He hadn't got any wounds or anything like that, hadn't got any abdominal pain. I think he'd got a UTI [urinary tract infection] as well. Yeah and then obviously if you tick one of those you have to go down into this box and then we realised he'd got all these red flags. Well, he'd got a low blood pressure, he'd got a high heart rate, he'd got low oxygen levels. So we contacted the doctor that was looking after him, Outreach Team (CCOT) and then they come to review him. Yeah, because we'd all had the training quite recently. Around the time that this happened. So it was all sort of fresh in our minds, if you like.
>
> **Southside Staff Nurse**

In this case, the heterogenous entities such as the nurses, equipment, specialist nurses and doctor aligned, and the gap between the map and terrain was crossed. The nurses had recently received training from the Quality Nurses, training as the *interessement* strategy resulted in the nurses enrolling into the actor-network and mobilising to complete the tool as intended by the focal actor, the ADNQ.

5.4.3 The Critical Care Outreach Team

Outside of the ED, the CCOT nurses played a key role in the recognition and treatment of sepsis at Southside. As a team of experienced critical and acute care nurses, the CCOT possessed the knowledge and skill to recognise and treat sepsis without the use of tools. They were competent decision-makers and had direct access to the critical care medical team to escalate patients as they considered necessary. Their work practices and problem-solving skills were aligned with detecting acute illness. As highlighted earlier in section 5.2.4, completion of the sepsis screening tool was not a routine part of their practice. Sepsis recognition and treatment were based on knowledge and problem-solving skills, rather than being driven by a tool or the CQUIN. As the snapshot presented below shows, the CCOT nurse, as an actor in the heterogeneous network, contributed towards alignment of entities to recognise and treat sepsis. However, by not completing the screening tool, translation of the actor-network as intended by the focal actor, the ADNQ, did not occur.

Snapshot – Critical Care Outreach Team

> The CCOT nurse had received a bleep, which was a referral for a 19-year-old woman on the respiratory ward. Before attending the ward, the CCOT nurse looked on the computer at the patient's results, nursing notes and X-rays. From the brief assessment of the information on the computer she expressed concern about the patient.

Upon arrival to the ward, a nurse told the CCOT nurse that she was worried about the 19-year-old patient; she 'didn't think she was "right", we are missing something with this girl, her EWS is 4'. A sepsis screening tool had been completed in ED prior to her transfer to the Acute Assessment Centre and then on to the ward 12 hours ago. She had not triggered the Sepsis Six care bundle. The CCOT nurse looked at the patient's notes and she was approached by the ward sister and the respiratory nurse specialist, who expressed concern about the patient. The CCOT nurse then went to assess the patient.

Following her assessment, the CCOT nurse commented that the patient was septic and immediately escalated her to the Critical Care Consultant for review. The Consultant attended quickly and assessed the patient. The Critical Care Consultant informed the ward team of doctors that the patient needed to be moved to intensive care. The CCOT nurse commented that she would stay on the ward and transfer the patient to intensive care when the bed was ready. She then reviewed another patient whilst she waited for an intensive care bed to be prepared.

The second patient was a 95-year-old man admitted directly to the ward from ED. He had been screened for sepsis and the Sepsis Six care bundle had been completed within an hour. The CCOT nurse checked through the documentation and found that a continuation plan was in place. She then received a bleep, which was a referral of a patient on the Acute Assessment Centre. Following a telephone handover, she looked the patient up on the computer and made a judgement that the patient was sicker than the 95-year-old man she was currently reviewing. The CCOT nurse summarised her findings and recommendations with the nurse and said she would return to review this patient later. She told me overall it is 'hit and miss' with the sepsis screening and Sepsis Six care bundle and saw her role to fill in the gaps. At this point the porters arrived to transfer the 19-year-old patient to intensive care. The CCOT nurse She commented that she would review the Acute Assessment Centre patient after she had completed the transfer.

In the case of the 95-year-old man, the CCOT nurse's workload was reduced because sepsis had been recognised and treated; the tool had been used efficiently throughout the patient's journey. For the 19-year-old, the sepsis screening tool was rigid and captured a moment in time; however, the

patient's condition had changed and no longer matched the previous representation on the tool.

In the ED, the work practices were more aligned with screening for sepsis and the tool was attached to the admission paperwork. It was evident from the fieldwork that the screening tool and the Sepsis Six had more of a presence in the ED than it did in acute inpatient areas. Outside of the ED, the nurses did not screen the 19-year-old for sepsis again but did escalate her care to the CCOT based on the EWS and a feeling that she 'wasn't right'. The CCOT nurse had the problem-solving skills to identify and treat sepsis and she had access to medical professionals. Her work practices were aligned to detect and treat acute illness. The CCOT nurse's assessment processes were not guided by a tool and were not linear. She accessed a range of information and applied her knowledge to inform her assessment before she examined the patient.

5.5 Conclusion

On the basis of the literature review and the theoretical framework, three precise research questions were framed:

1. How did the case sites interpret externally driven standardised tools?
2. How did the case sites implement externally driven standardised tools?
3. What happened when the tools were used in clinical practice in secondary care?

The research questions are considered in the following discussion of the findings from Southside.

In relation to interpretation and implementation of the tools the role of focal actor, the ADNQ identified the problem to be solved as achieving compliance with the national sepsis CQUIN. She enrolled and mobilised the corporate quality nursing team to act on her behalf. The Quality Nurses devised and

delivered training and audit that acted as *interessement* strategies intended to enrol and mobilise nurses in the ED and acute inpatient areas. The Quality Nurses were using the audit data to shape implementation plans and feedback to the Matron to lever behaviour change in order to solve the problem as identified by the focal actor, namely achievement of compliance with the CQUIN targets. Their interaction with medical staff was limited. The actor-network in the ED was translated but became unstable when completing the tools did not align with some healthcare workers' interests. The actor-network also became unstable when the department was busy, particularly in times of overcrowding, when the heterogeneous entities became more widely distributed, and when vital equipment, such as a functioning thermometer, was missing. As such, this introduced the potential of drift from the original intention of the tools, namely timely identification and treatment of sepsis.

In connection with the interpretation, implementation and use of the tools in clinical practice, the intention of this chapter has been to show that the stages of translation of the actor-network were not sequential and overlapped, often in a disorderly and iterative fashion. This was the case for the Quality Nurses as they delivered training and completed audit, and for healthcare workers as they navigated the ED or acute inpatient setting, which were both in constant motion.

The ED Consultant agreed to take on the role of Sepsis Clinical Lead but did not engage with *interessement* strategies to enrol medical staff to modify their behaviour to complete the sepsis screening tool as intended by the focal actor. Reporting on the sepsis CQUIN performance was via the nursing hierarchy, with limited medical representation at the meetings, and, in the absence of reporting from the sepsis group, *interessement* of executive and clinical medical staff to enrol into the ANDQ's actor-network did not occur. In the acute inpatient setting, sepsis occurred less frequently, and nurses predominantly used the EWS to escalate patient care to junior doctors and the CCOT. Completing the screening tool to recognise sepsis did not align with

the junior doctors' and CCOT interests, so they did not complete it; sepsis was recognised and treated using clinical knowledge and problem-solving skills.

In terms of when the tools were used in clinical practice work practices and exposure to sepsis differed between the ED and the inpatient setting, yet the tools being used were the same. They were abstract in nature; for them to come alive and realise the ambitions of their designers, they had to be interlocked with established work practices in the strongly preconfigured worlds of Southside (Berg, 1997a). When implementing a new tool, the Quality Nurse focussed on working through the boxes on the form in a linear way that did not reflect the complex trajectory of events (Tarrant et al., 2016).

The Quality Nurse represented the tool abstractly; she could not know the local circumstances in which the tool would be applied at any time by the ED or acute inpatient staff. The representation she presented was static and abstract, yet the work practices were real time and concrete (Berg, 1997a). Completion of the screening tool and Sepsis Six care bundle required chains of re-representations as a result of many complex interventions that had to be undertaken in the dynamic setting of the ED and acute inpatient wards.

The next chapter presents data generated from fieldwork at Westside University Hospitals. The intention is to provide an understanding of the differences between how and why Southside and Westside approached sepsis care improvement.

Chapter 6: Westside University Hospitals NHS Trust

6.1 Introduction

Southside Hospitals NHS Foundation Trust and Westside University Hospitals NHS Trust operated within the same national guidelines, regulatory regimes and employed professionals trained and regulated under the same systems. However, as the data will illustrate, each trust implemented sepsis screening and the Sepsis Six care bundle differently. A preliminary observation was that sepsis care improvement had been in place for over 10 years and was driven and led by a multi-professional team of experts who interpreted external evidence-based guidelines and financial targets for use at Westside. Specifically, clinicians were able to use their clinical and improvement expertise to interpret the terms of the sepsis CQUIN and develop implementation strategies tailored to local improvement work. As such, the sepsis team developed innovative improvement practices such as automated sepsis screening. Throughout the chapter, examples from the data will be related to concepts (see Table , Chapter 3) used in this research to show a dialogue between the evidence that was obtained during fieldwork and the theoretical stance of ANT and technology-in-practice.

The chapter will be structured in the following way. Firstly, a historical narrative of how Westside interpreted external drivers and developed implementation strategies will be presented. To demonstrate a dialogue with ANT the stages of translation will be used to illustrate how a multi-professional sepsis teams interpreted external drivers associated with the tools and adapted them into local implementation strategies. The intention is to build an understanding of how the human and non-human elements came together (or not) to form actor-networks. Secondly, what happened when sepsis screening tools and Sepsis Six care bundle was used in clinical practice will be illustrated. To demonstrate a dialogue with ANT and technology-in-

practice, the tools will be described as formal tools and presented as a map and a representation of evidence-based medicine. Data generated from the ethnographic fieldwork will then describe clinical practice as the terrain and will highlight the gap between the tools and the clinical practice and the chains of re-representations that occurred when the gap was crossed. To set the scene, the historical background to sepsis care improvement at Westside will first be presented.

6.2 Historical narrative of sepsis improvement

At Westside, the Sepsis Clinical Lead had been the focal actor for over 10 years (Figure 13). In 2005, as a junior doctor he problematised anecdotes from colleagues that patients with sepsis were not receiving timely treatment. He took action by leading a retrospective gap analysis. Data were gathered prospectively using a pro forma developed from the Surviving Sepsis Individual Chart Measurement Tool designed by the Institute for Healthcare Improvement in the United States (Surviving Sepsis Campaign, 2005). The tool was named the Westside Sepsis Measurement Tool and was designed to collect data at each stage of admission, as well as mortality at 90 days and one year. Analysis found that even in cases with severely abnormal physiology documented in the medical notes by the doctor, only 60% of patients had been referred to critical care. None of the patients received all the interventions of the sepsis care bundle within the specified time. As such, taking a robust approach to measuring variation in sepsis care validated the anecdotal evidence and the Sepsis Clinical Lead's problematisation: patients were indeed not receiving timely sepsis care.

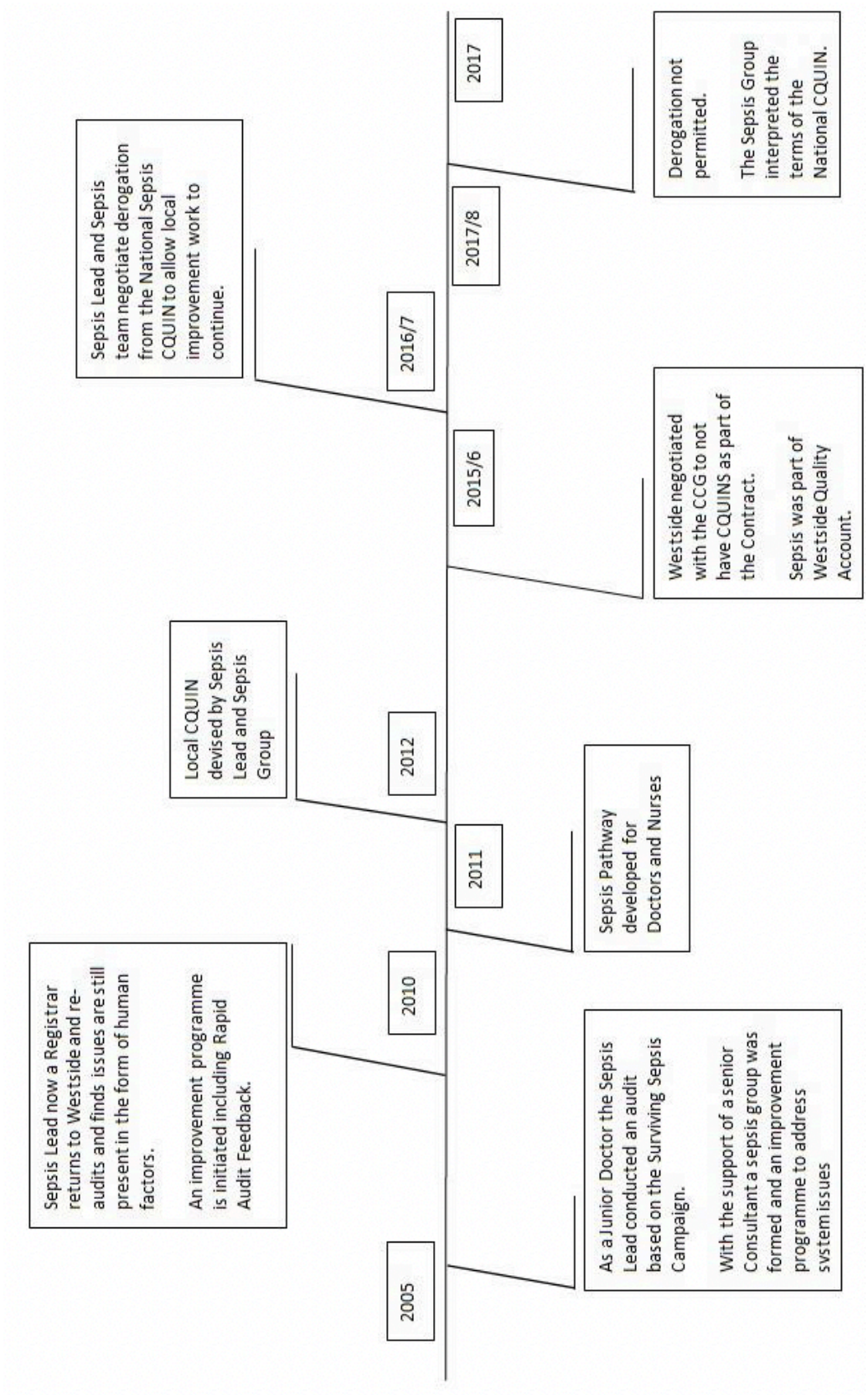


Figure 13. Westside timeline of sepsis improvement

The Sepsis Clinical Lead recognised that improvement would require logistical changes, so identified other actors whose identity and responsibility would contribute towards the configuration of a problem- solving network (Sarker et al., 2006). To embrace the actors' interests sufficiently, the Sepsis Clinical Lead used the audit results and SSC guidelines as a form of *interessement* strategy to enrol the multi-professional team and mobilised them to become a strategic and operational group. Initially, membership included interdisciplinary staff at Westside who were able to action issues as they arose.

> All of this work was driven by a group called the sepsis group, which was a group of people; it's still running so we have microbiologists, critical care, acute medicine, nurse education around a table, pharmacy. But certainly back then it was the people that encompassed where sepsis was a problem. It was that group that gave us access to a pharmacist and a microbiologist in the room saying 'yes we can put this antibiotic in people's cupboards'. We had access to medical physics so that we could put the lactate modules on, so whilst there is a core of three or four of us that are pushing sepsis as a medical emergency we did have access and support, to be fair, from the higher echelons of medical management, to do this work.
>
> **Clinical Sepsis Lead**

The group instituted an internal step-wise improvement programme to address the problem of patients not receiving timely treatment for sepsis, including a sepsis screening tool and the Sepsis Six, which were the OPPs. The Sepsis Clinical Lead became their spokesperson (Law, 1986).

6.2.1 The influence of the step-wise improvement programme on the stages of translation at Westside

The step-wise programme included ensuring that the equipment required to recognise and treat patients for sepsis was available on the wards and in the ED, for example blood culture bottles and intravenous antibiotics. Frontline staff with responsibility for undertaking physiological observations, screening for sepsis and escalating patient care as well as clinical decision-makers who could prescribe treatment were key to solving the problem of variation in

sepsis care identified by the Sepsis Clinical Lead. As *interessement* strategies, the sepsis group developed a teaching programme, intranet site and poster campaign to promote the needs of severely septic patients. A sepsis screening tool and the Sepsis Six care bundle were printed on the Early Warning Score (EWS) chart used to record patients' physiological observations.

In 2010, following clinical rotations elsewhere, the Sepsis Clinical Lead returned to Westside as a registrar. He repeated the 2005 audit and found very little difference had been made to the use of early interventions in sepsis. Despite system improvements, only 35% of patients who met the criteria received antibiotics within one hour and only 25% of patients received interventions such as blood cultures in a timely manner. The *interessement* strategies had not enrolled and mobilised healthcare workers and the actor-networks were not extensively translated. The problem as identified by the focal actor (the Sepsis Clinical Lead) had not been solved. He drew the conclusion that, whilst the necessary systems were in place, improvement in the early recognition of sepsis was still required.

> In terms of ownership, the problem with sepsis is when it's something trust-wide; it's very different if it's something which particularly is to do with surgery or peri-operative care or just acute admissions or something like that, to something which impacts upon every single ward area trust-wide. And that's whether they see one sepsis patient per year or whether they see 10 per month. And so ownership and engagement with it was a really big problem.
>
> **Sepsis Clinical Lead**

To address these issues, a local data-driven and clinically-led sepsis improvement programme was created. The programme included a pathway based on the SSC guidelines (Levy et al., 2004). A Lead Sepsis Nurse was employed and enrolled into the actor-network to act on behalf of the focal actor by implementing the *interessement* strategy and to enrol healthcare staff to pass through the OPPs.

> We just simplified everything. *Surviving Sepsis* is a very long and complicated document and talks at lot about intensive care

> interventions and I think it took quite a lot of time to get over that. Sepsis happens in ED, in acute medicine and general surgery whatever it may be. Let's focus on the interventions that we know make a difference and that's seeing the patient, recognising they are septic, give them antibiotics, take blood culture and a lactate, give them fluids and if that all doesn't work, call someone. In 2011 we came up with our first nursing and doctor one-page guidance, which very simply said: 'Do you think your patient has sepsis? If so, this is what you need to do.'
>
> **Sepsis Clinical Lead**

At the time of fieldwork, training had evolved to include all nurses who were newly qualified, new to acute care or international, and it involved attending a seven-day Acute Care Skills programme within the first six months of employment. The programme included sepsis education and learning, and was assessed through summative simulation and objective structured clinical examinations.

> We've changed our education a lot to talk about the understanding of each element of the bundle. It's all very well saying 'Right, reel off the Sepsis Six bundle, reel it off'; right, okay, I know our whole trust can reel off the Sepsis Six bundle. Well, if they don't know why we want to have two sets of blood cultures taken or why they should have their IV [intravenous] antibiotics within an hour, or why we should be taking a lactate or why we should treat with fluids, then you cannot physically appreciate the urgency in responding to that or even doing it in the first place.
>
> **Lead Sepsis Nurse**

This training programme did not take place whilst fieldwork was taking place. Doctors received sepsis training on induction programmes and as part of their first year of postgraduate training, known as the foundation year, using educational methods such as simulation.

The Clinical Sepsis Lead was an expert in sepsis care and was able to apply internationally recognised evidence-based guidelines to inform local improvement. He embedded governance processes within the programme and provided evidence of the impact the improvement to senior leadership.

National and local CQUINs also influenced sepsis care improvement at Westside. Rather than the terms of the CQUIN being negotiated by corporate and executive staff and implementation being delegated to sepsis teams, at Westside the sepsis team played a key role in the local interpretation and implementation of the CQUIN targets. Their role in sepsis CQUINs and how this related to sepsis care improvement will now be described.

6.2.2 The stages of translation at a corporate level – the Sepsis CQUINs

In 2012, the sepsis team devised and negotiated a two-year local sepsis CQUIN. The associated investment enabled an additional part-time Sepsis Nurse to be employed, who delivered the audit and education work.

> In 2011/12 we went to the commissioners to say we can improve this [sepsis care], and they accepted that and we got a two-year CQUIN and the CQUIN of course helps as it brought investment – not huge amounts but enough for us to have someone to focus entirely on sepsis – and we developed metrics and methodologies that we would never been able to do had we not had that investment.
>
> **Clinical Sepsis Lead**

The trust-wide campaign to improve sepsis care continued with the introduction of additional interventions, which acted as *interessement* strategies. These included sepsis documentation stickers, a sepsis screening tool for observation charts, an intranet website and computer-aided learning packages. The reported improvements after 2009 were: administration of antibiotics within an hour had risen from 40% to 80%; and compliance with the sepsis care bundle had risen from 25% to 70%. As such, the *interessement* strategies had been successful in the enrolment and mobilisation of healthcare workers to solve the problem as identified by the Sepsis Clinical Lead as focal actor.

In 2015/16, Westside and the commissioners opted for a tariff that did not include a requirement to agree local CQUINs or to report national CQUIN indicators. Sepsis care improvement continued as part the organisation's programme of patient safety. Treating patients promptly for sepsis remained

a priority, with success against locally set targets reported in the 2015/16 Quality Account report. It was reported in the 2015/16 Quality Account that Westside was to be included in 2016/17 national CQUIN. In view of the sepsis care improvement work that had taken place in the organisation, discussions with the commissioners took place. The outcome of discussions was that, for 2016/17, Westside negotiated derogation from the national CQUIN. The Clinical Sepsis Lead and Lead Sepsis Nurse, with consultation from the sepsis group, were instrumental in deciding what an appropriate derogation was.

> We've done the national CQUIN but we have derogated from it because of all of the improvement work that has gone on. And it was felt that if we just stuck to the national CQUIN we'd almost be going back a step. There's not the clinician feedback involved. We look at entire bundle compliance, including timely escalation to critical care. So. the derogation…. The sepsis group was involved in what we felt was going to be an appropriate derogation to the national [CQUIN] but still keep the commissioners happy in terms of what our commissioners would expect the national CQUIN would give them. She [Clinical Sepsis Lead] did the initial negotiation and then we've been ... so I've been involved with the commissioners since when they request their updates.
>
> **Lead Sepsis Nurse**

The national CQUIN target concerned screening patients admitted to emergency areas for sepsis and administration of antibiotics within an hour if sepsis was detected. As highlighted by the quote above, for the sepsis team at Westside, the CQUIN did not reflect the scope of their improvement work to date. The narrow focus of the national CQUIN was only a partial representation of their work. In a national context of external financial incentives for sepsis care improvement, the team at Westside was empowered to take an active role in negotiations with the CCG. The result was that, by the Clinical Sepsis Lead staying in his role as focal actor and spokesperson, he maintained a central role in the improvement work. This resulted in a connection being maintained between the CQUIN and local initiatives that was led by frontline clinicians with expertise in sepsis care and

improvement methods. The derogation enabled the programme of improvement that the sepsis team considered a more accurate representation of their work to date to continue throughout 2016/17.

At board level in the organisation, an approach to implement targets in 'an intelligent way' was advocated by the Chair.

> So I think the risk with all these things is, it comes back to unintended consequences. Well, there is a danger that if you too tightly focus people on a target, whether it's through an operational target or through a CQUIN, they will hit the target and miss the point. And actually not deliver what is best for patients but deliver the target. And actually that's not what this organisation wants to be doing; actually it's not what patients want either. Well, I think the issue is for the Board to be very careful about how some of these things are then translated into targets and objectives for the frontline, to make sure that that doesn't happen. So I think, particularly sometimes, some of the national initiatives are simplistic and have that risk of being misinterpreted or implemented in a way which wouldn't be in the best interests of the patients. And actually it's up to us to make sure that they're implemented in an intelligent way in the organisation.
>
> **Chair**

Despite derogation from the national CQUIN and the local targets reflecting local improvement work, a tension was evident between the commitment to continue local improvement efforts and the requirement to meet the CQUIN targets.

> I think almost if there wasn't the financial tag associated with some of this, there would probably be a bit more of an 'It's okay, let's try and learn around what we need to do differently to improve here'. And that the time-defined element[s] of the projects, if they could be a bit more relaxed, then we might, I think, create different approaches when you've got something that is a 'must do by quarter 4'. It kind of changes the emphasis and pushes your mindset to almost a sense of urgency of 'Well, we have to do something differently' and so on, when actually they might not be the right things to do. You can drift from what the real purpose is of this, which is, you know, improving

> things for the patient and I think some of that comes back to the way they've been designed as well.
>
> **Patient Safety Lead**

Observations at meetings found that there was a focus on the CQUIN *and* innovative sepsis care improvement operational plans as *interessement* strategies to solve the problem of variation in sepsis care. However, as illustrated by the quote, the requirement to meet quarterly targets inevitably influenced the actions of the sepsis team. The next section gives an example of how the sepsis group debated and interpreted the national CQUIN target.

6.2.3 Sepsis group

As indicated in section 6.2, the sepsis group had been established since the inception of sepsis improvement work, which pre-dated the national sepsis improvement agenda, including the sepsis CQUIN. At the time of fieldwork, the sepsis group formed part of the Patient Safety governance structure at Westside. The lines of reporting from the group fed to the Clinical Risk Committee. Reporting 'up' the organisation also resulted in the Patient Safety Lead making a bi-monthly report, including on sepsis work, to the Quality Committee, a meeting of the board. Throughout fieldwork, observations revealed that monthly meetings were regularly attended by the sepsis medical and nursing leads, microbiologists, critical care (adult and paediatric) and pharmacy. The meetings were collegial, with the Clinical Sepsis Lead, as focal actor and spokesperson, displaying a democratic leadership style over the implementation plans. The purpose of the meeting was to operationalise sepsis care improvement work across the trust. An actor-network had been translated and the problem as identified by the Clinical Sepsis Lead had been accepted by the group's membership.

The sepsis group had evolved to play a key strategic and operational role in the sepsis CQUIN at Westside. Monthly meetings brought together people to enable decisions to be made and a consistent interprofessional message to be delivered to the organisation. Debates and discussions preceded decisions

and regular communication appeared to maintain the momentum of work. Each financial year, the group played a central role in the local interpretation of the CQUIN targets and negotiated with the commissioners.

Data will now be presented from an observation of a meeting where it was announced that local targets would not be permitted in the next CQUIN. The data will provide a sense of how the group debated the challenge of balancing internal work with the requirements of the CQUIN. Whilst local targets would no longer be permitted, the group maintained jurisdiction over how the CQUIN would be interpreted locally. A short section of dialogue at the meeting ran as follows:

> Clinical Sepsis Lead: We have to follow the CQUIN. We must keep doing what we were doing, just because the CQUIN is telling us to downgrade. We will be counting different things now. So what are we going to do with the local audit?
>
> Consultant Microbiologist: The question is time and resource.
>
> Lead Sepsis Nurse (Sue): I can't keep doing the audit, CQUIN and training. I'm on my own until we know what staff we have.
>
> Critical Care Consultant 2: The CQUIN is telling us to do this. We could work around the target, but that's probably bad doctoring, although the CQUIN isn't about doctoring. How will we establish our baseline? When they say 'randomise', they mean not the best ones, right? You could randomise on hospital number every week? We need to think about practical steps.

The sepsis nurse reported that, as a member of the National Sepsis Nurse Forum, she was aware of local adaptation of the CQUIN. Other trusts were counting different things; the same CQUIN had different interpretations and different numbers in cohorts of patients, depending on the size of the trust. There was discussion around the payment framework, as after April there would not be a mandate to do the local audit.

> Sepsis Nurse: The local audit is our improvement methodology, agreed before with the commissioners.

Critical Care Consultant: Do the bare minimum and get the money or be good at sepsis care. When you hear 'CQUIN', you know it's a money game.

Consultant Microbiologist: I'm concerned about taking our eye off the ball if we take a backseat on the CQUIN, but I know Sue has only so many hours.

Paediatric Critical Care Consultant: The payment is staggered over the year and aggregated to a percentage compliance, so why not see what the baseline figures are, then decide whether to go for mid-range or if the top-range target is achievable.

The group agreed on this interpretation. As focal actor and spokesperson, the Clinical Sepsis Lead was then responsible for communicating the interpretation back to the relevant senior leadership team in the organisation and the CCG. The data demonstrate how a collective knowledge base of clinical acumen, an understanding of quantitative data and improvement methods enabled the group to maintain their local approach whilst appeasing the external financial driver.

At Westside, as highlighted so far in this chapter, the sepsis team devised and implemented a number of improvement initiatives. The leadership team in the ED worked alongside the sepsis team to interpret and adapt sepsis care improvement to match work processes that were unique to the department.

6.2.4 The stages of translation in the Emergency Department

The Clinical Director of the ED was enrolled and mobilised by the Clinical Sepsis Lead and was a member of the sepsis group before taking on the role of Director of the department. She was an ally of the focal actor and the problem of variation in sepsis recognition and treatment aligned with her interests as a clinician. As such, she led sepsis training in the department for a number of years.

So, I've worked on the trust sepsis group for the hospital for some years. So I'm less involved now because of my Director role. So what we did probably five years, maybe six years ago, I can't remember exact dates, is there was a recognition that a large percentage of

> sepsis comes from ED that ends up in Critical Care. So how could we roll out more information, more education, regarding the recognition of sepsis early on?
>
> **ED Clinical Director**

The focus of the improvement work was to raise awareness and provide education regarding the early recognition of sepsis. The ED had a team of educators that supported staff and ran training programmes, including induction, mandatory training and ongoing specialised education. Training took place on team away-days and in the morning, when the department was quieter, and formed part of the routine for nursing staff. Simulated patient scenarios provided opportunities for staff to implement updated guidelines away from the frontline of clinical practice. Training for Advanced Nurse Practitioners[3] (nurse educated to masters level in advanced practice) and doctors was case-based discussion and *ad hoc*, depending on the patients in the department.

> The best way of rolling it [NICE sepsis guidelines] out to the nursing staff would be to build it into team days and also probably do morning teaching to go over the initial assessment tools. So the team days are always themed but it would work very well. There's always simulations, so they always get simulated patients in the afternoon but we could very easily do stuff around it in the morning and then do simulation in the afternoon.
>
> **Advanced Nurse Practitioner, ED**

Alongside the sepsis improvement work, patient flow through the department was also changed. An external driver for the development of the tools was the four-hour target, where patients in ED must be seen, treated, admitted or discharged in under four hours (DoH, 2008a).

> The Department of Health brought out the four-hour target, [and] all of a sudden nurses just saw patients when they came in and did a

[3] An Advanced Nurse Practitioner had the authority to practise autonomously in the assessment, diagnosis and treatment of patients (Royal College of Nursing, 2018).

> plethora of bloods. So when the doctor saw them, they hoped that they'd got the right bloods there, that the doctor could then see them at two hours and go 'Yeah, you can go home'. What that does is just ... you do unnecessary investigations. So by introducing the initial assessment area and the initial assessment tools, we wanted to reduce investigations.
>
> **ED Clinical Director**

As indicated in the quote above, the leadership team in the ED developed initial assessment tools aligned with patient flow through the department.

The next section introduces the maps in use at Westside and demonstrates a dialogue between technology-in-practice and the data. The initial assessment tools, specifically the sepsis initial assessment tool was viewed as the map in the ED. The sepsis initial assessment tool contained multiple components, such as physiological observations, blood tests, insertion of an intravenous cannula and administration of treatment. In the acute inpatient setting the EWS embedded in the electronic patient observation system was viewed as the map. Before presenting a detailed account of the ethnographic data generated when observing the tools (maps) in use in clinical practice (terrain), the following section is a presentation of key aspects of the tool and a narrative of the working practices associated with completing them.

6.3 The maps

6.3.1 The initial assessment tools

The aim of the tools was to identify symptoms that would direct the nurses to which initial diagnostic tests and treatment were required, and that would indicate if the patient needed an early review by a clinical decision maker. Clinical decision makers were junior doctors and advanced nurse practitioners. The nurse had to identify the patient's presenting condition from the clinical handover and their initial assessment of the patient. There were multiple initial assessment tools in use, each one a representation of evidence-based medicine and local policy, written by a senior nurse and a

medical consultant. They provided a map of sequenced prescribed actions, from undressing the patient and applying a gown to diagnostic tests. The potential for variation was introduced because selection of the appropriate tool was reliant on the skills of the nurse.

> So everything that's in them is all referenced at the bottom, so there is something underpinning what you're doing. Sometimes they differ from NICE guidelines because of our departmental or our trust guidelines or whatever guidelines we've decided to use. So it also standardises what people who come from other trusts who come to work here or agency staff do. They have a huge amount of functions and it's great for the junior staff because it's very daunting being in Initial Assessment for them, so they can look at it.
>
> **Advanced Nurse Practitioner, ED**

After initial assessment, the clinical decision maker would decide which area in the department was appropriate for the patient's condition.

> It is a clinical decision maker role, working across all areas of the adult side of the Emergency Department. I'm involved from the start of a patient's journey to the end. The majority of my role is in 'majors', which is where I will see the patients, assess them, examine them, organise their treatment and their disposal, whether that's discharge or admission. Other parts of our role, clinically, are, we work in the Initial Assessment Unit, where we undertake an initial assessment, working as a clinical decision maker alongside the triage nurses. So early identification of red flags and quick-wins, like admissions and discharges.
>
> **Advanced Nurse Practitioner, ED**

The initial assessment tools were embedded in practice and formed a key aspect of the patient's initial assessment and treatment. Observations in the initial assessment area in the ED revealed that the initial assessment tools formed part of the common language of the department and played a key role in the organisation of work practices (Allen, 2012).

Sepsis initial assessment tool

The Sepsis Initial Assessment Tool (Figure 14) had been in use from 2015 and was a representation of the SSC's guidelines (Levy et al., 2012). The first section of the tool (Figure 15) presented the criteria to establish the likelihood of sepsis in order to progress with taking the specific investigations and action. The targeted time for completion of the tool was 20 minutes, which reflected the design of patient flow through the department to achieve the four-hour target. The equipment required to make physiological observations was available in each of the cubicles. As such, the heterogeneous entities (healthcare workers, patients and equipment) required to recognise and treat sepsis were designed to be closely aligned.

> We have the initial assessment tools on the wall, which are put together by our consultants for us to pick. So it's like a flow and we do the bloods, cannulas, whatever is needed in there. And then the patient is moved to the relevant area. It's set up with the monitors; it's set up with oxygen and stuff and suction; every cubicle is set up. So it's designed that if someone is poorly, very quickly we have everything on hand.
>
> **Clinical Support Worker**

Figure 14. Sepsis initial assessment tool

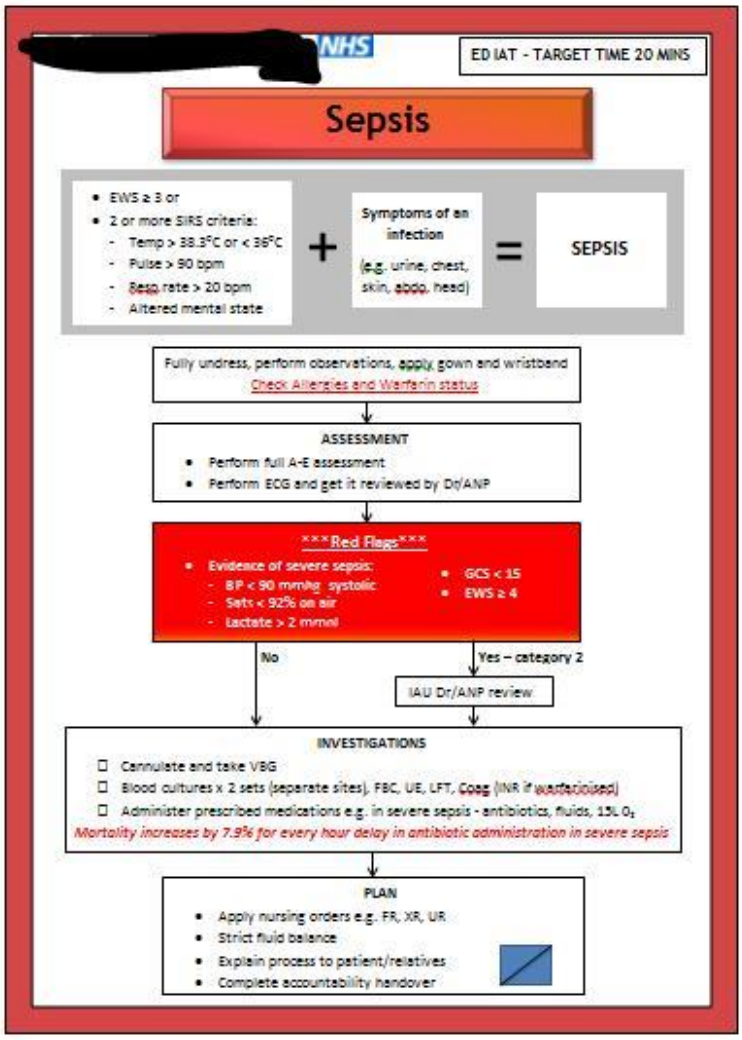
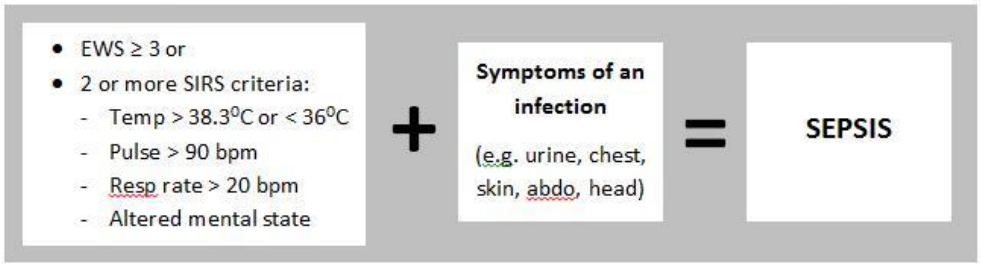


Figure 15. Criteria to screen for sepsis



The criteria in the red box (Figure 16) represented high-risk factors. To emphasise the importance of the 'red flags' the box is red (the term 'red flag' was used in every initial assessment tool to indicate physiological markers of concern). If there was evidence of severe sepsis, the patient required review by a clinical decision maker. The operational model of the initial assessment unit meant that a clinical decision maker worked alongside the nurses and patients, meaning that the heterogeneous entities required to recognise and treat sepsis were closely aligned.

The final box (Figure 17) included the Sepsis Six (UK Sepsis Trust, 2018), with an emphasis on the importance of antibiotic administration highlighted in red. The operational model of the initial assessment unit meant that nurses with skills to insert an intravenous cannula worked alongside clinical decision makers, who could assess the patient and prescribe antibiotics. Equipment to administer the antibiotics was also available. As such, the heterogeneous entities required to recognise and treat sepsis were not widely distributed across the ED.

Figure 16. High-risk factors

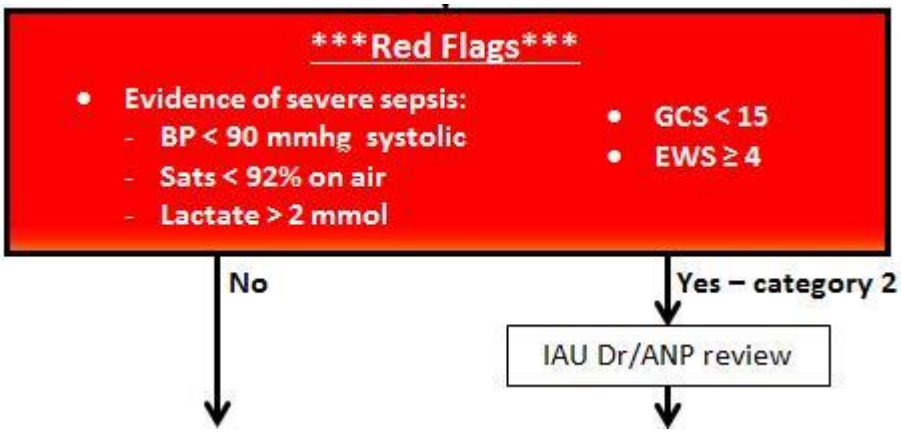
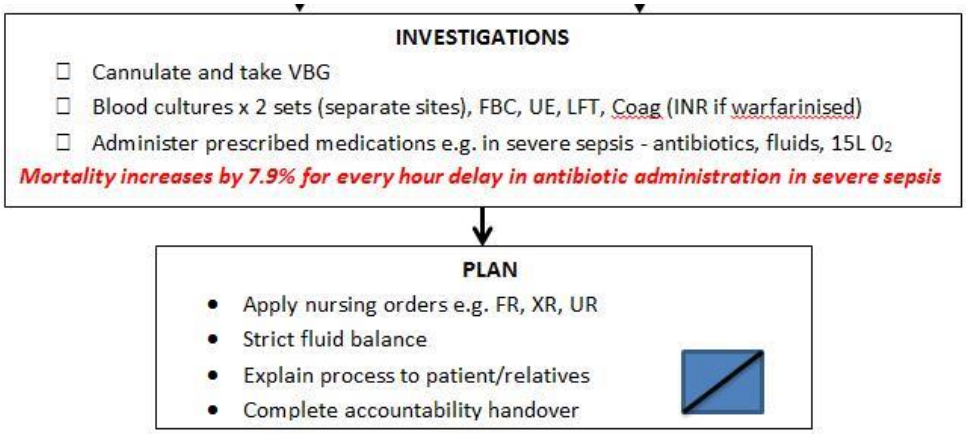


Figure 17. Westside ED Sepsis Six care bundle



6.3.2 The electronic patient observation system

The Clinical Sepsis Lead was the driving force behind technical advances in the field of the improvement of care for deteriorating patients at Westside. The result was that innovation in sepsis care improvement could happen outside the framework of the CQUIN. In 2015, in conjunction with an external computer software business, the Clinical Sepsis Lead led the introduction of an electronic patient observation system, which included automated sepsis screening, which gave a prompt to consider sepsis.

A detailed exploration of electronic observations is outside the scope of this study; however, at Westside the recording of electronic observations was intrinsically linked to screening for sepsis particularly in acute inpatient areas. The paper sepsis screening tool that had been in use in the acute inpatient setting (section 6.2.1) was represented by the software embedded in a mobile device. The electronic observations system acted as an *interessement* strategy in acute inpatient setting. Enrolment and mobilisation occurred through the established and fundamental working practices of making physiological observations and recording the results on the mobile device. Screening for sepsis did not require enrolment and mobilisation into an additional actor-network, nor did it add to the workload of healthcare staff.

> Electronic observations came off the back of sepsis; there's no doubt there is a clear line of sight between the two. We realised that EWS was probably our biggest problem. It's the final common dominator of all failure to rescue cases, because if you don't take the observations and add them up correctly and if you don't then tell someone about them, then you're stuffed. If we are saying that EWS is our primary way of identifying sick patients, most patients who are sick tell you they are sick through their physiology. So we did some audit work not dissimilar from the sepsis and started doing feedback and it got to the point where we recognised that we just ticked the box for saying 'yes we had an EWS system'. There are certain aspects of this that are so dependent on human factors that we need to remove that where we can.
>
> **Clinical Sepsis Lead**

Embedded within the electronic patient observation system was the EWS. The EWS was a formal tool representing an evidence-based approach to the recognition of a deteriorating patient and escalation policy. Once the patient's observations had been made and recorded on the handheld device, the software automatically calculated the EWS. Westside experienced problems in the consistent use of the EWS prior to the introduction of the system.

> So there were lots of issues four or five years ago in relation to the recognition of a patient in our paper-based EWS system and the adding up of scores, the escalation, the following of our really clear escalation. And so the development of the electronic system was superior to what we had in the paper-based system.
>
> **Critical Care Outreach Lead Nurse**

When a nursing assistant recorded the physiological observations on the handheld device, if the threshold score of 4 on the EWS was passed, an alert would be sent to the nurse responsible for the patient, the nurse in charge of the ward and the junior doctor responsible for the patient. The nurse responsible for the patient had to verify or 'close' the alert. Every member of the nursing and medical team had a handheld device.

> By March 2015 we rolled out 4,500 mobile devices to our staff. So all of our junior doctors have iPhones, all of our nursing staff have iPods. All of our physios, dieticians, OTs have iPhones, and what electronic observations have done is created the ability to communicate with the entire staff about patients.
>
> **Clinical Sepsis Lead**

Concern was expressed that the electronic observation may lead to a task-oriented mindset rather than understanding the reasons for a patient to score an EWS of over 4. Work practices associated with the use of electronic observations will be described in more detail later in section 6.5.2 - 6.5.4.

> The electronic observations stuff is phenomenal and it's designed for very good reasons in terms of trying to structure a system that will take out some of the potential human error of a process that's stretched, you know, the escalation and automation and that kind of stuff. But then the potential for that is that there's a disconnect for

> staff to do the electronic observations and assume that things have been escalated because there's a device that helps rather than necessarily the human touch of confirmation and conversation with people.
>
> **Patient Safety Lead**

Screening for sepsis was not a CQUIN indictor at Westside, and so did not carry as much emphasis as at Southside. Whilst fieldwork was taking place, the CQUIN targets focussed upon the rapid audit feedback programme, time to antibiotics, taking samples for blood cultures and the introduction of electronic sepsis screening. Prior to the introduction of electronic observations, the sepsis screening tool and the Sepsis Six care bundle were on the paper charts used to record observations. This meant a copy was accessible and that every patient had observations recorded. At the time of fieldwork outside of the ED, there was not a physical tool for screening sepsis and the Sepsis Six care bundle in use at Westside. The Lead Sepsis Nurse was not a naïve formalist, so did not believe in the *a priori* superiority of formal tools (Star, 1989). She considered that the completion of paper sepsis screening tools could become a 'tick box' exercise that did not inform improvement. One of the reasons to move to electronic sepsis screening was to remove the reliance upon nurses' knowledge to identify sepsis.

> And we know that sometimes tick boxes just become exactly that, that they become a tick box. It's very difficult to audit against them. So their use for that is not good, I don't think. So it's reliant upon the nurses' knowledge of sepsis in order to screen the patient at the moment; hence the move to electronic screening.
>
> **Lead Sepsis Nurse**

At the end of fieldwork, as indicated in the 2016/17 Quality Account, the trust was implementing electronic sepsis screening.

6.4 Quality improvement methods as *interessement* strategies

As indicated in section 6.2.1. the step-wise improvement programme formed part of the implementation strategy devised by the sepsis group to align

external drivers to local improvement plans. Quality improvement methods of rapid audit and feedback and process mapping were integrated into the strategy. Their influence as *interessement* strategies in the ED and acute inpatient setting will now be presented.

Rapid audit feedback

Rapid audit feedback which was aimed at: promoting severe sepsis as a medical emergency; disseminating 'best practice' guidance; and improving timely recognition and treatment of severe sepsis. A key feature of the improvement programme was audit and feedback. This method acted as an *interessement* strategy by highlighting where improvement should be made so that clinical practice aligned with SSC guidance. The method also reinforced practice that aligned with guidance by including praise and recognition when it occurred.

> The system was there but we obviously hadn't quite dealt with the human factors side of things, to actually get people to see this [sepsis] as a medical emergency. So, from 2011 onwards we started a programme that we called 'rapid audit feedback', which is where we changed the way we were auditing so we could get to the patients quicker and review a lot of cases in a rapid way and this allowed us to create reports for each individual patient [to give] to the teams looking after the patient at the time of admission or the time of deterioration, depending on what was going on at the hospital.
>
> **Sepsis Lead Nurse**

The audit was adapted from the Westside Sepsis Measurement Tool and encompassed patients admitted to critical care with a primary diagnosis of infection. The care patients received prior to critical care admission was audited against the Surviving Sepsis Guidelines (Levy et al., 2004). Information on the timings of key interventions such as doctor review and time to antibiotics was also gathered. The clinical team who had been involved in the patient's care prior to critical care were then emailed a report. In the role of spokesperson, the Sepsis Clinical Lead gained wider acceptance of this course

of action by enrolling a larger network of actors at executive board level. The Trust Quality Committee, a meeting of the board, endorsed the rapid audit feedback programme. The feedback was positioned as central to the programme by encouraging conversations between the improvement team and frontline clinicians. In the 2015/16 Quality Account, the programme was posited as converting routine collection of statistics into a mechanism to promote personal accountability. The audit programme was still in place at the end of fieldwork.

> The programme was revolutionary. It was quite unusual for people to get that kind of feedback. If statistics are shown to us and how the organisation is performing and if we were to say 29% of people in Westside got antibiotics in one hour I think the immediate response is 'That's really interesting, we really should do better', but internally the psychology is 'What are we going to do about it?' So the feedback firstly acted as an educational method as we were essentially saying what we are expecting you to do and this is what you did and next time they did a better and job. We've now shown that that has been sustained despite not quite so much pressure and banging people over the head. We have sustained that improvement.
>
> **Clinical Sepsis Lead**

The strategy from the perspective of the sepsis group was successful in enrolling and mobilising healthcare staff. This was evident when audit showed that documented practice aligned with the SSC guidance that underpinned the audit criteria. However, the audit was limited to the care of patients with sepsis who had been admitted to critical care, so it was not an inclusive approach (Sarker et al., 2006). Mobilisation of allies via this *interessement* strategy resulted in a cohesive approach between different groups of professionals in the sepsis group and legitimised the OPPs.

> The feedback they receive is signed by me but it very much says 'on behalf of the sepsis group'; it's not personal that I have reviewed their case and I feel this. So it's a standardised approach, an established approach within an organisation that's got, like, a collective behind it in terms of the sepsis group ... group, rather than a couple of individuals trying to do it.
>
> **Lead Sepsis Nurse**

Throughout fieldwork, the rapid audit feedback programme was portrayed by the sepsis team as a method of education for the wider interprofessional team, across the whole organisation. The programme was also viewed as a communication tool that targeted each member of the team who had been involved with care of a patient admitted to critical care with sepsis. As highlighted by the following quotation, the approach to education acted as an *interessement* strategy and enrolled healthcare staff from different professional backgrounds and different clinical settings:

> We have full email conversations between the seven people who are copied in. A great example was where blood cultures weren't done in the Emergency Department and this brilliant email trail between these seven people, consultants down in ED, consultants and Reg [Register] up on Medical HDU [High Dependency Unit], where the patient had then gone and the ward manager, all just discussing a beautiful story of human factors. Everybody then learnt a little bit from that. There was no blame involved. This was a generic 'Oh. how easy this happens'. Although we have a policy, but actually, when you're relying upon communication and human factors, then you've got the added problem of a patient being transferred from one ward area to another, it makes it difficult to achieve.
>
> **Lead Sepsis Nurse**

The quote above highlights that, rather than a linear set of steps as the patient progressed in their journey, a number of healthcare workers were involved in their care, which created a complex actor-network.

The rapid audit feedback programme was not perceived to have a positive impact on practice by all healthcare workers. In practice, the set criteria of the audit did not reflect the interests of all healthcare workers. At times, healthcare workers were implicated in the problematisation of other actor-networks and defined their identity and priorities in a manner that did not align with the actor-network, so they did not pass through the OPP. Achieving compliance with taking blood cultures is an example of when real-time events may not be apparent through the audit process. Whilst I was conducting an observation in 'resus', a junior ED doctor commented:

> There is a pressure to treat patients for sepsis with antibiotics in the department due to the time that they are here. If they deteriorate later down the line, on the wards, the finger is pointed to the ED staff for not treating. On the wards you have more time with the patients to wait [to] see how their condition progresses to make a decision to treat or not. We get emails about that and about blood cultures. 'Why haven't we taken them?' It might be that the patient was in a life-threatening situation or difficult to bleed.
>
> **Junior Doctor, ED**

In this case, rather than connect the sepsis team and frontline clinicians, the rapid audit feedback programme unintentionally created pressure on ED doctors to treat sepsis.

Process mapping

A local CQUIN target at Westside was taking blood cultures for patients who had been identified as septic and required the Sepsis Six. As such, the persistent issue of a shortfall in compliance with taking blood cultures in the ED was raised at CQUIN performance meetings, where the sepsis team were expected to provide assurance that action was being taken to meet the CQUIN target. Led by the Lead Sepsis Nurse, the decision was made to undertake a targeted programme of improvement with ED staff to establish the local issues. The following snapshot shows how, by working together and undertaking the process map, the corporate sepsis team and the ED team were able to identify work practices and tailor improvements as *interessement* strategies, to local need.

Snapshot – blood culture process map meeting

> A representative from the patient safety team (a doctor), the Sepsis Nurses, an ED registrar, Trust Practice Development Nurse who had experience of working in the ED, and a member of the ED education team met to process map blood cultures. Westside policy was to take two sets of blood cultures, as it was considered 'best practice', but the national picture reflected in the CQUIN was to take one set. The main

> question raised in the discussion between the healthcare professionals was if blood cultures add anything to the diagnosis of the source of infection once the antibiotics had been given. The discussion revealed that in the ED there was a belief that there is no point in taking blood cultures once the antibiotics had been given. This issue had been discussed at the sepsis group, which was attended by two Consultant Microbiologists. The Lead Sepsis Nurse was able to inform the group that Dr Wesley (a well-known Consultant Microbiologist at Westside) recommended that a second set of cultures should be taken, [as] even if antibiotics had been given, it would not impact the detection of bacteria. The ED registrar suggested deviating from policy to make the procedure easier: 'you would get loads more then'. The Lead Sepsis Nurse and Patient Safety Advisor discussed how they should advocate best practice, not practice that just gets the numbers up; 'but if we don't meet the CQUIN target, it's £2.5 million at risk here'. They all agreed it had to be best practice, 'otherwise you are teaching people bad habits.'

The Patient Safety Advisor took the lead, with input from the ED staff. The patient journey was mapped out, with an indication of when blood cultures should be taken and by whom. Questions were generated and critical points along the process were 'starred' on the flipchart. The team then went to walk through the process, starting in the initial assessment area. This stage of the process generated a further list of questions. The next stage was for the sepsis nurse to undertake an observation of the process and informally ask the team in the initial assessment area the questions generated from the team walking through the collection of blood cultures process.

The improvement process showed system issues and highlighted misconceptions about local policy and best practice. Discussion away from the clinical area, at the interdisciplinary sepsis group, enabled the Lead Sepsis Nurse to communicate what was perceived as advice from a credible expert (the microbiologist) without her being present at the process map meeting. To achieve the CQUIN target and best practice as deemed by experts at Westside, many cross-cutting networks that comprised different healthcare workers with different opinions on taking blood cultures had to be aligned. The contact between key healthcare staff related to delivery of the CQUIN

and those with clinical expertise at the sepsis group helped to cross the gap between operational plans for taking blood cultures and the frontline of practice in the ED.

The next section draws on concepts from ANT and technology-in-practice (Table 3) to present the ethnographic data generated through close observation of the initial assessment area and, specifically, the sepsis initial assessment tool in use. Ethnographic data generated in acute inpatient settings will also be presented. As described at Southside, the clinical settings were messy, concrete and heterogeneous, and several factors had an impact on the formation and stability of the actor-networks. The gap between the tools (map) and clinical practice (terrain) and the chain of re-representations that crossed the gap will be highlighted. The concepts of distribution and drift will be introduced to show to the reader how the nature of work in the ED and acute inpatient settings influenced implementation of the sepsis improvement tools, which at times was different from the intention of the designers.

6.5 Crossing the gap between the map and terrain

Thus far, this chapter has painted a picture of the translation of actor-networks to solve the problem of variation in sepsis care as identified by the Clinical Sepsis Lead. How the sepsis team managed the external influence of the CQUIN has also been presented. This section will present what happened when the formal tools, as maps, were used in the terrain of clinical practice at Westside. Close examination of work practices has enabled description of the chains of re-representations that were generated when the tools were used in the ED and acute inpatient setting. Similarly to Southside, work practices embedded within sepsis screening and the Sepsis Six care bundle differed between the ED and acute inpatient areas, which introduced the potential for

variation in the delivery of the care bundle. As such, the ED and acute inpatient setting will be presented in different sections.

6.5.1 When the formal tools were used as maps – the Emergency Department

The section begins with a description of the patient's journey through the ED at Westside. The purpose is to paint a picture of the impact on sepsis care when patient flow was designed to align patients with appropriately trained staff tools and equipment. The following extract from fieldnotes shows the organised way that different actors (healthcare workers and patients) entered the terrain.

> When patients arrived via the main door they would be required to 'book in'; this task was undertaken by an ED Assistant and was known as 'streaming.' The ED Assistants were trained to look for signs of a sick patient. The patient would then wait to see the streaming nurse, whose role was to identify which area of the department was appropriate for the patient based upon their assessment. This could be resus, the initial assessment area, ambulatory area or minors. The nurse referred to a locally developed streaming tool that included guidance on which area to send the patient based on their physiological observations and presenting condition. If arriving by ambulance the crew would pre-alert resus if the patient's condition required this level of care, or they would go directly to the initial assessment area and book the patient in. At this point in the patient's journey a formal screening tool for sepsis had not been used. Recognition of sepsis and its severity was reliant upon the skill of the healthcare worker. Despite the environmental boundaries of the department, the healthcare workers communicated with each other and used the space flexibly to meet the patient's needs.

On paper, the patient's journey was linear and planned to be efficient; in reality, healthcare workers adapted the processes in response to the ebb and flow of patients through the department. This created a dynamic network that was in constant motion. Data generated through observation of the associated work practices that occurred in the initial assessment area will now be presented. As observed at Southside, the ED experienced episodes of

overcrowding, when there were multiple patients waiting with ambulance crews to be booked in with the initial assessment area staff.

Initial assessment area

To illustrate how the heterogeneous entities (including the sepsis initial assessment tool – the map) in the terrain of the initial assessment area were central to sepsis care in the ED, the work practices observed will now be described.

When a patient arrived with the ambulance crew, the booking-in process in the initial assessment area included communication of the patient's demographic information to an ED assistant and a clinical handover to the nurse in charge of the area. The initial assessment area comprised six cubicles equipped with monitoring and diagnostic tools. There was a computer outside every other cubicle and one in the centre where the nurse in charge coordinated the work. Once the crew had completed the clinical handover, the nurse in charge allocated a cubicle. The area was staffed with nurses, clinical support workers, nursing assistants, an ED assistant and a clinical decision maker. The intended outcome for patients in the initial assessment area was that within 20 minutes the patient would be assessed by a nurse and clinical decision maker. Patient volume often resulted in a queue (of patients and ambulance crews) forming. Observations showed that if there was not a cubicle available after the patient had been booked in with the ED assistant, the ambulance crew would queue and wait.

> We do have times where there's so many crews come in that it's just, you think, blimey, but you've just got to keep going. You can only do one job at one time; you have to keep your patients safe. We have, I think, it's 450–500 through here a day: that's a huge amount of patients. The only thing I keep saying is those paramedics are trained up to the hilt [and] they're there with their patient; it's not like we're leaving them with anybody else. So they're there and as far as you know, until they hand over, they have to make that judgement call,

> does that patient need it now? They have to stay with their respective patient and they're supposed to monitor them there. So if they feel that they are deteriorating or concerned, they'll come and shout 'Can we get this person in?' And then we will.
>
> **Clinical Support Worker**

I listened to a handover between an ambulance crew member and a nurse. The nurse was inputting information into the computer. The crew reported the 'obs. are stable'; the nurse documented 'obs. stable'. At times, the nurse asked for further information. The crew reported 'the blood sugar is in range', the nurse commented 'What do you mean, "in range", between 4 and 6? Well what is it?'

At this stage in the patient's journey their presenting condition is being re-represented by the ambulance crew to the nurse, who re-represents the patient again onto the ED's computer. The nurses and Clinical Support Workers used this information to inform their assessment. At this point in the patient's journey, the healthcare workers again adapted the processes to meet patient needs. This required tacit knowledge and communication and introduced variation depending on the skills and experience of the healthcare worker.

> You're very reliant on the ambulance crew picking up on what is concerning. So sometimes you're relying on their experience. And you're also then relying on the nurses to identify ... the patients that can slip through. The obvious ones do well I think. It's the more subtle ones that come in. They just don't fit that perfect picture. But actually, when you go to look at them, you think they're actually really ill and actually they clearly are septic. And it's that group of patients who tend to be the elderly or tend to have multiple comorbidities, who are hard to identify. And I don't think you can expect an initial assessment for those sort of patients to fit that perfect package of systemic inflammatory response syndrome.
>
> **Advanced Nurse Practitioner**

Once patients had been assessed by the nurse, the nurses would decide which initial assessment tool to follow. The tools were displayed on a wall in the

initial assessment area; I frequently observed staff refer to them. I asked a nurse about the sepsis initial assessment tool. He commented, 'I've been here a year; in the induction it's drilled into us, sepsis, sepsis. In the ED, if you don't know, you've gone wrong somewhere. It's imprinted on my mind.' However, concern was expressed by experienced decision makers that the linear, standardised nature of the tool may result in 'the wrong' initial assessment tool being followed.

> Some of them [ED staff] are very good; there are more experienced ones and they'll think about what they're doing. Some staff are led down an initial assessment tool without thinking about the whole picture. Sometimes they won't escalate the obs.; they'll do the bloods but they won't have done a lactate and they haven't thought about what the obs. were. So then you have to re-bleed them for the lactate and then they haven't done blood cultures and you think, well, you should have done blood cultures. Or a junior doctor's gone in, seen the obs., seen their score for systemic inflammatory response syndrome and written them up for antibiotics and actually they're not scoring for sepsis. So it can be under-escalated and over-escalated quite easily, depending on which person has assessed the patient. Then that's a totally different initial assessment tool. So that's a limitation of the initial assessment tools, is that they're very strict on what they can tell people to do.
>
> **Advanced Nurse Practitioner**

The quote shows how the initial assessment tools were attributed central roles in the organisation of work and presents the complex context in which the linear initial assessment tools were used. The tools were presented as rigid and 'very strict', as if it had a superior logic to the healthcare worker (Berg, 1997a). As the quote highlights, despite attributing agency to the tool, the generative power of the tool was the result of the interrelation between the tool and the healthcare worker. The following snapshot provides a description of how the healthcare workers, equipment and initial assessment tool interrelated in the initial assessment area.

Snapshot – sepsis in the initial assessment area

The patient had attended the GP, who called an ambulance; she arrived in the department on a trolley with two ambulance crew. The initial assessment area was busy; there was a long queue of patients on ambulance trollies accompanied by ambulance staff. The queue reached all the way down the corridor. The ambulance crew worked in pairs; one stayed with the patient whilst the other went to the ED assistant to book the patient in. Once booked in, the 'clock' started; the aim was to not breach the four-hour target. The ambulance crew member returned to the patient and their partner in the queue.

The patient was in the queue for 40 minutes; they were then transferred into a cubicle in the initial assessment area and onto the ED trolley. The ambulance crew then waited for a nurse to hand over the clinical information; this occurred at 45 minutes. The nurse inputted the handover into the computer. The ambulance crew left. At 50 minutes the nurse attended the patient and applied a blood pressure cuff and oxygen saturation probe. The nurse left the patient to attend to other patients in her care. She returned at 57 minutes to document the observations; she asked the patient to change into a hospital gown and asked questions about their history. The nurse was new to the ED. She went to the initial assessment tools displayed on the wall. She told me she was unsure if she should follow the shortness-of-breath tool or the sepsis tool. She took her [mobile electronic] device from her pocket to look at the observations. There was not a signal so she borrowed someone else's. The EWS was 6; the patient met the criteria for both tools.

At 112 minutes the Clinical Support Worker returned from his break. The nurse decided to order the bloods from both the initial assessment tools. She ordered the tests on the computer using a sepsis order set and completed the patient's demographics on a drug prescription chart. At 117 minutes the nurse approached the advanced nurse practitioner with the prescription chart and gave an overview of the patient, suggesting that she was septic and required fluids and antibiotics. The Advanced Nurse Practitioner came to the patient'' bay. Using the computer outside the bay, he continued to document on the previous patient. He then went to review the patient, prescribing antibiotics and fluids at 130 minutes. The lactate result arrived at 139 minutes following a delay due to the machine being in a cleaning mode, so out of use. Antibiotics were administered at 142 minutes.

Work practices within the initial assessment area contributed towards the efficient function of the whole and were based on predefined rules. The illusion of efficiency presented by the intended outcome of the initial assessment area was challenged by increased patient volume and the skills and experience of the healthcare worker. The effect of efficiency had been displaced by the reality of patient volume and capacity. A chain of re-representations was observed as the healthcare workers condensed the patient case into the predefined criteria of the assessment tools on the computer. Not all patients fitted into the linear patient flow processes or the initial assessment tools. An interrelation between the initial assessment tools and the healthcare workers' practices was observed. Admission of the patient into the initial assessment area was not a set of linear steps that were taken between the healthcare worker and the initial assessment tool but a series of representational activities.

Close observation showed that, rather than a linear cause and effect process where patient flow was matched with initial assessment tools, for the sepsis initial assessment tool to be used, a gap between work practices and the tool needed to be crossed. Before the patient received antibiotics, a chain of re-representations had been created as the patient's signs and symptoms were measured, recorded, interpreted and communicated between the healthcare staff involved in her care. The initial assessment area was a bounded context where healthcare staff were observed to establish what Berg (1997) referred to as 'compatibility' between differing priorities. For example, the nurses achieved this by working between patients, applying the blood pressure cuff and oxygen saturation probe, and attending to another patient whilst the machine measured these observations. The nurse was new to the ED, so she opted to follow two initial assessment tools. Whilst one of the intentions of the initial assessment area was to reduce investigations, her workaround addressed a limitation of the tools, in that, to this less experienced nurse, the patient's signs and symptoms matched both tools.

In acute inpatient areas at Westside, identification of sepsis relied upon healthcare workers' knowledge and skill and/or a prompt generated from the mobile device once physiological observations had been recorded. Data in the next section will provide an understanding of how recording observations on the device and the generation of a prompt for sepsis influenced the organisation of work.

6.5.2 When the formal tools were used as maps – acute inpatient areas

The measurement and recording of observations were central to the recognition of sepsis. At Westside, observations were recorded on electronic handheld devices. Once the patient's observations had been added, the software calculated the EWS. The measurement and recording of observations on the electronic observation system resulted in a prompt for the healthcare worker to consider sepsis if the patient's EWS was 4 or over.

Electronic observations and mobile devices

As highlighted earlier in section 6.3.2, if the EWS was over 4 an alert would be sent to other healthcare workers' mobile devices. Throughout the course of fieldwork, it was noted when in the clinical area that there was a continual sound of alerts from healthcare workers' mobile devices.

> I will receive the escalation directly after they put the obs. I think it's useful but sometimes it's a bit over-activated because you will receive a lot every half hour, every hour if there's no change of news but you just receive ... for example there's an unwell patient scoring 5, you saw this patient, you managed this patient but after one hour it will just send you an alert and it's scoring 5. Although no intervention needs to be given. So I usually read through ... if I know a patient well, I know this is the patient I just saw five minutes ago, still scoring. Okay, let's give some time for the patient to recover from that episode of infection or whatever. When there's five patients scoring 5 to 5, no change but one patient is just scoring from 2 to 5, then maybe that patient needs treating first. Instead of asking the nurse one by one, it's visualised in front of you. It's good.
>
> **Core Medical Training Doctor, Level 1**

The intention of the alert was to assist in the escalation of the care of a patient whose EWS was 4 or more. This was a recognised threshold for identification of the deteriorating patient and could indicate the presence of sepsis (NICE, 2017). When considered within the self-contained sphere of the electronic observation system, this appeared to be an attractive function of the formal device. The quote above highlights how, when the alerts were sent to the doctor and out of the self-contained sphere, she developed workarounds to manage the conflicting priorities she faced within the cross-cutting networks she was enrolled in. The presence of the mobile device afforded the possibility for her to be enrolled in networks that extended beyond where she was located physically. The doctor's device was reacting to what information it received. An alert would be sent and another prompt made for sepsis assessment if the EWS remained 4 or over despite action being taken. The system was not able to capture and represent the steps undertaken at the point of care. Changes to work practices were evident but neither the healthcare staff nor the device was in control. The generative power came from the tool and the healthcare workers using it.

As was the case at Southside, the CCOT played a key role in the identification and treatment of sepsis outside of the ED. The following section describes the influence of the electronic mobile device on the CCOT's work practices and the identification and treatment of sepsis outside of the ED.

6.5.3 The Critical Care Outreach Team

The members of the CCOT carried mobile devices and received an alert when a patient's EWS was greater than 4. The device enabled the team to observe patients remotely. Whilst shadowing a member of the CCOT I observed that the mobile device influenced how they organised their work. Whilst on the wards the CCOT nurse took referrals over the phone. She gave advice after referring to the computer and her mobile device for information on the patient: 'Ask the doctor about extra fluids'; 'I will come to see the patient and will keep an eye on the electronic observations in the meantime. Call me if

you are worried and I will come sooner.' Her mobile device constantly gave alerts. She commented that being able to access the information on the mobile device enabled her to prioritise care and 'keep an eye on patients'.

The remote advice from the CCOT offered a source of support for ward nurses.

> I also like that you can talk to CCOT and have the obs. on the system. So, you know, if someone is triggering a 4/5/6 and you are worried they may have sepsis, you know, you don't have to explain everything ... they have half the information, they just need to talk ... you talk to them and you can get some more advice and I like that.
>
> **Staff Nurse, Acute Medical Assessment**

Westside was a very large organisation. Despite this, the mobile devices were part of an actor-network connecting experienced decision makers with ward staff. The device contained the equivalences of the EWS and quickly converted a series of clinical observations into a single number ready for further manipulation. There was no reliance on the paper forms. The following snapshot highlights how, once the prompt had been generated, a gap needed to be crossed for action to be taken.

Snapshot – medical outlier on a surgical admissions unit

> The nurse had referred the patient to CCOT as the EWS was 8. The nurse was concerned that the patient was septic. The patient was a medical patient but due to capacity issues was allocated a bed on the Surgical Admissions Unit. Upon arrival to the unit, the Sister provided a handover of the patient. The junior doctor approached the CCOT nurse with an arterial Blood Gas result. The CCOT nurse asked the junior doctor several questions; he appeared unsure of the answers. The doctor was a Foundation Year 1 doctor on a surgical rotation and had not yet completed a medical rotation in their training, so had limited experience caring for medical patients. When asked about the plan for the patient he reported that if the EWS was to go over 4 then the patient should be referred to the Medical High Dependency Unit

> doctors. The CCOT nurse pointed out that the EWS was 8 and asked if the referral had been made. The junior doctor looked unsure. The CCOT nurse commented that she had not reviewed the patient yet. She went into the office and started to complete her assessment paperwork using information on the computer and her mobile device. The CCOT nurse asked the junior doctor to call his senior to clarify what the plan was. The junior doctor did this using his mobile device. The junior doctor established that the patient should have more fluids and the oxygen should be increased. The CCOT nurse pointed out that the patient was receiving the highest level of oxygen possible in a ward setting. The senior surgical doctor was on her way to review the patient.

The junior doctor sought support from the CCOT nurse to make decisions. The CCOT nurse commented that she was concerned about the patient. 'He needs a review by the Medical Registrar; he is an unwell medical patient who might need to be transferred to the Medical High Dependency Unit'. The CCOT nurse gave the junior doctor advice on the patient's treatment and emphasised that the senior doctor must be called again if she had not reviewed the patient in the next 30 minutes. The CCOT nurse then left the ward to review the next patient, commenting that she would 'keep an eye' on the patient via her mobile device. In the quote below, the Critical Care Consultant comments on the limitations of the electronic observations and highlights how the technology is only part of the actor-network required to solve the problem of variation in sepsis care.

> The electronic observation system is amazing: it captures the intention of the sepsis pathway very well, so it captures whether the patient triggers and whether they're escalatable. But what it doesn't capture is what happened in response to that escalation and who's closed it. So it can tell you that a doctor or a nurse has closed the escalation but it doesn't tell you what they did in response to that escalation. So I don't know if a patient's been escalated, whether they've had fluids or antibiotics or blood cultures or a medical review. All I know is that somebody's clicked a button to close the call.
>
> **Critical Care Consultant 1**

The total net effect of the measurement and recording of observations and the calculation of the EWS was a sepsis prompt and referral to the CCOT. What happened after the prompt was beyond the scope of the technology's capabilities. The electronic observation system and sepsis prompt were promoted as being efficient, and, at the level of the technology, they were indeed observed to be efficient. The electronic observation system was introduced to address the issues of inaccurate calculation of the EWS and escalation of the care of deteriorating patients. The system was observed to afford a more continuous and precise monitoring of patients. However, concern was expressed that despite the sepsis prompt, some members of the healthcare team might be unsure of what action to take.

> I think, for now, it's [sepsis] embedded in people's brains, having a paper copy of the obs. chart and actually reading it and seeing what the escalation process was. Whereas now, on the electronic observations, you get pop-ups that say this patient might be septic, please consider the sepsis screening tool, but it's not a complete tool or diagram of what you do. There's no comprehensive flowchart like there is on the paper. It just says 'consider the sepsis screening tool'. And if you look at that and go 'Well, what sepsis screening tool?', then you're a bit scuppered really.
>
> **Band 5 Ward Nurse**

Therefore, in the absence of a physical (paper) screening tool, the recognition of sepsis relied upon the healthcare worker's knowledge and skill and/or the prompt from the mobile device following calculation of the EWS. All of these possible situations were potentially limited and dependent on a multitude of factors. As shown by the data, this resulted in variation in the timely recognition and treatment of sepsis.

6.5.4 Reliance on the electronic observation system as part of the actor-network

At Westside, the electronic observation system and prompt for sepsis assessment were central to the organisation's strategy for the deteriorating

patient and the recognition of sepsis. The quote below highlights how the tool could not be a substitute for trained and experienced healthcare workers.

> We had an incident where somebody who was young with sepsis had a low-ish blood pressure overnight which had not been picked up on the electronic system because they were only triggering an EWS of 1. Because she was young, her body was coping but the trained eye could recognise that she was sick. So she had not been escalated on appropriately and had problems as a consequence, but actually the system, the electronics, the technology, it cannot replace training and education and human judgement; it can't. At the end of the day, nurses and doctors are trained to respond to triggers and that's a lot of what we do; it's pattern recognition.
>
> **Critical Care Consultant 1**

In this situation a nurse made and recorded the observations. The device reacted upon the input it received and calculated the EWS. Berg (1997a) described the skilled cultural part of the calculation as the aspect of the EWS undertaken by the nurse. The nurse delegated the mechanical aspect of the calculation to the device. The intention of the electronic observation system was to send an alert when the EWS reached the threshold of 4. In this incident the EWS was 1, so an alert had not been sent. However, the patient was deteriorating and required escalation to a more experienced healthcare worker. Recognition of this relied on the problem-solving skills of the nurse. The device was an active element in the calculation of the EWS and production of alerts and prompts to consider sepsis. The device produced a number for further manipulation, but the healthcare worker's skills were also required. The centre of control did not lie with the tool or the nurse. The process of measurement, recording and escalation was highly distributed. The control and responsibility were transformed and dispersed between the tool and the nurse, resulting in the generative power arising from the two, not one or the other.

6.6 Conclusion

On the basis of the literature review and the theoretical framework, three precise research questions were framed:

1. How did the case sites interpret externally driven standardised tools?
2. How did the case sites implement externally driven standardised tools?
3. What happened when the tools were used in clinical practice in secondary care?

The research questions are considered in the following discussion of the findings from Westside.

At Westside, in relation to interpretation and implementation of the sepsis screening tool and Sepsis Six care bundle was driven locally, by a team of clinical experts. The clinicians were able to use their clinical and improvement expertise and credibility in an organisation that was supportive, mature and receptive. For example, the rapid audit feedback programme was an *interessement* for education and improvement as well as assessment and regulation. A doctor who had been involved in sepsis improvement at Westside maintained the role of focal actor and led the team to be empowered and owned sepsis improvement. With the introduction of the CQUIN they viewed their role as negotiating the terms in order to build on their work to date. By negotiating derogation from the national terms, the lead doctor and nurse took a central role in liaising with the commissioners, enabling them to drive innovation towards their view of electronic sepsis screening. The multi-professional sepsis team was enrolled in the network and engaged with the work.

Local organisational processes and technological innovation influenced implementation of the tools and what happened when the tools were used in clinical practice. The ED at Westside had a patient flow process designed to increase efficiency. The process intended to align patients, healthcare workers and equipment to identify and treat patients effectively. When observed, the

processes were adapted by healthcare staff to meet the dynamic nature of patient volume and acuity. Alignment with the patient's journey through the initial assessment unit resulted in the tool playing a key role in the organisation of work (Allen, 2012). Despite patient flow within the initial assessment area, increased capacity influenced the alignment of the network. Close observations showed that chains of re-representations were created in the admission process to the initial assessment area as the healthcare workers condensed and transformed patient cases to meet the predefined criteria of the initial assessment tools.

Recognition of sepsis relied on the knowledge of staff and/or a prompt and alert generated from the electronic mobile device. In the ED, patient flow was designed to align with the identification and treatment of sepsis. The prompt enabled healthcare workers to consider sepsis if they had not identified it as a possibility from assessment of the patient prior to the prompt. The alerts generated by the mobile device served two purposes. They enabled experienced decision makers to observe the patients remotely, which offered support to ward staff. Management of the alerts also became part of the healthcare workers' practice. Idiosyncratic limitations of the device had an impact on the organisation of work. The doctor, when receiving repeat alerts about a patient known to her, used the device to look over the patient and decide to continue observing remotely or to see the patient in person. She also used the EWS to help prioritise her work. If she was to act on a repeat alert, without consideration of her knowledge of the patient, it would be to accept that the function of the device was sufficient, more so than her problem-solving skills and tacit knowledge. However, this would disregard the transformation of the tool when used in practice (Berg, 1997a). By not accepting the alert as an accurate representation of the patient's condition, the doctor's detour fulfils the conflicting demands of the alert and her workload. She performs a balancing act between two cross-cutting networks, which were both changed in the process.

In connection with the interpretation, implementation and use of the tools in clinical practice, the purpose of Chapters 5 and 6 was to paint a picture of the organisational context of Southside Hospitals NHS Foundation Trust and Westside University Hospitals NHS Trust. The ethnographic fieldwork presented afforded an insight into the complexity of the organisations. The next chapter will compare these case studies.

Chapter 7: Cross-case comparison

7.1 Introduction

The previous two chapters described the organisational context of Southside Hospitals NHS Foundation Trust and Westside University Hospitals NHS Trust in relation to how external drivers for sepsis screening tools and the Sepsis Six care bundle were interpreted, implemented and used in clinical practice. Although both organisations operated within a broadly similar environment of national guidelines and regulatory regimes, they implemented the tools differently. As such, the chapters provided contextual understanding for explaining the similarities and differences in implementation. The conceptual framework applied in this research enabled analysis of what the tools did in practice and, as such, produced theoretical insight into the processes of everyday work. Drawing on the conceptual framework (see Table 3 for definitions of terms), this chapter will compare the case sites by presenting a more conceptual and analytical narrative. To orientate the reader to the conceptual framework which underpins the cross-case analysis, a summary of the analysis is presented in Table 14.

Table 14. Cross-case comparison table

Key notion	Southside	Westside
The four stages of translation	**Problematisation** – Focal actor changed, and problem shifted from variation in sepsis care to being dominated by achieving compliance with CQUIN. ***Interessement*** – Strategies devised from audit results and aimed at behaviour change. **Enrolment** – Successful, with healthcare staff such as Newly Qualified Nurses accepting the tools as defined by the focal actor and whose identity aligned with the tools. Unsuccessful, with healthcare staff who used clinical knowledge to recognise and treat sepsis as such, ignored the tools. Due to silo between doctors and nurses and a lack of medical engagement, enrolment was not attempted by some staff so they were unaware of the tools. **Mobilisation** – Staff were mobilised to complete the tool, which was evidenced by audit. Some staff were not represented by the focal actor and challenged or refused to complete the tools, so were not mobilised as an ally of the focal actor. A lack of governance structure limited the focal actor gaining acceptance of her solution to the problem of achieving compliance with the CQUIN.	**Problematisation** – Focal actor remained the same for 10 years. Problem identified as variation in sepsis care. Achieving the CQUIN was problematised by the focal actor but adapted to align with established work and was only part of sepsis improvement. ***Interessement*** – Strategies devised from audit results and underpinned with quality improvement methodology. In the ED, strategies included training and the cohesive narrative that adhering to the tools were 'what was done around here.' **Enrolment** – In the acute inpatient setting sepsis screening was embedded into the EWS, enrolment occurred as part of established work practices. In the ED, healthcare staff were enrolled through work practices and patient flow. **Mobilisation** – Staff were mobilised as intended by the focal actor through automated screening. The governance structure enabled a larger network of actors, up to board level, who supported the focal actor to gain wider acceptance of her solutions to variation in sepsis care.
Networks	To solve the problem as identified by the focal actor, actor-networks in the ED and acute inpatient setting were formed to achieve compliance with the CQUIN. Their stability was threatened by erratic patient flow and overcrowding in the ED, competing clinical pressures and clinical staff not being aware of the tools within the embedded units of analysis in the case site. Problem-solving skills and the proximity of healthcare workers who possessed clinical skills to screen and treat sepsis and the right equipment contributed towards stability of the network.	To solve the problem as identified by the focal actor, actor-networks in the ED and acute inpatient setting were formed to reduce variation in sepsis care and achieve compliance with the CQUIN. The initial assessment tool, patient flow in the ED and electronic observation system with automated alerts enabled associations within the network to be created. Stability was threatened by overcrowding in the ED and competing clinical pressures within the embedded units of analysis in the case site. Problem-solving skills and the proximity of healthcare workers who possessed clinical skills to

		screen and treat sepsis and the right equipment contributed towards stability of the network.
	Two actor-networks were identified, one at the corporate level, the other at the clinical frontline. The actor-networks could be connected by embedded governance reporting structures from the executive board to the clinical frontline, and by quality improvement methods to understand the influence of context on implementation, in addition to quantifiable measures of compliance.	
Naïve formalist and opponents	The corporate team believed in the *a priori* superiority of the tools, which influenced implementation plans, with the narrative that they were 'quick and easy to use' and would 'save lives'. Experienced clinicians were their opponents, who believed human skills saved the inadequacies of the 'tick box' tools.	The corporate team devised improvement strategies that paid attention to the generative power coming from the interrelation between the tools and the human. The intention was that the electronic device would calculate the EWS from the physiological observations observations, and issue a prompt, which the healthcare worker would then act upon. There was not a 'tick box' flowchart to work through. In the ED there was a belief in the *a priori* superiority of the initial assessment tool; it was viewed as 'telling the staff what to do.'
Map and terrain	**Map** – There were three iterations of the sepsis screening tool (map) over the course of fieldwork and one of the Sepsis Six. The screening tool was a flowchart design with boxes that had to be ticked following patent assessment. Limitations of the IT system resulted in a mismatch between the map on paper and the computer version of the tool. The map on the computer was not accessible outside of the ED. **Terrain** – In the ED patient flow was erratic and messy.	**Map** – Through the course of fieldwork there was one version of the tool in the ED. The tool was a flowchart design and was displayed in the initial assessment area where healthcare staff referred to it for guidance. The EWS and sepsis screening were embedded in an advanced IT system that enabled communication between healthcare staff across the hospital. **Terrain** – In the ED patient flow was designed to enable front-loaded patient assessment and was ordered and systematic.
Chain of re-representations	Across and within both case sites, ethnographic fieldwork observed the chains of re-representations that occurred as healthcare staff and equipment completed the multiple subtasks required to cross the gap between the map and terrain.	
Distribution	Across and within both case sites, ethnographic fieldwork observed that the subtasks required to screen and treat a patient for sepsis were widely distributed across a range of heterogeneous entities. Distribution increased when the proximity of actors increased. The actors were more widely distributed in the acute inpatient setting than in the ED.	
	In the ED, erratic patient flow increased distribution.	In the ED, ordered patient flow reduced distribution.

<table>
<tr><td rowspan="2">Drift</td><td colspan="2">Across and within both case sites, ethnographic fieldwork observed that, despite the formality of the tools, the network did not always operate in an ordered way. Drift occurred as a result of the dynamics that characterised the nature of work in the ED and the inpatient setting and resulted in the tools not being used as intended by the designers and the local implementation teams. Problem-solving skills of healthcare workers and proximity of healthcare workers, equipment and patients reduced drift. As a result of less exposure to sepsis and work practices not solely aligning to the recognition of sepsis, the likelihood of drift was greater in the inpatient setting than in the ED.</td></tr>
<tr><td>For the Quality Nurses and the Matron, for compliance to be achieved they believed that all ED staff would become part of the actor-network. This strategy resulted in the tendency of the network to erode itself from within as staff ignored the tool or in their view prioritised clinical work over completing the tool. This resulted in drift from their solution to the focal actor's problem.</td><td>The automated alerts reduced drift; they enabled decision makers to enrol into networks they were not physically located in to review the patient's physiological signs. Sepsis screening did not require additional subtasks.</td></tr>
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Reflecting Table 14, the chapter will be structured in the following way. Drawing concepts from ANT, the chapter will start by presenting the cross-case comparison of translation of actor-networks related to implementation of sepsis improvement tools within and across Southside and Westside. Focus will be given to the influence of the organisations' governance and quality improvement infrastructure related to sepsis care improvement on the interpretation and implementation of external guidelines and financial incentives, and the development of local improvement initiatives. In addition to concepts from ANT, concepts from technology-in-practice will then be drawn upon to present the cross-case comparison of what happened when the tools were used in practice.

7.2 Translation of actor-networks

The notion of networks, when applied to the data, has helped to trace and describe the multiple human and non-human actors that were involved in the implementation of sepsis tools, and also how networks were built to produce

local knowledge around the use of sepsis improvement tools (Law, 2007). The stages of translation (Table 1) were used in Chapters 5 and 6 to trace failure and success within and across the case studies to create actor-networks to solve the problems identified by the focal actors in their organisation related to sepsis care improvement. As highlighted in this thesis, there were a number of overarching and countervailing external networks that influenced the development of internal actor-networks and the implementation of sepsis care improvement tools. At Southside, initially, the focal actor was an ED Consultant who problematised variation in sepsis recognition and treatment. With the introduction of the national sepsis CQUIN, the Assistant Director of Nursing Quality (ADNQ) became the focal actor (with no challenge from the ED Consultant) and problematised achievement of the sepsis CQUIN. At Westside, the Sepsis Clinical Lead had been the focal actor for 10 years and problematised variation in sepsis recognition and treatment. With the introduction of the national sepsis CQUIN, led by the focal actor, the established sepsis team negotiated the terms of the CQUIN to align with their established programme of improvement.

Across and within the case sites, the focal actors problematised the external influences and led the translation of actor-networks to solve the problem. As such, there were multiple actors involved in the implementation of sepsis care improvement tools across and within the case sites. It is also important to note that observations showed that sepsis was recognised and treated without the use of the sepsis care improvement tools. The significance of this to the implementation of the sepsis tools will be discussed throughout this chapter.

Analysis showed that the formation of actor-networks and translation at the case sites was not sequential; rather, it overlapped in a disorderly and iterative fashion, which had an impact on the translation and formation of actor-networks, and, in turn, on the implementation and utilisation of the sepsis care improvement tools.

7.2.1 Translation of the actor-networks at Southside

At Southside, the ED Consultant was initially the focal actor who had problematised the lack of a standardised approach towards sepsis identification and management, and had translated an actor-network in the ED for sepsis improvement. With the introduction of the national CQUIN and without consultation with the established sepsis team, the Chief Nurse and Lead Nurse for CQUINs interpreted, negotiated and agreed the terms of the sepsis CQUIN with the CCG. The Chief Nurse and Lead Nurse for CQUINs delegated the management of the CQUIN to the ADNQ, who then became the focal actor, replacing the ED Consultant. Interpretation and negotiation of the terms of the CQUIN were not activities he felt he could influence. The ED Consultant gave the impression that the organisation and the influence of the CQUIN were more powerful than he was, despite his expertise, professional judgement and evidence that local initiatives had improved sepsis care. The perceived power of external bodies appeared to have disempowered him to challenge the senior nurse's interpretation of the CQUIN and subsequent implementation of the CQUIN in the ED, a department where he was the Clinical Lead. There was a sense of acceptance that external bodies (and the senior nurses) had this power, which reinforced the financial target approach over clinical expertise. The ED Consultant agreed to be the Clinical Sepsis Lead to act on behalf of the ADNQ.

When the ED Consultant stepped down from the lead role, the Quality Nurses were left without clinical expertise in sepsis. The lack of medical lead resulted in a source of uncertainty during the stages of translation. Enrolment of healthcare staff into the actor-network was intended to solve the problem as identified by the ADNQ, and this continued both to succeed and to fail, despite the *interessement* strategies devised by the Quality Nurses and ED Matron. The strategies included prompts for staff to change behaviour by attaching the tool to all patients' notes for nurses, and forcing behaviour change by using the IT system to mandate completion of the sepsis screening tools for doctors. The corporate team's focus on solving the problem of

CQUIN compliance resulted in a lack of acknowledgement that healthcare workers (such as experienced ED nurses, doctors and the CCOT) who, as a result of their clinical experience and education, were able to recognise and treat sepsis without use of the screening tool. As a result, they did not complete the sepsis screening tool. In ANT terms, the sepsis screening tool was the OPP as defined by the ADNQ to solve the problem of compliance with the CQUIN. By not completing it, such staff did not pass through the OPP. The problem, as defined by the focal actor, namely compliance with the CQUIN, did not align with all their interests. Indeed, the work that emerged from the solution (completing the tools) was viewed as a 'tick box' exercise that added to workload and was at odds with their priorities. As such, the Quality Nurses' *interessement* strategies aimed at behaviour change did not account for their interests. Accordingly, the final stage of translation, mobilisation into routine practice, did not occur.

7.2.2 Translation of the Actor-Networks at Westside

Throughout fieldwork, sepsis improvement at Westside was led by the same focal actor, the Clinical Sepsis Lead, for 10 years and was focussed on implementing Surviving Sepsis Campaign guidelines and the Sepsis Six, adapted to the local context. Initially, he led a retrospective gap analysis to validate anecdotal evidence that there was variation in sepsis recognition and treatment at Westside. The results were used as an *interessement* strategy to enrol and mobilise actors to form a sepsis group. As the focal actor, he led the translation of an actor-network that legitimised the problem as he had defined it: variation in sepsis recognition and management. Over the next 10 years, he maintained the position of focal actor and spokesperson by leading improvement work, which became embedded in the organisation's governance reporting structure. This included negotiating the terms of the sepsis CQUIN. *Interessement* strategies included quality improvement approaches such as rapid audit and feedback and process mapping.

Sepsis improvement in the ED was led by the Clinical Lead. As a member of the sepsis group, she acted on behalf of the Clinical Sepsis Lead to solve the problem of variation in sepsis recognition and treatment and adapted improvement work to the ED setting. The Clinical Lead problematised that there were inconsistencies in patient assessment, and that the introduction of the four-hour target required modification of working practices to enable patients to be admitted, transferred or discharged within four hours of arriving in the department (DoH, 2008a). As a result, the solution was to introduce a system of patient flow through the department that enabled front-loaded patient assessment. This included the sepsis initial assessment tool, which was the OPP. The Clinical Lead identified senior nurses, Advanced Nurse Practitioners and ED consultants, whose identity and responsibility as senior clinicians in the department meant that they contributed towards the creation and configuration of the actor-network by writing the initial assessment tools. Training and audit, delivered by the ED's team of in-house educators, were *interessement* strategies to enrol and mobilise staff to adhere to the sepsis initial assessment tool. Over time, the sepsis initial assessment tool became accepted 'as what we do around here'. ED staff behaviour had been modified to adhering to the tools and, as such, the legitimacy of the tool (OPP) was validated.

At both case sites, there where occasions when the stability of the network was challenged, and translation and implementation of the sepsis tool were unsuccessful. Overcrowding in the ED, a lack of equipment and competing needs of patients were observed to have an impact on the stability of actor-networks. This highlights that there were no absolute means of ensuring translation of a network and mobilisation of healthcare workers to solve the problem as identified by the focal actor (Law, 1986). An image of a potential network in relation to the introduction of the sepsis screening tool and Sepsis Six in the ED is provided in Appendix IV.

7.3 The influence of governance and Quality Improvement infrastructure on the translation of actor-networks

In relation to the reporting of sepsis care improvement activities to the executive board, there was a notable difference between Southside and Westside in the configuration and consistency of sepsis group meetings. At Southside, the absence of regular meetings and reporting mechanisms meant there was a fragmented approach to implementation planning and delivery, which led to some healthcare staff (senior nurses, doctors and the CCOT) failing to enrol in the actor-network to solve the problem as identified by the ADNQ, as focal actor, namely achievement of the CQUIN. Without a corporate message and team approach to sepsis improvement, a Quality Nurse (who had been in post for six months) devised an implementation strategy based on her interpretation of what the CQUIN targets meant and how this related to the current screening tools devised by the UK Sepsis Trust. The impact on implementation plans was that she and the Senior Quality Improvement Nurse held different perceptions of events surrounding the introduction of iteration 2 of the tool. Furthermore, the Sepsis Clinical Lead was unaware that the second iteration had been implemented in the department where he was clinical lead. *Interessement* strategies were directed towards changing the behaviour of staff to complete the tools, training sessions and mandatory screen on the computer system. The result was that translation of actor-networks failed in some instances but was successful in others.

Conversely, at Westside the sepsis group was an interdisciplinary team which translated into a cohesive corporate message related to the CQUIN and best practice in sepsis care. For example, when there was a shortfall in compliance with taking blood cultures in the ED, using the quality improvement method of process mapping, the sepsis team worked in partnership with ED clinical staff to identify how improvements could be made. The process highlighted system issues and misconceptions about local policy and best practice. Discussion away from the clinical area, at the interdisciplinary sepsis group, enabled the Lead Sepsis Nurse to communicate what was perceived by the

attendees as advice from a credible expert (the microbiologist) without her being present when the process map of collecting blood cultures in the ED took place. The contact between key healthcare staff related to delivery of the CQUIN and those with clinical expertise at the sepsis group helped to translate the actor-network to solve the problem of variation in sepsis management and achieve the CQUIN target. Process mapping produced insight into why healthcare workers were not enrolling in the actor-network and being mobilised to modify their practice to align with that of the spokesperson, the Clinical Sepsis Lead. This enabled *interessement* strategies to be modified to align with the interests of ED staff.

Drawing on the work of Berg (1997a: 404), the sepsis improvement tools can be considered to be formal tools 'that operate on circumscribed input using rules and contain a model of the workplace in which they are to function'. Accordingly, formalisation allowed for detachment of knowledge from its local context without losing its essence. It allowed comparability across sites and times, and manipulation into higher-order levels of abstraction while retaining direct relevance to that which is represented (Berg, 1997a). At both case sites, data abstraction, in the form of audit to demonstrate compliance with the CQUIN, was undertaken and used to inform *interessement* strategies. However, how this was accomplished differed.

At Southside, despite staff having reservations about undertaking audit for the purpose of demonstrating compliance with the CQUIN, the Quality Nurses were able to reconcile this tension by justifying the role of audit in identifying areas that needed improving to reduce mortal rates. Such reconciliation resulted in the Quality Nurses forming an alliance with the ADNQ to undertake monthly audit and act on the results on her behalf. As such, the ADNQ's problematisation of achieving compliance with the CQUIN was legitimised and validated (Callon, 1986). The Quality Nurses believed that the abstraction of data from the sepsis tools through audit retained relevance to the practice of the healthcare staff who completed the tools. This belief, rather than consideration of the many distractions in the ED described in

Chapter 5, led to behaviour change strategies such as asking the Matron to 'have a word' with staff if they had not completed the tools or given antibiotics within an hour.

Conversely, the sepsis team at Westside questioned if abstraction of data through audit captured the essence of the clinical setting. Drawing on the organisation's multi-professional team of quality improvement experts, process mapping of the collection of blood cultures in the ED was undertaken. The intention was to understand the 'richness of the empirical world' and discover what had been deleted by the audit of the formal rule-based tool (Berg, 1997a: 405). The sepsis team's knowledge of quality improvement methods, working relationship with the Patient Safety team and the ED, *and* the organisational infrastructure and resources, permitted the team to explore in a structured way the 'richness of the empirical world' to inform sepsis care quality improvement strategies (Berg, 1997a: 405).

At Southside, as a result of the upgraded IT infrastructure, the computer-based sepsis screening tool and Sepsis Six was configured only on the ED admission assessment screens. The information could not be accessed outside of the ED. The IT system within the trust was not sophisticated enough to interlock with healthcare workers delivering care outside of the ED (albeit within the same building). Its function as a formal tool, allowing for the detachment of knowledge from its context for manipulation, was limited to evidence for the Quality Nurses that patients had been screened for sepsis for the CQUIN only, not to inform clinical care. In contrast, at Westside, the IT infrastructure enabled more advanced and sophisticated software programmes that allowed knowledge to be shared and detached from its context (via the use of mobile devices). The system issued alerts to healthcare workers and provided information on a patient's condition, which enabled a holistic coordination of care activities over time and place. As a result, healthcare staff were able to remotely review the patient's clinical observations.

According to Callon (1986), to enrol in a network and take up a new strategy, change needs to be in the interests of actors. Callon (1986) considers that when a continuous translation of interests occurs, the network becomes more stable. At Southside, without a forum for doctors and nurses to interpret, discuss and negotiate the goals of *interessement* strategies, alignment of networks was put at risk. In contrast, at Westside, there were established ways of reporting of sepsis care improvement to the executive board. The regular communication appeared to contribute towards a continuous translation of interests between different networks (corporate and clinical frontline) within the organisation. The team at Westside had the autonomy to interpret the terms of the CQUIN, whilst, in contrast, at Southside the Senior Quality Nurse was not aware of the CQUIN processes between the trust and the CCG, and the Clinical Sepsis Lead did not consider it within his power to challenge the terms of the CQUIN.

Drawing on concepts from ANT and technology-in-practice, the next section will focus on the similarities and differences within and across the case sites when the sepsis care improvement tools (maps) were in use in the clinical settings (terrain).

7.4 Naïve formalists and their opponents

As described by Star (1989), the notion of naïve formalists and their opponents has been used here to describe the difference between healthcare staff who viewed the tool as the solution to variation in sepsis care (naïve formalists) and those who thought that human skill was fundamental to the delivery of reliable sepsis care (opponents). At Southside, the Quality Nurses had faith in the power of the formal tool as a representation of practice. Their opponents believed that healthcare workers fixed the inadequacies of the tools. As will be shown below, there was evidence that some felt that the inflexibility of the tools resulted in inaccurate functioning in some cases. Rather than modelling the criteria to recognise a patient with sepsis, the tools resulted in 'improper functioning' (Berg, 1997a: 406) and healthcare staff

missing another diagnosis. The snapshot below is a narrative from the Medical Director regarding the investigation of a serious incident. The focus on the tools resulted in a healthcare worker becoming distracted and missing a diagnosis.

Snapshot – narrative from the Medical Director

> So, I've got a serious incident at the moment that we're investigating: a 29-year-old woman, abdominal pain. Now, if you go through these boxes: respiratory rate was up, heart rate was up, so she's got two of those criteria. And then she'd had a collapse at home. Could it be an infection? Well yes, it could have been an infection; it could have been her gall bladder because it was a strange sort of abdominal pain; it could have been appendicitis. And there actually were red flag signs in that her blood pressure was below 90 and her heart rate was above 130. So immediately we give her Tazocin, 4.5 grams, presumed abdominal sepsis, maybe/maybe not (who knows?) but we'll give her 4.5 ... give her a little bit of fluid and refer this to the medics.
>
> Nobody did a pregnancy test. She had an ectopic pregnancy and three litres of blood in her abdomen. So it's one of those 'golden rules' pitfalls in A&E: 29-year-old woman collapsed, she's pregnant until you've told me she isn't and you've got it proved, and we forgot that because we went down the SIRS criteria and ended up in a sepsis pathway. Fortunately, the medical doctor on call said 'Are you pregnant?' You haven't had a period for three months and we did the pregnancy test and she goes to theatre and everything's fine. But that for me is a near miss. And I think that is one of the risks about guidelines, is that you risk railroading decision-making. And you're relying on clinicians cross-referencing one guideline and actually thinking, well, she is a 29-year-old woman with abdominal pain, therefore we've still got to do a pregnancy test. And we didn't do that. So you've got to ... in some ways that's the skill of it now – which guideline am I on and then am I prepared to move from this guideline and when is it evidenced to the contrary? You know, you can begin to see how, if you get railroaded down a path, you've got to make a decision.

As the Medical Director argued, the formal tool could not function on its own within the complexity of the patient's presenting condition. The presence of the tools in clinical practice had changed communication over time. The patient having 'red flag sepsis' or the patient's status as 'scoring' facilitated communication between healthcare workers. Clinical judgement was required to discern between when a patient met the criteria but was or was not septic. At divisional level, a Head Nurse argued that the tools functioned in a rigid and impoverished way and de-skilled the nurses.

> Sepsis is a really difficult one for me because we come under a lot of criticism because we weren't filling in the forms and we didn't meet the CQUIN. Actually they were receiving the right care but because we hadn't filled a form in ... and to me that's all wrong you know. How can we have a CQUIN that says because you haven't filled that form in you're not doing the right thing? It's about how a piece of paper defines what we've done for that patient. You've got frontline staff that are doing the right thing but aren't ticking the box. We've just moved to a mindset of 'but the tick has to be in the box' otherwise you've failed almost. And the message that was going out was, 'You've failed the CQUIN', but we hadn't failed the patient. And to me I find that really difficult.
>
> **Head Nurse**

The requirement to complete the tool to achieve the target created a tension between the tool as evidence-based medicine and the tool as evidence for the CQUIN. Indeed, if the healthcare worker possessed the knowledge and skill to recognise sepsis and deliver the Sepsis Six in line with the evidence base, but the healthcare worker was not engaged with the CQUIN, there was an argument for the screening tool not to be completed. However, the pressure to achieve compliance with the CQUIN (the problem as identified by the focal actor) also created a tension with the view that recognition of a patient with sepsis required problem-solving skills and the ability to 'think outside the box'.

> In respect of the sepsis screening flowcharts, I think they're great for people who might not be as clinically experienced and actually they're quite simple and easy to follow. You do need to have some level of clinical experience behind it and that's the thing sometimes with

> flowcharts and tick boxes, is if flowcharts and tick boxes are followed to the T, without that clinical knowledge, experience and insight, there is a risk that they can become detrimental to a patient because other signs aren't spotted or other questions aren't asked because people are very focussed on this thing that's in front of them. I think we probably need to be more careful about what we're putting onto a flowchart or a tick box because it can almost get a bit like medicine by numbers. People lose the ability to think.
>
> **Matron, ED**

Berg (1997a) considered protocols to be cookbook medicine that de-skilled the healthcare worker and that clinical judgement must be used alongside the tools. In the quote below, a Cardiac Consultant considers that, at the frontline, a cohesive team approach to patient care was essential and the ability to problem solve and understand the potential consequences of following a tick-box flowchart was required.

> I've certainly come to the conclusion that the care that I give is team care. And I don't think all members of who I regard as a team necessarily appreciate that. And I think the quality of the team care is most affected by the weakest member of the team. And you can't necessarily make up for that. I might see a patient once a day, that patient might be fine at 9 o'clock when I see them, they could be nearly dead by the next day if the other members of the team don't do the right thing. So someone taking the ... a very junior nurse who's taking the obs. who doesn't do anything about a patient with a systolic of 60, and then a nurse who still gives a drug which will lower blood pressure, even though the systolic was 60, is enough to make it impossible for me to necessarily rectify that.
>
> **Cardiac Consultant, Southside**

The sepsis team at Westside differed from the Quality Nurses at Southside in that they were not naïve formalists, but nor were they fiercely opponents.

> And we know that sometimes tick boxes just become exactly that, that they become a tick box. So, it's reliant upon the nurses' knowledge of sepsis in order to screen the patient at the moment. That said, when we ask in education most people what the elements are, they are able to come up with all six. It's been fairly … you know, the Sepsis Six is

> nothing new, it's fairly well established actually. So people are very good at coming up with that, so then they deliver it.
>
> **Lead Sepsis Nurse**

Despite the absence of a physical tool at Westside, the electronic observations system presented a similar risk to that just described at Southside. The quote below, from a doctor who was experienced in the recognition and treatment of sepsis, highlights the risk.

> The systems are great because they do all the adding up for you and they take a lot of the kind of bits and paper and bits of things getting lost and that kind of thing away and out of the loop. But what it doesn't do is, it's not as intelligent as a nurse or a doctor. It can't be by definition, so you cannot replace human judgement and education and training. You take some of that human error of adding up out of the problems but you can't replace that.
>
> **Critical Care Consultant 1, Westside**

The Critical Care Consultant's view aligns with Berg's (1997a) argument that the generative power comes from the interrelation of the tool and the healthcare worker. The tools were implemented into a strongly preconfigured world. Whilst the tools remained fixed and static, the healthcare workers' knowledge and experience varied. The change in practice that emerged from the interrelation of the tool and the healthcare worker was dependent on multiple factors and was therefore dynamic and unpredictable. Work practices needed to interlock for the tool to come to life. For healthcare workers who did not possess the knowledge, experience and confidence to recognise sepsis and escalate care, interlocking with the tool was beneficial. Whilst the outcome may not have been managing the patient independently, the outcome was escalation to an experienced healthcare worker who was able to problem solve and make decisions.

7.5 Crossing the gap between the map and terrain – the use of human skill

The quotes presented in section 7.4 are from the perspective of experts in the care of the deteriorating patient at both case sites. The knowledge required to problem solve outside the boxes of the tool is gained through education and experience. At Southside, post-registration acute care education was limited, and sepsis education was limited to completion of the sepsis screening tool and the Sepsis Six care bundle. At Westside, the focus on alerts and sepsis prompts presented a complex series of events dependent on the skills of the healthcare worker inputting the observations.

> It's quite tricky with electronic obs. because increased resp. rate … every patient on here has got an increased resp. rate. And it sort of pops up and says 'consider the sepsis screening tool' and you're, like, 'no, it's a patient with COPD that's just walked to the bathroom'. But less knowledgeable practitioners, certainly some of the newer HCAs [healthcare assistants], don't really recognise the signs of sepsis because they're just being taught to use the electronic obs. If a patient scored 3 on the electronic obs., that wouldn't require the HCA to then go and find a nurse to check on that. I think that probably the biggest issue is that the electronic obs. introduces a behaviour, if you like, of not seeing clinical trends outside of the EWS score. They'll look at the EWS and the EWS is fine but they don't see past that to the clinical markers beyond the EWS score, which can become quite a problem.
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> **Staff Nurse, Westside Medical Ward**

The quote shows that bridging the gap between the map (tools) and terrain (clinical practice) required skilful human work. As highlighted in section 7.4 by the Critical Care Consultant, whilst electronic observations allowed the EWS to be calculated automatically and a prompt to be issued to consider sepsis, it was the performance of the human being that would have yielded a more meaningful performance of the formal tool. Skilful human work in the recognition and treatment of sepsis is complex. For nurses with less experience and/or exposure to sepsis at Southside, the Quality Nurses' message gave the impression that the tool compensated for a lack of

knowledge and assured staff that it was 'what you are doing anyway'. Conversely, more experienced staff considered that the flexible intelligent performance of healthcare workers was required to distinguish between sepsis and other acute conditions, and to recognise when a patient is unwell despite not triggering the EWS. As such, versatile and creative skills such as the use of clinical judgement, which would not respond to behaviour change techniques, would be required. The Deputy Medical Director at Southside eloquently captured the tension between the use of standardised tools and the work of an expert practitioner.

> Medicine's a very human and, you know, healthcare generally is a very human thing. So it doesn't really fit a necessarily completely prescriptive mechanical technical variability reduced sort of model like maybe a car would or a plane would. So there is that human element. And I suppose the slight danger I have in my head is that one of my analogies, I suppose, is that it's like asking people to sort of paint by numbers. So basically if you took somebody like Leonardo Da Vinci and forced him to paint by numbers, you would get something that looked like the Mona Lisa and you would recognise the Mona Lisa but you would lose something. It wouldn't be the Mona Lisa because you'd have moved that work at the margins, the room for creativity which often is actually what advances organisations. It's often the people thinking around the problem, outside the box. The imaginative, creative work is taking place at the margins.
>
> **Deputy Medical Director, Southside**

At Southside this meant that the tools were not always used to recognise sepsis. Conversely, in the ED at Westside, the initial sepsis assessment tool became embedded within work practices. If the healthcare worker was unsure whether sepsis was suspected they would follow several initial assessment tools or use clinical judgement to decide. In the inpatient setting the software embedded in the mobile device used by staff issued a prompt to consider sepsis, which might result in the nurse taking action because of the prompt or clinical judgement being used. In each of these cases, additional 'work' of completing a tool to screen a patient for sepsis was not required.

The next section zooms in on the differences in work practices within and across the case sites, specifically between the ED and the inpatient setting.

7.6 The chains of re-representations and distribution

At Southside ED, when a patient had been booked into the department the first task was the measurement and recording of physiological observations. To perform this task the nurse had to gather the equipment required to make and record the physiological observations or delegate the task to a nursing assistant. Once the measurements had been made, the data were recorded on a paper physiological observations chart and the computer-based triage system. The function of the computer-based triage system was to prioritise the order in which patients should be assessed by doctors and nurses, based upon their presenting condition and the physiological observations. In the ED at Southside this involved locating functioning equipment and one of the computers that were shared between the healthcare team. To document the observations, the paper physiological observations chart had to be located; this information was also added to the computer admission screens. To screen for sepsis, physiological observations and the patient's presenting condition were cross-referenced with the sepsis screening tool (if the nurse opted to use one).

The fieldwork showed that nurses would refer to the computer-based triage system to prioritise and organise their work but would also use tacit knowledge to recognise visual clues of a deteriorating patient and use this assessment to decide the order in which to see the patients. As such, the computer triage system and nurses' experience in the recognition of the deteriorating patient were used to shape decisions. This introduced the possibility of variation depending on the nurse's experience and the competing pressures of the ED, through sudden deterioration of patients and overcrowding. Conversely, in the ED at Westside patient flow through the department meant that the heterogeneous entities required to recognise and treat sepsis were closely aligned and not as widely distributed as at Southside.

The initial assessment unit was designed for patient assessment, so the nurse did not have to decide which patient to see next unless alerted by the ambulance crew. Each bay was appropriately equipped for the physiological observations. Nurses added the physiological observation data to their mobile device, which they kept in their pocket, and the ED computer admission screens, which were located permanently in the initial assessment area.

Close observation of the different work practices showed a chain of re-representations as the patient was represented on the various tools at both case sites, such as paper physiological observations, computer-based triage system, the sepsis screening tool and the electronic observations. Once the physiological observations were made, the first step of representing the patient onto the formal sepsis tool was performed. The blood pressure machine and cuff, saturation probe, heart trace leads, monitor and thermometer performed part of the step across the gap between the sepsis tool (map) and terrain (ED and inpatient setting). These artefacts transformed the patient's presenting condition into numbers, ready for further manipulation. The range of activities required to produce the data involved intricate nursing routines and tasks (Berg, 1997a). The gap between the map and terrain was crossed in a series of routines and tasks, and this had an impact on the implementation of the tools. Observations in real time showed the intertwinement of the tools and practice as these activities were undertaken across and within the case sites.

This first re-representation was a 'practical task of abstraction' performed by the artefacts. The nurses performed the second re-representation by transporting the numbers from to the formal tool (Latour, 1994). The formal tools established the equivalences of the physiological variables required to screen a patient for sepsis and calculate an EWS, and so materially contained the required relations between the isolated observations. The nurses then transferred the numbers onto the formal tools, which were used to screen the patient for sepsis or calculated the EWS. The equipment required was therefore a crucial part of the network. The tools re-represented the patient

and made the task doable and a component of the overall process. At Westside the EWS software performed the calculation and issued the sepsis prompt.

When performing the subtasks to cross the gap between the map and the terrain, nurses observed in fieldwork commented that they checked that the medical device produced a reading that was realistic (based on their clinical skills and judgement) and matched their visual assessment of the patient. For example, when the saturation probe produced a low number which did not match their visual assessment, they would re-position the probe until a number appeared that was 'possible in the light of the previous one' (Berg, 1997a: 416). On occasions when functioning equipment was not available, the nurse recalled a temperature and judged if it was 'possible' and transferred the recalled temperature to the formal tool to keep her work moving. The data highlighted how the work performed was highly distributed across a range of heterogeneous entities. The whole process was the sum of the subtasks and chains of re-representations. Screening a patient for sepsis and calculating an EWS were influenced by the tools' pre-fixed criteria and prompts for action. They were also influenced by the nurse's decision making, availability of equipment, competing priorities and distractions. The 'total net effect' (Berg, 1997a: 418) resulted in the screening tool being completed and the EWS calculated.

As the patient journeyed from the ED to the inpatient setting, the actors required for sepsis screening and administration of the sepsis care bundle (patients, healthcare workers, the tools and equipment) became more widely distributed. The nursing and medical teams were simultaneously implicated in the problematisation stage of several other networks, such as supporting colleagues, responding to sudden changes in a patient's condition and attending to a patient's care needs (Sarker and Sidorova, 2006). Analysis of the data generated at Southside and Westside showed that the actors required to screen for sepsis and deliver the Sepsis Six were more aligned in the ED than in acute inpatient areas. At the ED in Westside patient flow had

been designed to align with healthcare staff, equipment and initial assessment tools to increase efficiency. In contrast, the patient journey through the ED at Southside was more erratic and dependent upon the decision making of the nurse in charge regarding the placement of patients in the department when capacity was reached. In both settings, alignment of the network was observed where each aspect required to screen for sepsis and deliver the Sepsis Six occurred and resulted in timely sepsis care in line with evidence-based guidelines and the CQUIN target. It was observed that at both case sites this occurred with the use of the screening tool and the initial assessment tool, but also without it. At times of overcrowding, despite the operating model at Westside, the tasks became increasingly distributed across the actor-network of both EDs.

At Southside, the focus of the 2016/17 CQUIN was on screening for sepsis in acute inpatient areas and administration of antibiotics within 90 minutes. Throughout fieldwork, the target remained in place and unchanged in the ED. The tools were fixed and abstract regardless of the site of implementation. However, the ED and acute inpatient areas differed in the nature of their workload and the roles and skills of the staff who worked there. In the ED, patients generally arrived acutely unwell and work practices were aligned with assessment, diagnosis and treatment. In acute inpatient areas, patients were admitted for a variety of reasons. Their treatment might have been continuation of that in ED or they might have been waiting for, or recovering from, elective surgery. This resulted in differences between the established work practices of ED and acute inpatient areas, and these required negotiation when the tool was implemented. In the ED at Southside, the strategy to increase compliance with screening patients for sepsis was to include the screening tool with the admission paperwork.

Conversely, the tools were less accessible in acute inpatient areas, as they were stored in a filing cabinet and were accessed when the healthcare worker had identified the possibility of sepsis. In these areas, the nurse therefore had to make a decision to screen the patient and, as such, screening relied on the

knowledge and skills of the healthcare workers. Therefore, the different work practices between the ED and acute inpatient areas introduced the potential for variation in the delivery of the care bundle.

In the ED at both case sites, if a patient met the criteria for the Sepsis Six, the nurse was competent to insert a cannula, take blood samples and blood cultures. In contrast, in the inpatient setting at Southside, the nursing assistant had to alert the nurse, who then had to decide whether to screen the patient for sepsis, get a tool from the stationery cabinet, complete it, then alert the junior doctor, who might be elsewhere in the hospital busy, with other patients or on a ward round. On the wards at Westside, the nurse and doctor received an alert and prompt to consider sepsis but would have to decipher and prioritise the alert in the context of their current work demands. Nurses at both sites could have bleeped the CCOT for support, but the CCOT could be busy elsewhere. Not all nurses in acute inpatient areas were competent to insert a cannula, take blood samples and blood cultures, which introduced a delay as they waited for a junior doctor, a member of the CCOT or a clinical support worker to attend. Each of these healthcare workers could be enrolled in other networks across the organisation.

The notion of drift (Berg, 1997a) has been used in this research to explain how the complexities of clinical practice can contribute towards the tools not being used as intended by their designers or the local implementation teams. Analysis identified that when the heterogeneous entities required to recognise and treat sepsis were widely distributed, this influenced the implementation of the tools. As such, the degree of distribution influenced the degree of drift from the tools being used as originally intended.

7.7 When the tools were not used as intended – drift

Berg (1997a) argued that formal tools cannot function by themselves within the complexity of the empirical world. When heterogeneous entities are aligned, actor-networks can produce the effect of efficiency. For example,

compliance rates with completing the sepsis screening tool were at times 100%. For the Quality Nurses, as naïve formalists, this reflected their ideal image of the tools being used smoothly and efficiently in clinical practice. They took for granted that using the tools would result in efficient sepsis screening and timely treatment. However, Berg (1997a) also argued that the notion of an actor-network of smooth and efficient interlocking subtasks when heterogeneous entities (patient, healthcare staff, the tools and equipment) continuously aligned was an ideal image. As shown in Chapters 5 and 6, the formal tools contained pre-set rules, yet the heterogeneous entities involved in the subtasks (such as making physiological observations and the administration of antibiotics) did not always interlock and perform efficiently and according to the pre-set rules.

As such, despite the formality of the tools, the actor-network did not always operate in an ordered way as the heterogeneous entities (patient, healthcare staff, the tools and equipment) were pulled apart by competing pressures, distractions, different levels of experience of staff and overcrowding, all of which characterised the nature of work in the ED and the inpatient setting. Healthcare staff were also enrolled in other cross-cutting actor-networks. Moreover, for the CCOT and doctors, this involved actor-networks outside of the one they were physically located in.

Observations showed that the conditions described above resulted in a drift from the original intention of the tools (Berg, 1997a; Allen, 2012). For example, the administration of intravenous antibiotics within an hour of recognition of severe sepsis did not always occur. Close observation showed that just one aspect of administration of intravenous antibiotics, the prescription, required the interlocking of multiple subtasks. The nurse had to inform a doctor that the patient had triggered the Sepsis Six, and the doctor had to review the patient, then write the prescription and then inform the nurse. As shown in Chapters 5 and 6, the resultant lack of alignment or delay in alignment of heterogeneous entities caused a drift from the intention of the evidence-based guidelines and the CQUIN target.

The tools could not function without the healthcare staff entering their data. Completion, though, was only one of a whole array of demands they had to attend to. Healthcare staff were tied up in cross-cutting actor-networks that characterised the work in the ED and inpatient areas, for example pain management, end-of-life care, completing documentation, clinical procedures, ward rounds, personal care, accompanying patients for tests, updating families and medication rounds. As such, some healthcare staff did not complete the screening tools, and some worked around the tools. Throughout the patient's journey, the degree of drift was observed to be reduced by the problem-solving skills of the healthcare workers who came into contact with the patient. For example, when waiting in the queue for initial assessment at Westside, if a patient deteriorated, this was recognised by the ambulance crew, who could alert the nurse.

As a result of the factors described, the networks were observed as having 'the tendency to fall apart, to contain glitches, and to behave unexpectedly' (Berg, 1997a: 423). The smooth, linear functioning of the tool that was described by the Quality Nurses was not always observed. The heterogeneous entities (patients, staff, the tools and equipment) were in constant motion and were kept from aligning by their involvement in cross-cutting networks. Yet, despite the competing pressures and distractions, the work kept going.

Experienced healthcare staff were aware of the tools' limitations and worked around them. Their primary task was to care for their patients. In the ED at Southside, the completion of the tool was an addition to the workload and was driven by the CQUIN, and so at times it was ignored. For compliance to be achieved, the Quality Nurses and the Matron believed that all ED staff would become part of the actor-network. However, by employing this strategy, the tendency of the network to erode itself from within was introduced, as staff either ignored the tool or prioritised clinical work over completing the tool. In the ED at Westside, the patient flow through the department and the initial assessment tool were routine work practices.

At both case sites, in the inpatient setting, the EWS was an embedded work practice, and so was completed routinely. At Southside, in the event of the EWS reaching the trigger threshold, escalation occurred via the bleep system and verbal communication between healthcare staff. At Westside, the trigger and escalation were automated but this meant that the doctors receiving the alert had to establish compatibility between the different demands in the network they were part of. The electronic observations and alerts allowed this to occur when the doctor was not physically located in the same clinical setting.

Paradoxically, the mobile device allowed the trigger to occur in the first instance and added to the workload, creating new work practices of dealing with the alerts and new competencies of prioritising the alerts for those receiving them (Berg, 1997a). The doctor was able to satisfy the patient's acute need and the record's demands. The quote below shows how, if the healthcare worker had followed the demands of the tool, it would stand in the way of their primary tasks, that is, dealing with the acute needs of other patients, speaking with relatives and supporting colleagues.

> We have a target of doing it within an hour I believe, having the patient assessed within an hour. But obviously, when there's something like this and there's a lot to do, I'm not so worried about the computer work, more worried about the patient in front of me that needs treatment.... I know it's probably important and ... but then I think this is more important, the patient.
>
> **Band 5 Nurse, ED**

The nurse was observed completing the computer work later; she performed a detour in order to satisfy the patient's needs and the tool's demands. As a result, she re-established compatibility between the different demands of the different networks she was part of (Dodier, 1995). The reality of clinical work meant that the healthcare staff operated outside the 'self-contained sphere of the formal' (Berg, 1997a: 424), where the formal tools did not adequately embody what their work was like. Workarounds and tinkering were inevitable and directed at mending the drift in all juxtaposed elements (Allen, 2012).

In training and observations at meetings, the formal tools were depicted by the Quality Nurses as a smoothly operating part of the healthcare staff workload: 'they just needed to be completed'; 'it's what they should be doing anyway'. There was a view that the heterogeneous entities required to screen the patient for sepsis and treat with the Sepsis Six would align and interrelate as indicated in policy, guidelines and the CQUIN. What was observed, however, was what Berg (1997a: 427) describes as a 'fragile, never static equilibrium, characterised by never-ending frictions, loose ends, and unforeseen consequences'. The formal tools were intended to standardise sepsis recognition and treatment. However, at Southside, as a result of implementation strategies and the IT infrastructure, at times they contributed towards the persistence of drift, which they were intended to counter.

7.8 The tools as representing multiple scripts at Southside

Analysis of the ethnographic data generated at Southside revealed that the tools embodied diverse scripts that impacted on their implementation, from the executive board to the clinical frontline (Akrich, 1992). The tools acted as evidence that the financial targets had or had not been achieved. At the same time, they were predicated on an evidence base and model of patient assessment and care delivery (Daniels and Nutbeam, 2017). The notion of the tools representing evidence-based medicine and evidence for CQUINs has been introduced in this thesis. From an organisational standpoint, the tools were rational, scientific and straightforward to implement. They were viewed as simple artefacts that would produce predictable change in the organisation. The abstraction and manipulation of data added to the tools through audit indicated that there was an unstated assumption that the tools would remain unchanged as they travelled through the organisation. Data analysis has shown that interpretation of a tool's script influenced how the healthcare worker translated that tool into their clinical practice and provided insight into how healthcare workers viewed the various tools.

At Southside there was an organisational narrative associated with the tools that positioned them as 'quick and easy' to use and that their use would 'saves lives'. Conversely, senior nurses, medical leaders and frontline clinical experts in sepsis care expressed concern that the tools led to a 'tick box' approach to sepsis screening and treatment and considered that clinical judgement should be used in conjunction with them. There was not a focus on the underpinning understanding as to why a patient's physiological parameters were deranged in sepsis.

A lack of resources, infrastructure and clinical expertise in the corporate team, and silo working between doctors and nurses, contributed towards this situation. Therefore, the opportunity to develop problem-solving skills in the recognition of sepsis was dependent on exposure to patients with sepsis. This varied between clinical settings. At Southside, junior healthcare workers and staff with less exposure to sepsis found the structured tool beneficial as an aide-memoire to guide them through screening and treating a patient for sepsis and an additional voice to escalate the care of patients to doctors and/or the CCOT. However, the tools were also viewed by some staff as a burden, as an unnecessary addition to their workload. Data will be presented that illuminate how the tools served multiple purposes and embodied diverse scripts, and how this influenced the implementation of the sepsis screening tool and Sepsis Six at Southside.

7.8.1 Script 1 – additional voice

If the patient triggered the Sepsis Six care bundle, the nurses used the sepsis screening tool to communicate with the doctors. In the ED this might have resulted in doctors re-prioritising their work to assess the patient, or the prescription of fluids and antibiotics without assessing the patient first.

> They [doctors] would ask you, 'Why, what evidence have you got? Why do you want antibiotics? So for you to explain why you feel that, you know, hypotensive, tachycardia, you can't explain that. If you've got the tool, then you can say, 'Well, look, this is what their obs. are'; they've come in with sepsis, then obviously it could be that. Some of

> them are just asthmatic patients that are just having an asthma attack; then they wouldn't necessarily be a SIRS patient. So then the doctor would say 'No, they're not septic; they're fine'. So as long as you're happy to say or document that you've said that, then that's fine and wait till you go and see them.
>
> **Newly Qualified Nurse**

The Newly Qualified Nurse used the tool to enable her to escalate patient care to the doctor. She identified that the patient met the criteria on the sepsis screening tool to trigger the Sepsis Six. She used the tool to interrupt the doctor to ask for a decision based on the information the tool was providing. In this case, the generative power came from the tool and the healthcare workers: the nurse and the tool, and then the doctor and the tool. Recognising that the patient might not have sepsis, the newly qualified nurse passed accountability to the doctor via the tool. The nurse had an expectation that the doctor would make a decision based on the information on the tool and a brief handover of the patient's background.

A more experienced nurse used the tool to negotiate with the doctor to re-prioritise their work.

> If the doctors are busy and they're in 'resus' with patients that are unwell, then that can be difficult but generally they are pretty good, to be fair, at saying 'I think this patient's septic. I've filled this out. What do you think?' They will say, 'Oh yeah, okay, fair enough. Nip in and see the patient.'
>
> **Band 5 Staff Nurse, ED**

The ED Consultant and Trust Sepsis Lead shared this view.

> So if somebody comes up to me and says 'They're triggering for this', I'm going to say 'Okay, what have they come in with?' Well actually they've got known pancreatitis, they've got gallstones or excess ethanol and you go 'Okay, come with me, let's go and see them. Is this likely to be sepsis? Go and examine the patient.' So that in itself is a trigger to then say this patient is unwell. It may be sepsis, it may not be, but they're unwell.
>
> **ED Consultant and Trust Sepsis Lead**

When delivering training, a Quality Nurse gave the message that the tools could empower the nurses. She associated the narrative of empowerment with enabling nurses to fulfil their role as patient advocates and 'doing the right thing'. In her perception, the tool played a significant role in the nurses' clinical work.

In the acute inpatient settings, the data showed that the junior doctors' work could be remote and was widely distributed across the organisation. Given such distribution and lack of contact between doctors and nurses, the tool provided structure to the nurses in their communication to doctors. As the quote below highlights, when on call the junior doctors had to respond to multiple requests from several different clinical areas. The junior doctors perceived the tool as supporting them to prioritise their workload, particularly when on call.

> If they're worried about a particular patient and if they are bleeping an out-of-hours doctor, they can say 'This is what my patient's observations are. I think there's some kind of sepsis. Can you come and review of the patient?' And then that gives you an indication of actually how one, you can prioritise all the patients ... because obviously you get called all over the hospital at night-time and, like I say, from a patient safety perspective it's all about prioritising the sickest people first and knowing which things can wait a while.... And part of having these tools is that early recognition.
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> **Foundation Year 1 Doctor 02**

7.8.2 Script 2 – aide-memoire

For junior healthcare staff with less experience in the recognition and treatment of sepsis, the screening tool and Sepsis six acted as memory aid documents which reminded them what course of action to take. As highlighted in section 7.6, on acute inpatient settings at Southside the sepsis screening tool and the Sepsis Six care bundle were stored in a filing cabinet. Completion of the tool relied on the healthcare worker considering sepsis and/or recalling that completion of the tool was recommended when the EWS was 4 or more. For junior staff and those with less exposure to patients with

sepsis, the tools embodied a script which served the purpose of an aide-memoire. As shown in the quote below, the design of the screening tool and sepsis care bundle was presented as a linear process that provided structure in the hectic environment of the ED.

> Colour-coded, that makes it easier straightaway, so it's a visual thing, it's a simple flowchart, yes/no, gives you the help … and obviously if you've done all that and then you go down to the red, and obviously you have to follow the sepsis pathway which you do over the page. So yeah it is, I like the colour-coding … it's easy, it's simple. For such a serious thing it's such a simple chart to follow, you know what I mean?
>
> **Newly Qualified Nurse**

Accordingly, interpreting the tool's script as an aide-memoire influenced how healthcare workers translated the tools into their clinical practice and provided insight into how healthcare workers with less experience in the recognition and treatment of sepsis viewed the tools.

7.8.3 Script 3 – burden

Analysis found that as healthcare staff gained more knowledge and experience in the recognition and treatment of sepsis, the tools embodied a script that was interpreted as requiring additional work to complete. As the following quotes will highlight, when healthcare workers interpreted the tools script as requiring additional work they were viewed as a burden.

> In terms of actually completing the bundles, I think they're quite good but it also means that because Emergency Departments are so busy now, still people feel like it's a bit of a burden to tick everything. Because some people feel like they know that the management process is being done, they just don't feel like they need to fill in additional paperwork to do their own job. But then you've got other people who are more junior, like myself, or other people, who feel like it's a good aid-memoire when you see people.
>
> **Foundation Year 1 Doctor 02**

The view of the sepsis tools and the Sepsis Six was seemingly on a continuum, being interpreted as an aide-memoire by junior staff but as a burden by more

experienced workers, who knowledge of sepsis was embedded. The quote below highlights that the Sister in ED was aware that the tools had to be completed. However, the tool's presence on every set of admission documentation resulted in a drift from the tool's original intention: to identify patients with sepsis. The Sister used her clinical experience to identify that the patients were not septic and prioritised patient care over completing the tool. From her perspective as an experienced healthcare worker, screening for sepsis in patients who were not septic was not important in the complex network of a busy ED. The screening tool was viewed as less important than treating the patient.

> On Tuesday I had a Sepsis Six flowchart in every one of my patients. Well, if they were clinically okay, I wasn't even filling them out. Really I should be filling them out for every patient whether they're right or wrong but it's that quick: look, they're okay, they're stable, their obs. are stable, I'm doing it. And that's because the turnover's so vast and we're busy and you're concentrating on the important thing. I know it's important but if your patient's fine it's not getting done.
>
> **Band 6 Sister, ED**

Although completion of the tools was widely distributed across the network, their function as an aide-memoire reduced the drift from their original intention. As the healthcare worker became more experienced and did not view the tool as an aide-memoire, completion became a burden. To reduce distribution of their work, the nurses chose not to complete the tool and instead focussed on the patient. Whilst this action did not result in drift from the delivery of sepsis care, it did cause a drift from the translation of the tool as evidence for the CQUIN.

7.9 Crossing the gap between the map and terrain: the role of electronic observations and sepsis prompts at Westside

Those taking the position of a naïve formalist believed in the *a priori* superiority of the formal tool in decision making over the human. The electronic observation system and sepsis prompt were able (as a formal

model) to detach information about the patient from the context in the form of the alert and allow for further manipulation, whilst retaining relevance to the representation of the patient (Star, 1995). An opposing view is that the formal model deleted the details of what it represented and that bridging the distance between the represented and the representation required interpretation in the context of the patient, which in turn required the skills of the healthcare worker. For example, the sepsis prompt was triggered when physiological observations reached a pre-defined threshold embedded in the software. Naïve formalists would believe that the prompt was an accurate representation of the patient's condition. Their opponents would accept that the sepsis prompt was a representation of the patient but would interpret the prompt by considering other information, such as the patient's previous physiological observations and presenting condition, both of which require problem-solving skills and experience of the deteriorating patient. The following data analysis demonstrates that the electronic observation system's alerts and sepsis prompts were distributed. As Berg (1997a: 420) argues:

> By zooming in on the way tool and work practices are interwoven, the distributed nature of the tasks comes into view: the way control and responsibility are transformed and dispersed over the heterogeneous assembly.

At Westside, the CCOT and junior doctors played an important role in alignment of the networks to enable timely sepsis care outside of the ED. The electronic observation system embedded in the mobile devices enabled the CCOT and junior doctors to remotely enrol in networks they were not physically located in. As a result, they were able to 'keep an eye' on patients. However, the alerts and sepsis prompts only partially represented the patient and actions of healthcare staff at the point of care. Translation of the alerts and sepsis prompts at the point of care consisted of a series of social interactions and system processes that the software in the mobile device could not capture. The system therefore acted as a decision-support technique. The system turned inputted data into outputs 'using a collection of symbolic rules or statistical formulas' (Berg 1998: 88).

The idiosyncratic limitations of the electronic observations had an impact on the organisation of work. The data presented in the last chapter highlighted that when doctors in the inpatient setting received multiple alerts for patients on inpatient settings, they were not located in, they performed balancing acts between the alerts which indicated that patients were potentially acutely unwell and their current workload. This balancing act required problem-solving skills to enable them to react to the patient's condition, which was represented by the electronic observations system and the alerts. As a result of this balancing act, both actor-networks they were enrolled in changed.

> When you're busy with other patients, you've got alerts and you won't to be able to see it. You're doing a procedure, you've got the catheter, you've got the NG [nasogastric] tube, you wash your hands and there's a lot. I think it's useful if the nurse staff are just popping in to tell you, 'Oh, that patient is 8', it does help. So if it's an emergency I think it's better just to talk to us in person. Every patient needs my time, needs my attention, new treatment, but we only have one doctor covering six really unwell patients. One patient is scoring then I think you spend two hours there, talk to their family. And then if there's another family showed up in the meantime then you won't be able to talk to them because you're dealing with another patient which is your priority.
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> **Core Medical Training Doctor, Level 1**

Accordingly, the alert and sepsis prompt resulted in action that was not necessarily in line with the course of action as intended by the designers of the system. For the doctor, the alert required further manipulation. Delivery of this action was dependent upon the actor-network as whole, such as the healthcare staff undertaking the physiological observations, how busy the clinical setting was and the availability of functioning equipment.

According to Berg (1996), the electronic observations was an instance of a system acting as a representing device. There were elements of the patient's emerging trajectory that were not covered by the tools. The formal pre-set criteria embedded in the tool were superseded by situational exigencies that the healthcare workers dealt with, often through informal and *ad hoc* procedures. These required the healthcare professionals to use their clinical

judgement. The tools might have served as useful prompts for directing action in certain contexts, but their highly structured design and selective focus excluded certain information necessary for all situations and coordination of work. The electronic observation system was reactive to the information it received. The doctor quoted above used her clinical judgement to reinterpret the information provided by the alerts and other healthcare workers within the network. By doing this she was able to manage the complexity and fluidity of her workload. As such, the electronic observations system was, therefore, part and parcel of the ongoing (re)construction of her present (Berg, 1996).

The device contained the equivalences of the EWS and un-hesitantly converted a series of clinical observations into a single number ready for further manipulation. Berg (1997a) described the skilled cultural part of the calculation as the aspect undertaken by the nurse. The nurse delegated the mechanical aspect of the calculation to the device. The centre of control did not lie with the tool or the nurse. Instead, the process of measurement, recording and escalation was highly distributed. The control and responsibility were transformed and dispersed between the tool and the nurse, resulting in the generative power arising from the interaction of the two, rather than one or the other. As highlighted in this thesis, observation of the real-time functioning of the tool showed that smooth and efficient actor-networks were ideal images. The heterogeneous entities involved in using the electronic observations were caught up in other actor-networks. The alerts and sepsis prompts were produced in an actor-network of complex driving forces that brought the mobile device to life. Acting upon the data provided by the tool, the mobile device represented the patient and produced an outcome for further manipulation by the healthcare worker. However, despite good intentions, as the analysis above has shown, the alerts and prompts could be turned into obstructers of the network's smooth functioning.

If working away from the patient, the healthcare worker did not have insight into the actions taken in response to the sepsis prompt. The mobile device had transformed the input into information that was ready for further

manipulation. The steps taken after this point were as a result of the action taken by the healthcare worker. The data reported in the last chapter showed that reliance on the electronic observations system was not a substitute for trained and experienced healthcare workers. In the incident described in the quote above, the patient had a high EWS of 8, which indicated a deteriorating patient and resulted in escalation of care to the junior doctor, but this did not guarantee that timely action was taken. Furthermore, a low EWS of 1 did not result in an alert to a junior doctor, as the patient's physiological observations did not reach the trigger. However, in the example given, the patient was not adequately represented by the system, and human skill was required to recognise the severity of their condition. The gap between the tool and practice was crossed by a chain of re-representations and tasks that interlocked to produce a number. Once the number had been generated, human skill was required to interpret the number and take clinical action. Consequently, no single element was in control and, as highlighted by the data in this chapter, the smooth and efficient network can be corroded as a result of the dynamic nature of the hybrid (Berg, 1997a).

7.10 Implications for implementation of the tools

On the basis of the literature review and the theoretical framework, three precise research questions were framed:

1. How did the case sites interpret externally driven standardised tools?
2. How did the case sites implement externally driven standardised tools?
3. What happened when the tools were used in clinical practice in secondary care?

The research questions are considered in the following discussion of the cross-case comparison.

At both case sites, interpretation and implementation of the tools was in two actor-networks. One was the interpretation and management of external guidelines, implementation plans, audit reporting and responding to external changes or drops in compliance. The temporal nature of the CQUIN targets resulted in *interessement* devised to encourage behaviour change towards meeting the target. At both case sites, CQUINs exerted an influence in the actor-network which created pressure to meet the targets. Evidence-based medicine interpreted by the SSC consensus committees and the UK Sepsis Trust also influenced the content of sepsis screening tools and the Sepsis Six care bundles at Southside and Westside. The other network was in clinical practice, where the tools were interpreted, translated and used regardless of external drivers and implementation plans. At Westside, the electronic observation system calculated the EWS and, if the threshold score was met, an alert was sent to decision makers and a prompt was issued by the mobile device to consider sepsis. At Southside, the different translations of the tools were dependent on what they meant to the individual healthcare worker at that time in their daily work and their level of experience. Due to their fixed and static design, the tools could not capture all eventualities and clinical judgement was required to recognise and treat a patient with sepsis.

In terms of use in clinical practice, the data generated at both case sites showed that practices varied from patient to patient, between staff, from one shift to the next, and even hour by hour due to the unpredictability at the clinical frontline. The practices were influenced by what was happening in that moment in the clinical area and were fluid, dynamic, flowing and erratic. The tools and the electronic observation system were part of the network, but in contrast to the physical environment where frontline care was delivered, were ordered, static and fixed. The data showed that, at both case sites, despite the re-representation of the patient on the tool or the mobile device, this did not always accurately represent the patient, the care provided, the problem-solving skills applied by the healthcare worker or the proximity of healthcare workers – all factors required to deliver the Sepsis Six care bundle.

The proximity of heterogeneous entities in the network influenced efficiency across sepsis screening and the whole sepsis care bundle, from recording of observations, escalation and review, to administration of treatment. As a result of the alignment of the network in ED, there was less distribution than on the inpatient wards, resulting in less drift from the original intention of evidence-based guidelines and the CQUIN target. The nature of the work in the ED was aligned with the application of problem solving to recognise and treat acute and emergency conditions. Sepsis in acute inpatient areas was less common, so there was less opportunity for healthcare staff to develop and hone their problem-solving skills. When considered together, the close proximity of competent problem solvers and other actors required for the recognition and treatment of sepsis in the ED resulted in the alignment of the network. The alignment of networks influenced how quickly a decision maker (junior doctor and/or CCOT nurse) could attend to the patient either remotely via the computer or in person. Outside of the ED, decision makers were more widely distributed, and the healthcare workers were more distracted by a workload that was not primarily focussed on the recognition of acutely unwell patients. The data at both sites showed that, in the majority of cases within the ED, work practices were aligned with sepsis recognition and treatment. However, in acute inpatient areas, a lack of alignment between work practices and sepsis recognition and treatment was observed.

The original intention of the screening tool was to reduce variation in the recognition and treatment of sepsis. This would be achieved by the tool accurately representing the patient's condition in that moment in time, so the experience of the healthcare worker in the recognition and treatment was not necessarily required for the patient to receive the treatment for sepsis in the timeframe. The goal for the agents performing the tasks (healthcare workers) was to maintain the flow through the chains of re-representations as they worked to fit the patient into the shape of the sepsis tools. It was, therefore, the sum of all the parts that became the accuracy of the representation. The representation also captured the care delivered, so that evidence could be

provided for the CQUIN. By zooming in on the sepsis screening tool, Sepsis Six care bundle and electronic observations system, work practices that were interwoven tasks came into view. These work practices were not linear but, rather, were dispersed over a complex heterogeneous assembly. When used in clinical practice, as this research has shown, there were occasions where healthcare workers were forced to create workarounds to fix tensions presented by the tools when they did not fit into established work practices. The workarounds were not measured or shared, but locally became an accepted variation.

In connection with the interpretation and implementation of the tools, from their designers' perspective, the intention of the tools was to represent complex guidelines and deliver evidence-based medicine (Levy et al., 2016; UK Sepsis Trust, 2018). Southside used the screening tool in an additional way: as evidence for the CQUIN, which impacted on its implementation and use. Resources at Southside allowed only for sepsis care improvement to be directed towards achieving compliance with the CQUIN. As a result of the changing focus of CQUINs, the organisational message from the ADNQ was that an expert in sepsis was not required but, rather, that someone who was able to change behaviour was needed. Due to the pressure to meet the CQUIN, the change in behaviour required was for healthcare staff to screen patients for sepsis using the screening tool or computer-based tool and deliver antibiotics within an hour. The focus was on counting screening tools completed and the number of patients who had received antibiotics in an hour. When implemented, the standardised nature of the tools afforded greater transparency by providing a window through which the Quality Nurses could look to collect the data, which then represented whether the department as a whole was compliant or not with the CQUIN.

At Southside there were not resources available within the sepsis team to teach underpinning knowledge related to sepsis to nursing staff. This reinforced the focus on the tools to support the recognition and treatment of sepsis. At both case sites, there was a consistent message that people needed

to be able to think outside of the guidelines in order to problem solve. However, becoming an expert from a novice baseline was a complex process, with a lack of exposure to sepsis and opportunities for education contributing towards hindering the development of problem-solving skills. There was a continuum in how useful the standardised tools were; this in some ways reflected the patient journey where patients were seen by the nursing assistant, then a nurse or then the junior doctor before the experienced CCOT nurse or senior doctor. How healthcare workers responded to the tools changed and evolved as they developed as a healthcare professional along a continuum of experience and knowledge that come only over time.

The continuum was not unidirectional; it was dynamic as the healthcare worker came across new patient scenarios that did not fit the fixed criteria within the tools. Over time, with exposure to many different patients, healthcare workers became experts, such as the CCOT, Cardiology Consultant and Critical Care Consultant. Senior nurses and doctors considered that the tools introduced risk, by encouraging a tick-box approach and a lack of clinical judgement in sepsis recognition and treatment. However, without opportunity for the development of knowledge and skills junior healthcare workers and those who were not exposed to sepsis very frequently found the tools useful as an aide-memoire. In addition, in the ED and acute inpatient areas, the screening tool connected healthcare workers with a decision maker. This generated a cycle at Southside where experienced healthcare workers expressed a critical appreciation of the risk associated with the tools, but there was not the infrastructure to address training needs. The tool changed in function relative to knowledge and experience, from being a useful aide-memoire to a burden. This cycle reinforced the normative linear approach to sepsis improvement seen at Southside.

In terms of implementation of the tools, at Westside, sepsis improvement was driven by an interprofessional team of clinical experts who also had experience of improvement methods. The team, led by a Consultant in Medicine and Critical Care, were established in the organisation. Interview

data showed that the Chair of the organisation supported and advocated 'intelligent improvement'. Despite this, the sepsis CQUIN exerted an influence on implementation of the sepsis tools and wider improvement work. The infrastructure and established sepsis team at Westside resulted in the alignment of networks, from the board to implementation teams to the frontline.

In contrast, at Southside, silo working, a lack of communication, ownership and empowerment in implementation teams were observed. In the case of sepsis care improvement, this resulted in a fragmented approach to implementation that relied on individuals' views rather than a corporate message informed by quality improvement methodology. This meant the Quality Nurses relied upon external expertise and the CQUIN as drivers rather than nuanced improvement for local contexts. Taking the example of CQUIN negotiations, a hierarchical approach was evident that resulted in the Senior Quality Improvement Nurse waiting 'to be told what to do' before she could delegate implementation of the CQUIN to the Quality Nurses. Supported by a governance structure at Westside, the multi-professional team acted as one, producing a cohesive message that translated across the organisation through the rapid audit feedback programme, as exemplified by the process mapping exercise for blood cultures in the ED (section 6.4).

At Southside, there was a gap between management and the Senior Quality Support Nurse and Quality Nurses that was not bridged with a sepsis group or other governance structures. The rapid audit feedback system, which was considered a successful method of improvement at Westside, would have been challenging for the Quality Nurses at Southside to recreate. At Southside, barriers to innovative approaches to improvement existed through the hierarchical boundaries within and across professions – between doctors and nurses, between teams of nurses and between managers and healthcare workers. In order for the tools to be implemented, the gap between the management and clinical frontline needed to be crossed. Accordingly, the way that organisations mobilised around the external pressures and guidelines,

their orientation towards improvement, and how external pressures were balanced against the intended purpose of these tools in clinical practice influenced the design of implementation strategies. In clinical practice, the characteristics of the clinical setting, experience of healthcare workers and their interpretation of the tools' scripts influenced implementation and use in clinical practice. As such, different perspectives of the care bundle were not always aligned. The two actor-networks could, however, be connected by embedded governance reporting structures, from the executive board to the clinical frontline, and by quality improvement methods, to understand the influence of context on implementation, in addition to quantifiable measures of compliance.

Chapter 8: Discussion

8.1 Introduction

Change initiatives, such as care bundles, checklists and pathways, are predicated on linear behavioural change models which often fail to address social, cultural and organisational factors (Waring et al., 2016; Kislov, 2018). This may contribute towards explaining the variation in approaches to implementation, the persistence of poor outcomes and why success in one setting is difficult to reproduce in another (Allen, 2017; Dixon-Woods, 2019). Policy and initiatives associated with implementation of care bundles, in particular financial incentives, were situated in the positivist paradigm, with improvement measured and risk understood by objective and systematic analysis (Waring et al., 2016). Despite the intended linear design of such initiatives in this research, when interpreted by the case sites, implementation strategies differed. The external drivers generated the introduction of a care bundle into existing social practices and the strongly preconfigured worlds of the ED and acute inpatient settings, and required negotiation with all relevant parties (Berg, 1997a; Allen, 2009). As advocated by Allen (2017: 1), in this research the tools were treated as 'actors' that did things in healthcare processes rather than inanimate objects, and their use was systematically and critically analysed.

The focus of the research was a systematic and critical examination of the role that standardised tools, specifically sepsis screening tools and the Sepsis Six care bundle, had in organisational life in the context of healthcare. Using a conceptual framework based on ANT and technology-in-practice has allowed a move away from the idea that technology impacts upon humans as an external force, and allowed for technical interventions to be considered as active actors that affect implementation strategies (Callon, 1986; Berg, 1997a). Specifically, this research has focussed on what happens (why and

how) when financially incentivised care bundle was implemented in secondary care.

Three precise research questions were framed:

1. How did the case sites interpret externally driven standardised tools?
2. How did the case sites implement externally driven standardised tools?
3. What happened when the tools were used in clinical practice in secondary care?

To answer the research questions, in this chapter I integrate findings of the individual case studies and cross-case comparisons described in Chapters 5, 6 and 7 with the literature, and re-examine my findings in more detail in light of the conceptual framework used. I argue that there were two distinct actor-networks operating in order to implement externally imposed improvements: one at a corporate level and the other in clinical practice. Different perspectives of the care bundle were not always aligned. The way that organisations mobilised around the external pressures and guidelines, their orientation towards improvement, and how external pressures were balanced against the intended purpose of these tools in clinical practice influenced the design of implementation strategies. In clinical practice, the characteristics of the clinical setting, experience of healthcare workers and their interpretation of the tools' scripts influenced implementation and use in clinical practice. However, the actor-networks could be connected by embedded governance reporting structures, from the executive board to the clinical frontline, and by quality improvement methods to understand the influence of context on implementation, in addition to quantifiable measures of compliance.

This research did not intend to question the tools' validity; the intention was to explore how external drivers of evidence-based medicine and financial incentives were interpreted and implemented by focal actors at the case sites and what happened when the tools were used in clinical practice. The data presented in this thesis demonstrate that the tools did not just slip into the

social world of secondary care in the NHS. Crucially, this reflects the findings reported in the literature: implementation is complex and contextual, not a simple linear decision (May and Finch, 2009; Allen, 2012, 2017; Dixon-Woods and Martin, 2016; Greenhalgh et al., 2017; Horton et al., 2018; Dixon-Woods, 2019; Kocman et al., 2019).

By drawing on ANT and technology-in-practice, this research builds upon this body of literature, by explaining how and why implementation of the tools occurred. This chapter begins by discussing the external drivers and organisational factors that influenced the interpretation of external drivers and how the multiplicity of interpretations of the tools in clinical practice influenced its use. A discussion of how and why differences between the organisations and clinical settings influenced the implementation of the tools will follow. The chapter concludes with the contributions this research offers to implementation science and science and technology studies.

8.2 Interpretation of external drivers – the limitations of *interessement* strategies

As Chapters 5 and 6 have illustrated, there were several external forces that influenced the implementation landscape, which were largely financial in character and which speak to the widespread financialisation and commercialisation of services. The sepsis CQUIN, publication of international and national guidelines, the rising prominence of the UK Sepsis Trust, and political and media involvement led the case sites to 'become increasingly sensitised to expectations of good practice' (Dixon-Woods et al., 2013: 11). By applying the notion of an actor-network, a key task in this research was to explore how and why the external drivers were interpreted and translated into actor-networks within and across both organisations, from the executive board to the clinical frontline. By tracing the associations between humans and non-humans involved in the interpretation, implementation and use of the tools, I was able to explore how the associations were ordered and reconfigured over time (Latour, 2005) (Appendix IV). The actor-networks

observed were constantly evolving; seen through the lens of ANT, social reality was both complex and fluid (Callon, 1986).

The flattened perspective afforded by the ANT approach enabled equal value to be placed on human (healthcare workers) and non-human actors (the tools, equipment, patient flow design, audit), referred to by Berg (1997a) as heterogeneous entities. Through tracing how all entities became assembled and enacted allowed for focus on what objects meant and what they did in addition to the action of humans. Drawing on these notions, Berg (1997a) traced the associations between heterogeneous entities when the electronic health record was implemented in one intensive care unit (ICU). He argued that ANT's equal focus on humans and non-humans shows that the work associated with use of formal tools was distributed across a range of heterogeneous entities in the context of the ICU. The translational effect was that entities in the actor-network were held together and (temporarily) stabilised, which produced the effect of knowledge, routines and improvements. Building on this argument, this research traced associations between heterogeneous entities in two organisations and two clinical settings (the ED and acute inpatient setting), that differed in configuration and work practices to each other and contrasted with Berg's ICU setting.

By examining the stages of translation of an actor-network, this research found that in both cases, translation of an actor-network at an executive and corporate level and at the clinical frontline was necessary for the focal actor's problem to be solved. However, despite international and national policy, guidelines and financial incentives, interpretation and implementation of sepsis care improvement differed between the case sites. This is because, the nature of the problem identified by the focal actors differed between case sites. The focal actor at the corporate level in both case sites had significant influence on the interpretation and implementation of external guidelines.

The problem identified by the focal actor had an influence on the *interessement* strategies devised and implemented by staff enrolled into their

actor-network who were tasked with solving the problem(s) each trust faced. At Southside, the problem was focussed on achieving compliance with the CQUIN and behaviour change towards the narrow focus of the CQUIN was employed. At Westside, the problem was focussed on reducing variation in sepsis recognition and treatment. Whilst the sepsis team was required to meet the national CQUIN, the CQUIN in and of itself did not dominate sepsis care improvement work. To solve the problem of variation in sepsis recognition and treatment, the sepsis team employed a range of quality improvement methods which aimed both to change behaviour and also increase understanding of the influence of the context on implementation. The data demonstrate that despite the same external drivers forcing the implementation of the care bundle, *interessement* strategies were aimed at solving the different problems.

According to Latour (2005), to enrol in a network and to take up a new strategy, change needs to be in the interests of the actors involved. This research found that *interessement* strategies were not always successful in enrolling clinical staff into the actor-network and to mobilise them to solve the problem as identified by the focal actor. At Southside, for the Quality Nurses, the tools were indispensable; they had to be completed to solve the problem identified by the focal actor – achieving the CQUIN. However, despite *interessement* strategies aimed at changing the behaviour of healthcare workers, not all staff enrolled in the network completed/used the tools, as this was not in line with their interests.

Dixon-Woods (2019) argued that the unintended consequences of improvement initiatives can occur distally to the target intervention. This is in part because the work of many hands characterises the provision of healthcare (Dixon-Woods and Pronovost, 2016). Patients receive care from different providers, care which is based on a multitude of sources, such as tacit knowledge and evidence-based medicine, which is then often translated into local guidelines and policies. As such, care delivery is conditioned by differences in knowledge, social worlds and occupational cultures (Allen,

2015). In addition, healthcare organisations have less control over the pattern of their work, with healthcare workers having to manage competing demands on their time. Accordingly, there will always be some elements of healthcare work that cannot be controlled by standardised tools. Everyday service provision is characterised by action and knowledge that are distributed across time and space, fragmented and involve multiple understandings of the patient (Mol, 2002). Allen (2015) considered that these factors can have important consequences for healthcare quality and safety. The following section offers a theoretical explanation for these differences and how and why they have an impact on the interpretation, implementation and use of sepsis screening tools and the Sepsis Six care bundle.

8.3 The multiplicity of screening tools and care bundles

The tools were designed to translate complex guidelines into practice and to standardise care. This research found that the tools, as actors in the network, were like a map: fixed and abstract and intended to be a representation of the terrain (clinical practice) (Berg, 1997a). Yet through the eyes of healthcare staff, the tools had different meanings. They occupied a position between several worlds and gathered information that had different meanings to different people (Star and Griesemer, 1989). At the corporate level, the tools could provide evidence for the improvement audits and the CQUIN. For some clinical staff (e.g. the ED Consultant at Southside), the tools were a representation of evidence-based medicine and could reduce variation in the recognition and treatment of sepsis. The Quality Nurses and the ED Consultant at Southside took the position of naïve formalists as described by Star (1995). They exhibited a belief in the *a priori* superiority of the formal tool over the healthcare worker's problem-solving abilities. It was their perspective that the objective nature of the tool would result in implementation; the tools were 'quick and easy' to use, matched ED work practices and would save lives. This position, according to Berg (1997c: 168), means that:

> It is only the resistances that have to be accounted for and dealt with ... the tools are like faithful, objective maps: representations of optimal practice that lead medical personnel towards supreme performance.

Drawing on the conceptualisation of the formal tool being the map and clinical practice being the terrain further explains the gap between the naïve formalist and their opponents. The tools provided a map that aided healthcare workers to recognise and treat sepsis. The notion of the map and terrain is a useful analogy for conceptualising the implementation and use of the tools in clinical practice. The map is the formal tool, abstract and symbolic, a representation. In contrast, the terrain is the work; this is messy and concrete and notably heterogeneous. The terrain is the represented. The formal tool is a representation of clinical guidelines; the terrain is the multiple work settings, patients, healthcare workers and equipment (Star, 1989; Berg, 1997a).

For some healthcare workers (junior staff and those with less exposure to sepsis) the tools did act as a map by coordinating their activity and providing a point of reference and a common language (Star, 1989). These groups of staff were also naïve formalists: they exhibited a belief in the *a priori* superiority of the tools over human skill. Drawing on Akrich's (1992) notion of scripts, analysis of the data found that this interpretation meant that the tools were viewed as an additional voice and an aide-memoir. These staff found the tools to be beneficial in supporting them in the recognition and treatment of sepsis. This finding is echoed by Wadmann et al. (2018), who reported that, for less experienced nurses, standardised procedures contributed to a sense of professional control. These nurses felt they could rely on the tools to provide them with answers, by acting as a 'self-protective coping strategy for junior professionals and helped them deal with feelings of insecurity' (Wadmann et al., 2018: 10). Accordingly, *interessement* strategies aligned with their interests and they were enrolled and mobilised into the focal actor's actor-network. The present research found that when the actor-network was translated, the tools could help to reduce distribution of the heterogeneous

entities in the actor-network by organising the work. The actors in the network pulled together and drift from the original intention of the tool (timely sepsis recognition and treatment) was reduced because healthcare workers were instructed what to do and were supported in escalating patient care to a clinical decision maker.

The introduction of the tools into an existing practice was a process of continual negotiation (Berg, 1997a). The tools contained which clinical signs were relevant or which were not. The initial assessment tool used in the ED at Westside had an inscribed script that portrayed what the relevant elements were, such as instructions to the healthcare worker (e.g. 'provide gown for the patient'). When the tools were implemented, the script was challenged by the heterogeneous elements they affected (Akrich, 1992). For example, the original script of the sepsis screening tool stipulated recording the patient's temperature. However, as discussed in Chapter 5, as a result of a lack of functioning equipment, when completing the tool on the computer the nurse added a temperature she judged as 'close enough', to keep the re-representations flowing between the tool (map) and her work (terrain), to allow her to continue with her work. In addition, some members of the healthcare team chose not to subscribe to the script, and instead interpreted the script as a burden. They did not need a map to guide them, so viewed completion of the tool as an unnecessary addition to their workload and did not use the screening tool, but, rather, depended on their clinical judgement to recognise and treat sepsis.

8.4 Development of clinical judgement

Martin et al. (2013) and Wadmann et al. (2018) found that reliance on standardised tools could limit the development of clinical judgement and had the potential to introduce new risks. This research found that the Critical Care Outreach Team (CCOT), as well as experienced doctors and senior nurses were concerned that the tools were 'tick box' exercises which limited the development of clinical judgement. Proponents of care bundles claim they are

not intended to replace clinical judgement (Dellinger et al., 2004). However, this research has found that whilst clinical judgement evolved over time, contrastingly, the tools were promoted as being 'quick and easy' to use, which contributed towards the impression that screening and treating a patient for sepsis could be distilled into a set of instructions (Berg, 1996).

In this research, adherence to the tools had come to constitute good practice at both case sites. The Early Warning Score (EWS) was used more commonly by acute inpatient staff to identify deteriorating patients and to escalate their care to the CCOT and/or doctors in order to make up for any lack of experience and tacit knowledge healthcare workers may have had of sepsis. Allen (2018: 9) commented:

> they [trigger tools] may also have the unintended consequence of diminishing the importance of their [healthcare staff] interpretative repertoires within the field, [and] professional pattern recognition in detecting deterioration.

This research found that, at an organisational level, at both case sites, there was an expectation that healthcare workers would adhere to standardised tools. This expectation was driven by the CQUIN and the desire for evidence-based medicine. This was coupled with a further expectation that healthcare workers would use the tools in combination with their clinical judgement, in order to be responsive and flexible to the dynamic nature of healthcare work, such as changes in a patient's condition and in service delivery. This reflects the results of McDonald et al.'s (2013) evaluation of the CQUIN framework. As a lever for change, the evaluation found that the schemes were useful in helping commissioners and providers to identify local quality improvement needs. But there was an assumption that CQUINs would change professional behaviour.

Paradoxically, the tools hindered the development of clinical judgement in healthcare workers with less experience of sepsis because they worked in settings where few patients developed sepsis. The effect of the tools was then twofold. (1) Their presence and function in the network reduced the

opportunity for healthcare workers with less exposure to sepsis to develop problem-solving skills. (2) The very nature of the script embedded within the tools was intended to account for a lack of experience by alerting clinical decision makers with experience and knowledge.

This research found that a cycle was evident, whereby the tools were considered a tick-box exercise by senior staff but a useful tool by junior staff. Senior staff commented that junior staff did not have the knowledge and skills to recognise and treat sepsis, yet junior staff had limited opportunity for education and frequently lacked exposure to patients with sepsis. This resulted in junior staff relying on the tools, which was considered by senior staff to be a tick-box approach. As described by Berg's (1997a) the self-contained sphere of the formal tools is an appealing idea but, the fixed formal tool could not capture the eventualities of clinical practice, different patients and competing pressures, and so clinical judgement was needed.

At Westside, the mobile device system calculated the EWS and issued a prompt to consider sepsis when a threshold was met. This again reduced the opportunity for healthcare workers to develop problem-solving skills but potentially reduced drift from the intention behind the tool, that is, to recognise deteriorating patients and escalate their care, and to act as a prompt for the recognition of sepsis. The electronic observations system was introduced at Westside with the intention of reducing error in the calculation of the EWS. Downey et al. (2017: 117) recommended the introduction of automated EWS systems to minimise the risk of error:

> using a handheld computer device to document vital signs can highlight erroneous data, improve accuracy of calculations and prompt escalation. Scores can be accessed remotely, which aids communication between healthcare professionals.

Taking the position of the naïve formalist (Berg, 1997a), for the Quality Nurses, this was not a problem when training nurses how to use the tools. They used language such as 'quick and easy' and the tool will 'save lives'. As such, they took the position that the normative values embedded in the

scripts which defined the tools would account for the eventualities of clinical practice. They took a reductionist, linear, cause-and-effect perspective that the tools when used in practice would save lives, and tasks such as administration of antibiotics would be achieved within an hour. For their opponents, processing input data into output data was a matter of concern, as bridging the gap between the formal tool and clinical practice had to be achieved by the healthcare worker's professional skill. As such, the formal tool will always be limited but the versatility of healthcare workers will account for a tool's shortcomings (Berg, 1997a). The perception here is that the tool and the healthcare worker can bring about change. Drawing on Akrich's (1992) notion of scripts has shown that the multiplicity of interpretations of the tools' scripts can influence whether a healthcare worker enrolled into the actor-network. This has shown that a singular reality of how healthcare staff interpret and use the tools was not the case; rather, multiple realities were enacted which influenced the interpretation, implementation and use of the tools in clinical practice.

8.5 The influence of organisational quality improvement infrastructure

Brewster et al. (2016) identified that a positive impact of a performance management regime was the establishment of formal structures and lines of accountability which provided clarity of goals, responsibility and resource. This research found that there were differences in operational mechanisms enabling each trust to respond to external drivers. Within-case analysis permitted insight into the mechanisms through which organisation-wide strategies operated at the level of individual services. Across-case comparisons enabled key dimensions of organisational strategies that led to successful and unsuccessful implementation of the tools to be identified. For example, an embedded governance structure related to sepsis care improvement and CQUIN reporting had a positive impact on how the sepsis team operated at Westside. The sepsis team was able negotiate the terms of

the CQUIN and innovate, whereas, in contrast, Southside was reliant on the publication of external guidelines to direct its work.

At Westside, sepsis care improvement was reported to a variety of audiences. There were formal reporting mechanisms for sepsis care improvement and CQUIN performance to the board through a hierarchy of multi-professional meetings. Sepsis care improvement formed part of the strategic mission of the organisation. Vaughn et al. (2019) conducted a systematic review of the characteristics of healthcare organisations struggling to improve quality and found that top-performing organisations shared common features. Organisational norms and values which allowed flexibility to adopt initiatives and robust patient safety programmes led by committed individuals were common features. However, for quality improvement to work, the right kinds of organisational and institutional features had to be in place. Whilst it is difficult to directly attribute the use of structured methods of quality improvement and organisational norms and values to the success (or otherwise) of improvement in an organisation, it is likely that the organisation will value quality and safety (Dixon-Woods, 2019). At Westside, the membership of the sepsis group and regular meetings within an organisation with infrastructure for quality improvement and board support allowed flexibility to adopt initiatives and robust patient safety programmes, such as the use of audit and feedback, process mapping and technological innovation.

Conversely, at Southside, in the absence of a sepsis team with clinical and quality improvement expertise, silo working resulted, with a narrow focus on sepsis improvement that was directed towards achieving the CQUIN. This led to reliance on external sources of evidence-based medicine and periods of uncertainty as the external evidence evolved. The systematic review conducted by Vaughn et al. (2019: 76) found that five domains consistently characterised struggling healthcare organisations: poor organisational culture; inadequate infrastructure; lack of cohesive mission and vision; system shocks; and dysfunctional external relations. Prior to fieldwork, Southside as an organisation had experienced a system shock when it was identified as a

'Keogh trust' (Keogh, 2013) and placed in special measures by the CQC. Following a CQC review at the start of fieldwork, the trust was no longer in special measures but the 'requires improvement' status remained. By taking a comparative case study approach, this research offers a theoretical explanation of how and why operational mechanisms resulted in the trusts responding differently to external drivers.

In their research exploring the use of patient safety data in secondary care, Donetto et al. (2019) found that quality improvement is often tied to analysis and improvement of quantifiable indicators such as falls, pressure ulcers and mortality indicators. Reporting on quantifiable indicators in the form of compliance with the CQUIN target was an external requirement at both case sites; soft intelligence from the sharp end of care was not formally required (Martin et al., 2018). By analysing data through the lens of ANT and technology-in-practice, this research contributes towards the debate that there is an ontological difference between local knowledge and managerial knowledge (Yanow, 2014). Reflecting the literature (Donetto et al., 2019, Martin et al., 2018), this research found that the barriers to and facilitators of sepsis care improvement cannot solely be measured by quantifiable indicators. What was recorded and reported as a result of audit at both case sites was not the outcome of a neutral scientific process. Rather, there was a disjuncture between what is known informally and what reaches the status of official knowledge (Waring and Bishop, 2010).

This research found that for an organisation to undertake improvement work outside of the confines of externally driven quantifiable indicators, there needs to be support and engagement from the executive board to develop and sustain a quality improvement infrastructure as well as driven clinical leaders with improvement capability to lead the work. When formal quality improvement processes interacted with *interessement* strategies, this enabled insight into soft intelligence to be captured. In turn, this allowed for an iterative approach to the development of implementation strategies and

organisational learning which connected the actor-network at the corporate level with the actor-network at the clinical frontline.

Conversely, when implementation strategies were developed locally and not formally reported, it did not contribute towards organisational learning. Dixon-Woods and Martin (2016: 192) caution against such localised quality improvement initiatives: 'they may come up with a small fix or workaround that fails to solve the true problems and, in doing so, may introduce new risks'. At Southside, the unreported local activity was part of *interessement* strategies employed by the Quality Nurses; these resulted in localised action in the ED in the form of behaviour change prompts through the nursing hierarchy and forced behaviour change using the computer system. Rather than producing replicable organisational learning for the implementation of the sepsis tools and *interessement* strategies, the activities undertaken by the Quality Nurses in the ED only applied in the context of their origin; they were not value-neutral and they intensified the problem of implementation strategies being specific to a particular workplace (Dixon-Woods and Martin, 2016). For example, behaviour change prompts for the nurses resulted in the tool's scripts being interpreted as a burden and ignored or being seen as a 'tick-box' exercise. In addition, as illustrated in Chapter 5, the action taken by the Quality Nurses and Matron to mandate completion of the screening tools for doctors to admit or discharge patients from the ED was a local task, with the outcome of the assessment not being accessible to healthcare staff continuing the patient care outside of the ED.

Reporting on quantifiable indicators in the form of compliance with the CQUIN target was an external requirement at both case sites. Indeed, CQUIN performance was an attribute of both organisations, which in turn influenced the implementation of sepsis care improvement.

The next section discusses the findings in relation to the influence of financial incentives on implementation of the care bundle.

8.6 The influence of financial incentives

The design of the sepsis screening tools and Sepsis Six care bundle was codified and structured, and the narrow focus of the CQUIN led to an even more bounded representation of sepsis practice, which dominated audit, as the data mandated by the target had to be collected. These audits were done at both case sites. In addition, audit for improvement had been in place for several years at Westside. When the tools were implemented in practice, they afforded a greater transparency, which provided a window through which others could look to judge practice (Berg and Goorman, 1997). Martin et al. (2013) found that surveillance of individual-level clinical behaviour formed a key element of the approaches taken to addressing the problems of quality and safety.

This research found that both organisations used audit as a tool of surveillance. For example, the administration of antibiotics within an hour of recognition of severe sepsis was a CQUIN target. Therefore, this work practice was audited to provide compliance data for the CQUIN. The collection of data for the CQUIN was not a visible re-representation of the empirical world in the tool, which resulted in the context being stripped away. The performative nature of the audit meant that the question 'Have antibiotics been given within an hour?' functioned as an action (Sauder and Espeland, 2006). The 'yes' or 'no' response translated to percentage compliance with the CQUIN. Real-time events were not apparent through the audit process.

Smith (1995) and Brewster at el. (2016) used the term tunnel vision to describe situations where the focus is on performance as measured by the target, at the expense of other, unmeasured aspects of performance. Such tunnel vison was found in this research. However, a finding from the ethnographic fieldwork enabled close examination of the chain of re-representations and revealed local practices that were not visible to the eye of the auditor. The final outcome of the audit was a percentage compliance figure, which was actually the result of a series of decisions and practices

made and implemented within dynamic and often messy networks. Thus, these decisions and practices were eventually translated into quantitative data to calculate performance on a certain indicator. Therefore, the complexities of clinical practice were not captured. However, such valuations were hard, if not impossible, to quantify and capture in an indicator (Wallenburg et al., 2016).

Directive performance management systems have been shown to produce strategic behaviour or 'gaming', as individuals alter the way in which they behave to fulfil expectations (Mannion and Braithwaite, 2012; Wallenburg et al., 2016). This research found that in the case of financial incentives, CQUINs exerted an influence in the actor-network at the corporate level and at the clinical frontline, in the form of pressure to meet targets. The temporal nature of the CQUIN targets generated work and resulted in implementation plans devised to encourage behaviour change towards achieving the target. For example, to prompt behaviour change in nurses, the screening tool was attached to the notes of all patients admitted to 'majors' and 'resus', and there was the option to complete the tool on the computer system.

To force behaviour change in doctors, completion of the screening tool was mandated for doctors seeking to admit a patient to the hospital or discharge a patient from the ED. The terms of the CQUIN did not require that all patients in the ED were screened for sepsis. The action taken there was driven by a need on the part of the Quality Nurse and Matron to achieve the CQUIN. The action was not driven by evidence-based medicine, which specified different selection criteria for screening patients for sepsis. As such, the Quality Nurses and ED Matron duplicated work for ED staff and inadvertently created practices that were stricter than was formally required by the CQUIN. In turn, this strategy resulted in mixed messages about sepsis improvement and the CQUIN, and meant the Quality Nurses had to trawl through multiple sources for the audit. They complicated their own work and were drawn into a vicious cycle of quality control. Wadmann et al. (2018: 2) comment:

> professional groups with differing status and interest can be drawn into a vicious cycle in which their strategies inadvertently drive an escalation of standards and measurement that ultimately complicate their own work.

The findings of this research offer a contribution to the literature that a stable organisation, an embedded governance reporting structure for improvement and a capability in quality improvement approaches underpin robust quality improvement (Dixon-Woods, 2019, Vaughan et al., 2019, Jones et al., 2018).

This section has discussed translation of the two actor-networks, one at the corporate level and the other at the clinical frontline. The notions of map and terrain have been discussed in section 8.3 to illustrate how and why the different interpretations of the tools' scripts by healthcare workers influenced translation of the actor-network as intended by the focal actors. The next section will draw again on the notions of map and terrain to discuss the findings from close examination of the tools in use in clinical practice. The intention is to illustrate how analysis through the lens of ANT and technology-in-practice permitted attention to be paid to the subtle factors that influenced translation of an actor-network in clinical practice.

8.7 Crossing the gap between the map and terrain

Berg (1997a) argued that there is a gap between the map and terrain that must be crossed (see Figure 5, Chapter 3). For example, input data (physiological observations) must be processed into output data (Sepsis Six care bundles). Tracing the associations between humans and non-humans showed that completing the subtasks (e.g. making and recording physiological observations, the prescription and administration of antibiotics) generated the chain of re-representations to cross the gap between the map and terrain, and was influenced by factors in the actor-network that caused the heterogeneous entities to pull together or pull apart.

Advocates of care bundles claim they are a structured way of improving the processes of care and patient outcomes (Institute for Healthcare

Improvement, 2015). Seemingly, their use carries a single answer to a path of action, an optimal path that constitutes the healthcare workers' complex field of action. Therefore, if advocating the care bundle approach, the work of managing a patient's health is reduced to a series of rational, linear, formal steps, and it follows that the problem of variation in healthcare will be solved. Yet throughout fieldwork, it was observed that care delivery was rarely a linear and simple process but dependent on a multitude of factors (Berg, 1997a). There were many distractions in the clinical environment: time pressures, interruptions, the sudden deterioration of patients and varying experience of colleagues, all of which had an impact on the implementation of the tools. Healthcare practice was fluid. Healthcare workers who were expected to adhere to a set of instructions were at the same time expected to be responsive and flexible to the unpredictable nature of patients, colleagues and the environment. Berg (1997b: 1083) describes a 'Clash between the formal image of healthcare practice embedded in a protocol and realities of the social world of healthcare'.

Analysis of the data presented in this thesis has shown that the tools were depicted as a means of distributing evidence-based medicine and reducing variability by standardising work practices. However, following Berg's (1997b) interpretation, there were many reproductions of a situation in which the tools were intended for use. Adherence to the view that a linear process drives the use of tools in clinical practice would lead to a multitude of sociocultural factors that influence implementation being lost, such as workarounds and the different scripts embedded within the tools.

Complex guidelines were abstracted, standardised and simplified in order to create the formal tools that contained heterogeneous but coherent representations (Star, 1989). Accordingly, the tools were considered to be formal tools, as they operated on circumscribed input elements using sets of prefixed criteria (Berg, 1997a). As such, by taking this view, in this research the tools were considered to be fixed, such that they disregarded any practical shape the gathering of input data (physiological observations) might

take. This research found that the work involved in adding the data to the tools was executed differently and was dependent on a multitude of factors.

For example, the criteria for sepsis screening had been decided and embedded within the tool by designers away from the clinical frontline. However, when used in practice, the context and the healthcare workers had an influence on how the data were collected and added to the tools. For example, overcrowding in the ED delayed physiological observations (input data) being recorded on admission to the ED, which in turn delayed sepsis screening. Such rigid criteria did not allow for variability in how patients presented in reality. A further example was at Westside (section 6.5.4), when a patient's EWS was 1. In line with the pre-fixed rules embedded within the mobile device, this meant that an alert or subsequent advice in the form of a prompt to consider sepsis was not generated. In reality, in the absence of an alert for a more experienced healthcare worker and/or clinical decision maker, recognition of the patient's condition was reliant upon the skills of the healthcare worker, which could not be predicted. The tools did not contain rules that fully covered the diverse nature of healthcare workers' differences in experience. This is an important finding that counters the assumption that the tools can invariably be used in a single way despite the varied activity taking place within the actor-networks in which they are implemented.

Berg (1997a) argued that the gap between the map and terrain is crossed in a chain of re-representations and it is through this process that change in practice occurs. As such, the conceptualisation of the tools and workplaces studied in this research as a map and terrain, with the gap between them crossed in a chain of re-representations, blurs the boundaries between the tools, healthcare workers, contexts and equipment (McLean and Hassard, 2004). Re-representations constitute a series of immediate, representational activities performed by materially heterogeneous entities. At each step, according to Berg (1997a: 416):

> input from the territory is condensed, elaborated, repeated and transformed until it matches the abstraction and level of detail of the map.

Berg (1997a) argued that the generative power of formal tools lies not in the tools themselves or the healthcare worker, but instead in the ongoing flow of re-representations in the gap between the map and the terrain. This can be illustrated empirically by taking the example of the measurement and recording of patients' physiological observations either in paper or electronic form. This was the first re-representation and was delegated to non-human actors (blood pressure machine, oxygen saturation probe, thermometer) by the healthcare worker. According to Berg (1997a), the unmediated empirical realm, for example measuring a patient's temperature, was transformed into a number by the thermometer. Considering the case of the taking of a patient's temperature in 'resus' in the ED at Southside, presented in section 5.4.1, the absence of a functioning thermometer had an impact on the chain of re-representations between the tool and the work practices. The thermometer was a crucial part of the network, not just something that may be drawn upon when necessary (Berg, 1997a). To maintain the smooth functioning of the nurse's work in the absence of a key element in the actor-network, a functioning thermometer, she completed the subtask required by the fixed criteria in the tool by adding a temperature she judged to be reasonably accurate based on her clinical skills and experience. She performed the second re-representation by transferring the temperature data onto the electronic sepsis screening tool.

In the case of giving antibiotics in the ED, at both case sites, crossing the gap between the tool and the empirical world involved multiple subtasks that were under the influence of the ebb and flow of the department. The chain of re-representations within the subtasks commenced when the healthcare worker measured and recorded the input data (the patient's physiological observations) and screened for sepsis (with the support of a tool or tacit knowledge). If the patient triggered the Sepsis Six, escalation of care to a

clinical decision maker would be required, so that antibiotics could be prescribed. When the nurse administered the antibiotics and signed the prescription, this represented the time at which the antibiotics had been given.

As presented in Chapters 5 and 6, the work was highly distributed across the dynamic terrain of the ED. The tools contained criteria that turned input data (physiological observations) into output data (administer the Sepsis Six). However, when audited, the recorded temperature and the signature to indicate the antibiotics had been given occurred at a time that had passed, rendering the re-representation on the tool a snapshot of a time that could not be revisited nor captured through the fixed criteria of the audit tools. In both these examples, the goal for the agents performing the tasks was to maintain the flow through the chains of re-representations as they worked to fit the patient into the pre-defined criteria of the map. As such, it was the sum of all the parts that became the accuracy of the re-representation (Star, 1989).

A feature of a formal tool is that all possible outputs must be feasible in the practice in which the tool functions (Berg, 1997a). However, taking sepsis tools as an example, in the acute inpatient settings not all staff had the clinical skills required to prescribe and deliver the Sepsis Six. Berg (1997c: 91) argued that: 'the tools require many of the diverse elements constituting the medical practices to behave in a uniform, stable and predictable way'. The tools' scripts aligned with the structured organisational routines in the ED more at Westside than at Southside due to the combination of patient flow and the initial assessment tool. In acute inpatient areas, the script did not always fit in with the less ordered organisational routine. As demonstrated in the data, the requirements of the screening tool and the Sepsis Six care bundle could not always be met. For example, insertion of a cannula was less distributed in the ED than in acute inpatient areas. Therefore, local practices need to be configured and aligned to allow for the scripts to be translated (Latour, 2005). Consideration of the specific contexts was not built into the tools; they were

fixed, regardless of the site of implementation. Inevitably, this was found to have an impact on the translation of the tools' scripts, for example that antibiotics should be given within an hour of recognition of severe sepsis.

By taking a sociotechnical approach, human and non-human actors were traced, which allowed for the heterogeneous entities to be distinguished from each other. Analysis showed that it was not just the tools that shaped the implementation of the care bundle and CQUIN performance, but also the availability of healthcare workers and equipment. Close examination of humans and non-humans in the ED and acute inpatient settings produced the finding that routine working practices related to use of the tools were more widely distributed across heterogeneous entities in the acute inpatient setting than in the ED. Yet the tools were intended to be used in the same way, regardless of the location they were used in. Accordingly, this led to occasions when the network pulled apart and also led to drift from the tool's original intention.

Taking the escalation of patient care to a clinical decision maker as an example, in the ED, healthcare workers worked side by side, whereas in the acute inpatient setting clinical decision makers worked across multiple clinical locations. A finding from this research is that when the actors were in closer proximity, the degree of distribution was reduced. This prevented the heterogeneous entities pulling apart consequently reduced drift from the original intention of the tools. When healthcare workers with tacit knowledge and standardised tools were in close proximity, contextual factors, such as an increase in the volume of patients and missing equipment, could result in the heterogeneous entities pulling apart and hinder the alignment of actor-network required to implement standardised tools. These factors were found to introduce conditions where distribution and drift increased. Therefore, this research has found that the proximity of actors in the networks played a part in the implementation of the tools.

8.8 The influence of technological innovation

Technological innovation had an impact on how actors in the network outside of the ED could be connected. At Southside, to escalate patient care to a clinical decision maker, the nurse had to contact them via the hospital bleep system. If the clinical decision maker was able to access a computer, they were able to view the patient's notes and blood results remotely in order to prioritise their workload. At Westside, the electronic observation system issued an automated alert to a clinical decision maker. The mobile device which received that alert enabled the clinical decision maker to view the patient's physiological observations remotely. However, the temporal dimension of the computer-based observations was crucial to the patient's illness trajectory; data items needed to be constantly reinterpreted and reconstructed. As Berg and Goorman (1999: 55) commented:

> Medical information is not a timeless collection of unchangeable entities that retain their essence once captured in a record.... Data are tied to the purpose of their generation and they are part of an evolving array of medical data which constantly shapes their meaning.

In the case of the junior doctor at Westside who managed the multiple alerts she received, a reactive response was required. To enable her to prioritise and manage her workload rather than respond to every alert (as intended by the designers), she acted pragmatically. In Berg's terms, she had to 'react to topically salient events – to respond to cues that happen to be at hand' (Berg, 1997b: 135). To do this, she traced back divergent lines that required tacit knowledge and problem-solving skills. She considered the alert in the context of the patient: if she knew the patient well, had just treated them or if their EWS had changed significantly from the previous alert. The mobile device system helped to align the networks required to recognise and treat sepsis in acute inpatient areas by alerting decision makers and senior staff, who might be working remotely from the patient. In turn, the proximity of decision makers to the healthcare staff, despite not being physically located in the same clinical area, was increased. The process was distributed across a range

of heterogeneous entities, the outcome of which was emergent and had to be adapted to be responsive to the dynamic nature of frontline clinical care.

The literature review (Chapter 2) highlighted that change initiatives predicated on linear behaviour change models often create difficulties in the implementation of those initiatives, and that inevitably generate unintended consequences, along with any benefits that they bring (Braithwaite and Coiera, 2010). Therefore, understanding the generative mechanisms of tools and their unintended consequences requires analysis of the relationship between the tool and practices without exclusively attributing agency to the tool or the humans working with it (Allen, 2009). As Chapters 5 and 6 illustrated, conceptualising the sepsis tools and working practices as the map and terrain and the gap between them being crossed by a chain of re-representations has permitted the close examination of what occurred in the real-time use of the tools in practice. Rather than a series of rational steps, there were multiple subtasks which were widely distributed across heterogeneous entities and which comprised activities such as work-arounds that required problem-solving skills. Drift from the original intention of the tools occurred as healthcare workers condensed the messy complex world of practice into the fixed, rigid and static criteria of the tools, and when the actors involved in the network were widely distributed.

8.9 Contributions to implementation science

This research offers two contributions to implementation science. Firstly, by tracing the associations of heterogeneous entities, this research found that two actor-networks were simultaneously translated for the care bundle to be used. One actor-network operated at the executive and corporate level, as external guidelines were interpreted and implementation strategies designed; the other occurred when the tools were interpreted and used at the clinical frontline. The organisation's governance reporting structures, engagement in quality improvement and quality improvement capability had an influence on the interpretation of external drivers. In turn, this had an influence on the

focal actors' problematisation of external drivers and the design of implementation plans by corporate teams.

At the clinical frontline, some healthcare workers were enrolled in the actor-network to solve the focal actor's problem, but others were not. Translation of the focal actor's network to solve the problem was dependent on a number of factors and so was linked to the multiplicity of interpretations of the tool. If the healthcare worker was a naïve formalist, they viewed the tools as an additional voice and aide-memoir and used them. As such, the actor-network to solve the focal actor's problem was translated. If the healthcare worker considered the tools to be a 'tick-box' exercise as they had the clinical knowledge to recognise and treat sepsis, they viewed the tools as a burden and did not complete them. If sepsis was recognised (with the support of a tool or tacit knowledge), translation of the actor-network at the clinical frontline to administer the Sepsis Six care bundle within an hour (as was the original intention of the tools' designers) was influenced by a number of factors. Screening a patient for sepsis and delivering the Sepsis Six was only partially attributable to the tools. By foregrounding the tools as 'quick and easy' to use and having the potential to 'save lives' rendered invisible the use of tacit knowledge to problem solve and manage the multiple distractions of the clinical setting that contributed to the timely recognition and treatment of sepsis.

The proximity of patients, healthcare workers and equipment influenced the degree of distribution. When the actors worked in close proximity (as in the ED) distribution was reduced, which prevented the actors from pulling apart and producing a drift from the original intention of the tool. Outside of the ED, when patients, healthcare workers and equipment were located in one inpatient setting and the clinical decision maker was located in another, distribution increased and the actor-network had a tendency to pull apart. This could result in a drift from the original intention. Despite actors working in close proximity either in the ED or when it occurred in the inpatient setting, the clinical work which characterised the setting (sudden deterioration of

patients, increased volume of patients, attending to the personal care of patients, speaking with families) could increase distribution and result in drift.

The empirical findings offer a contribution to the implementation science literature by taking into account the socio-material infrastructure. Exploring the role that non-humans played (the tools, equipment, design of patient flow, technical innovation), this research has responded to Allen's call (2017) and paid attention to a dimension of context not taken into account by quality improvement initiatives aimed at behaviour change. As argued by Berg (1997a) and Allen (2009), the tools did not slip into a predefined space in the workplace.

Building on these insights, I argue that, to address the replicability problem in the NHS (Horton et al., 2019), consideration of interpretation of the tools' scripts should be given, from the executive board to the clinical frontline. Interpretation of the script was consequential for implementation at the corporate level and the clinical frontline. Understanding the relationship between interpretation of the script and the impact on development of implementation strategies (corporate level) and organisation of work (clinical frontline) allows for relevant questions to be asked from both perspectives about how the tools transformed the overall task, in this case the timely recognition and treatment of sepsis. These questions are important for implementation science, as acknowledging the different interpretations opens up the possibility of analysing the impact. This can then be built into implementation strategies and balancing measures can be integrated into the design of the tools, in a way that is sensitive to the situated work setting (Berg, 1997a).

In addition, the socio-material infrastructure into which the tools were introduced influenced the distribution of tasks (in this case, screening a patient for sepsis and administration of antibiotics in an overcrowded ED, or a junior doctor covering several acute inpatient settings). Implementation strategies intended to effect behaviour change will not allow for close

examination of the subtasks involved in undertaking the activities, in the present context taking a patient's temperature or prioritising multiple alerts received when a patient's EWS meets the pre-fixed criteria in the mobile device. The conceptual framework applied in this research has permitted an understanding of the relationships between the heterogeneous entities in the actor-network. As Berg (1997a) argued, introduction of the tools did require negotiation with existing heterogeneous entities, which held together (and pulled apart), affecting stability of the actor-network. This research found that, as a result of the heterogeneous entities being caught in cross-cutting networks that characterised the routine working practices of a clinical setting, entities could pull apart and use of the tools could drift from their original intention (Berg, 1997a, Allen, 2009). This conceptual understanding is useful for implementation science, as it provides an explanation for why evidence-based interventions are not always replicated from one setting to another (Dixon-Woods, 2019).

The second contribution offered to implementation science comes from viewing sepsis screening tools and the Sepsis Six care bundle as a formal tools. This research found that the fixed and rigid criteria inherent in the tools did not take account of the characteristics found within different clinical settings. As such, audit alone of compliance with care bundle implementation for external and internal purposes was unable to capture the intricate subtasks required for their use in clinical practice. Governance reporting structures, from the executive board to the clinical frontline, and quality improvement capability to understand the influence of context on implementation, in addition to quantifiable measures of compliance, allowed this to be captured. The findings of this research suggest that financial incentives can shape implementation strategies towards the narrow focus of the CQUIN target. This results in a drift from the notion of evidence-based practice which underpins the design of the tools. This drift can be reduced by a quality improvement and governance infrastructure that supports and enables improvement outside of financial targets.

The view that audit tools and audit data were actors in the network offers useful insights for implementation science. This research found that the audit results were, as Berg and Goorman (1999) argued, a 'commodity' that could be shared and transferred. This perspective was actioned differently at each case site. At Southside, compliance with the CQUIN was viewed an attribute of the organisation (Allen, 2009) so implementation plans were dominated by the requirement for the tools to be completed but did not always reflect the realities of clinical practice. In addition, this led to a reliance on implementation strategies that, as Aveling et al. (2015) found, pertained to blame and isolating individuals in the hope that getting them to change would improve compliance with the CQUIN. At Westside, improvement was not dominated by compliance with the CQUIN and there was recognition that information was entangled with its production (Berg and Goorman, 1999). Accordingly, implementation strategies were designed to include methods (process mapping) that did not presume the operation of 'rational linear processes' (Allen, 2009: 473).

8.10 Theoretical contributions to ANT and technology-in-practice

This research offers two contributions to ANT and technology-in-practice. This first relates to Berg's (1997a) application of concepts from ANT and technology-in-practice that underpin the conceptual framework applied in this research. By undertaking an ethnography, Berg (1997a) explored the implementation of the electronic health record at one Intensive Care Unit (ICU). He paid attention to how the social structures in the ICU influenced the implementation of a formal tool and queried how formal tools actually worked in practice, by observing the intertwinement of a formal tool and practice in real time. He used the notions of distribution and drift to explain what the interrelation between the tool and clinical practice looked like when the tools were in use and argued that the generative power arose from the interrelations of the tools and the healthcare workers and was not solely attributed to the tool alone or the healthcare workers alone.

This research offers further application of ANT and technology-in-practice to increase understanding of the implementation of standardised tools in two organisations and two clinical contexts: the ED and the acute inpatient setting. The organisations and clinical contexts differed in configuration and work practices to each other and to Berg's ICU example. The case study approach enabled the application of the conceptual framework to show how the characteristics of two different organisations influenced the interpretation and implementation of formal tools, and how two different clinical settings influenced the interrelation between the tools and clinical practice. This research demonstrated empirically how and why the social structures of two different organisations and two different clinical settings influenced interpretation, implementation and use of standardised tools in healthcare.

The second contribution to knowledge relates to Akrich's (1992) notion of scripts. This research has explained that the sepsis screening tools and the Sepsis Six care bundle were interpreted in different ways than was originally intended by the designers. The meaning attributed to the tools had an impact on development of implementation strategies and their use in clinical practice. Applying the notion of scripts to the implementation of standardised formal tools has contributed towards ANT and technology-in-practice by demonstrating how an empirical application of the notion of scripts can help to explain technologies-in-use.

8.11 Conclusion

Care bundles can be viewed as a magic bullet which will solve the problem of variation in healthcare delivery by translating evidence-based guidelines into practice and which will make care processes visible for external surveillance (Dixon-Woods and Martin, 2016). The conceptual framework used in this research has permitted a more nuanced perspective on the interpretation of external drivers, implementation and use in clinical practice of standardised tools in healthcare. By taking an ANT and technology-in-practice approach, this research contributes to the body of work that separates a quality

improvement intervention from its context, to understand how and why the dynamic interplay between the intervention and its context influences implementation. Drawing on concepts from ANT and technology-in-practice, the findings provide a theoretically informed explanation of how and why the two actor-networks identified in this research can be connected by embedded governance reporting structures, from the executive board to the clinical frontline, and by quality improvement methods. This allows a better understanding of the influence of context on interpretation, implementation and use in clinical practice of standardised tools in healthcare.

Chapter 9: Conclusion

The final chapter will conclude the thesis. A brief overview of the research is provided, followed by the implications for practice. The strengths and methodological limitations of the research will be recognised and suggestions for future research.

9.1 Overview of the research

This research has applied theoretical concepts from ANT and technology-in-practice to research the implementation of sepsis screening tools and the Sepsis Six care bundle. Sepsis is a high-profile and current healthcare issue, where improvement initiatives are driven by evidence-based medicine translated into screening tools and the Sepsis Six care bundle and implementation is incentivised by financial incentives. As such, they offered a useful example to answer the research questions. The ethnographic methodology allowed for exploration of interpretation, implementation and use of the tools from the perspective of key stakeholders, from the executive board to the clinical frontline. The multi-site case study approach enabled application of the conceptual framework to understand how the characteristics of two different organisations influenced the implementation of screening tools and a care bundle. Replicating quality improvement is a long-standing issue, so the selection of two different organisations with embedded units of analysis offered interesting and appropriate case sites for this research. This methodological and theoretical approach offered new insights into implementation science and Science and Technology Studies. The conceptual tools contributed towards a better analytical grasp of the workings and failings of formal tools in work practices (Berg, 1997a).

9.2 Implications for practice

Healthcare systems are complex, and are challenged internally and externally by political, technical, professional and social influences. As a result of this complexity but also the poor theoretical underpinning of implementation activities, it can be difficult to understand and explain why some implementation efforts succeed while others fail (Dixon-Woods et al., 2013; Davidoff et al., 2015; Nilsen, 2015). This research offers a theoretical explanation for these persistent issues by providing insight into why implementation strategies are successful in one setting but not another, or even in the same setting.

9.2.1 Theory-driven improvement methods

Balancing the competing pressures of delivering a healthcare service with building awareness of quality improvement approaches and capacity to deliver quality improvement is a challenge (Dixon-Woods, 2019). The sepsis tools met the needs of the case sites for standardisation, evidence for the CQUIN and for the purpose of audit, and also provided transparency of care; nevertheless, they were used differently, depending on how the healthcare worker interpreted their script (Akrich, 1992). There was no singular interpretation of the tools. Instead, there were a multiplicity of interpretations. The tools were seen as useful for directing and escalating care, and some healthcare workers appreciated the tools as prompts for action. For other groups of healthcare workers, the tools' highly codified and structured content was interpreted as being insufficiently flexible, limiting use of clinical judgement and encouraging a tick-box approach which was inadequate for the purposes of patient assessment. This undermined their usefulness and utility.

The consequence was that the tool was not completed and evidence for the CQUIN not provided. Rather than being a 'quick and easy' tool to use to reduce variation in sepsis recognition and management, they added a layer of paperwork to the increasing degree of documentation that had to be

completed. However, when the screening tool was embedded within established work practices, as was the case with the initial assessment tool used in the ED and electronic physiological observations at Westside (Chapter 6), screening occurred without 'additional work' either as a result of accepted practices or technological innovation.

Automated screening can mitigate the risks associated with paper screening, in the present context by screening the patient automatically and sending an automated prompt to doctors if the Sepsis Six care bundle was triggered (Bhattacharjee et al., 2017). The mobile device system in use at Westside helped to align the networks required to recognise and treat sepsis in acute inpatient areas by alerting decision makers and senior staff who may have been working remotely from the patient. This research shows that automated screening and alert systems can reduce the distribution of the actors and reduce drift from the original intention of the tools. However, the process was distributed across a range of heterogeneous entities, the outcome of which was emergent and had to be adapted by the decision maker using problem-solving skills responsive to the dynamic nature of frontline clinical care.

The way that implementation teams interpreted the tools' scripts influenced their implementation strategies. If staff took the position of a naïve formalist, the tools were considered to be superior to the healthcare worker's skill. There was a belief that the tools were simple, quick and easy to use. These staff believed that the tools would work as intended. Reflecting this belief, implementation strategies included actions aimed at changing the behaviour of healthcare workers, and brief updates, posters and prompt cards were the chosen methods of updating staff when the tools changed in response to external guidelines. The notion that the tools were 'quick and easy' to use focussed on the end state: the patient had or had not triggered the Sepsis Six.

Yet viewing formal tools as a map and clinical practice as a terrain, with the gap between the two crossed in a series of subtasks, showed that the multiple subtasks could be influenced by the actors in the network they were part of.

The clinical settings were different, however, and the tools, as fixed formal tools, were used differently in response to changes in the network. As such, there as a blind spot to the complexities of the context, to the inefficiencies and problems, to the reasons why healthcare workers either did or did not administer antibiotics within an hour.

Standardised procedures and tools have been identified as an effective means by which nurses can refer deteriorating patients to doctors. Standardisation enabled nurses to obtain a sense of security and to cope with complex work tasks, provided a concise and unambiguous means of communication and contributed to a sense of professional control by empowering nurses to seek medical assistance (Downey et al., 2017; Wadman et al., 2018). When completed by healthcare workers, the standardised tools influenced interprofessional relationships by acting as an additional voice and aide-memoire for junior healthcare staff and/or healthcare staff who had had little previous experience of patients with sepsis. As healthcare workers became more experienced, the tool's script was interpreted as a burden. Applying the concept of actor-networks explained the differences in clinical settings that contributed towards healthcare workers developing either clinical knowledge or a reliance on standardised tools. Work practices differed between clinical settings. For example, the work in the ED was directed towards the recognition and treatment of acute illness. The tools were repeatedly used in the ED as healthcare staff were frequently exposed to patients with suspected sepsis. Over time, healthcare workers developed a certain set of skills, knowledge and experience. In the acute inpatient setting, work practices were directed towards the recognition and treatment of acute illness but also included a diverse range of other clinical activities. Coupled with a lack of exposure to sepsis and use of sepsis screening tools, this hindered the acquisition of skills, knowledge and experience to recognise and treat sepsis, or escalate care.

Drawing on ANT and technology-in-practice enabled an understanding of the differences in work practices between the ED and acute inpatient setting. The

implication for practice is that, as a result of the subtasks and the influence of the network, formal tools will be used differently in response to changes in the network. For example, using the tool in the ED was different from using it in the acute inpatient setting. Quality improvement methods such as process mapping revealed work practices that informed implementation strategies outside of the confines of behaviour change driven in response to audit and financial targets. Accordingly, implementation strategies can account for these differences, for example by recognising the need to develop bespoke and targeted education interventions to support the enrolment of different clinical groups in different clinical settings.

9.2.2 Executive board support and quality improvement infrastructure

The best-performing healthcare organisations have been found to share common characteristics (Vaughn et al., 2019). Structured methods of continuous quality improvement and organisational norms and values that allow the flexibility to adopt initiatives and robust patient safety programmes led by committed individuals are such common features (Dixon-Woods, 2019; Vaughn et al., 2019). By taking a comparative case study approach and using sepsis improvement as an example, this research makes a contribution to understanding the factors that create conditions for an organisation to be high performing. An improvement team that was multi-professional, with clinical and quality improvement expertise, and that reported through an embedded governance structure for the CQUIN, as well as improvement work being conducted outside of the CQUIN targets, all resulted in internal experts interpreting external evidence-based guidelines and adapting it for local use using quality improvement methodology. Conversely, teams with limited clinical and quality improvement expertise and silo working resulted and with a narrow focus towards improvement (in this case directed solely towards achieving the CQUIN target). These factors led to a reliance on external sources of evidence-based medicine, periods of uncertainty as the external evidence evolved and changed, and work that was directed towards behaviour change to meet the CQUIN targets. For an organisation to

undertake improvement work outside of the confines of externally driven quantifiable indicators, there needs to be support and engagement from the executive board to develop and sustain a quality improvement infrastructure as well as driven clinical leaders with improvement capability.

The findings contribute towards an understanding of the mechanisms by which improvement programmes may work in one clinical setting but fail to be replicated in another. In summary, the following conditions influenced and stabilised the actor-network and reduced distribution and drift from the original intentions of sepsis screening tools and the Sepsis Six care bundle:

- Healthcare workers enrolled in the actor-network and completed the tools to solve the problem as identified by the focal actor.
- Healthcare workers had clinical knowledge relevant to the tool (supported by the tool itself or tacit knowledge) *and* worked alongside each other so patient care could be readily escalated to a clinical decision maker.
- Healthcare workers were connected with technology (electronic observations and sepsis prompts embedded in a mobile device) when in different clinical settings.
- Healthcare staff had the clinical skills (e.g. taking blood and inserting an intravenous cannula) required by the standardised tool.

This research found that the actor-network became unstable and pulled apart, which increased distribution and drift from sepsis screening tools and the Sepsis Six care bundle's original intentions, in the following conditions:

- Distractions and competing pressures characterised the clinical setting, such as sudden change in a patient's condition, increased volume of patients, supporting colleagues, speaking with relatives, attending to patients' dietary, toileting and hygiene needs, documentation and giving medications.

- Healthcare workers had clinical knowledge relevant to the tool (supported by the tool itself or tacit knowledge) but worked apart from each other, often in different clinical settings, which caused a delay in escalation of patient care to a clinical decision maker.
- The number of healthcare staff in a clinical setting with the relevant clinical skills (e.g. taking blood and inserting an intravenous cannula) was below that required by the standardised tool.

9.2.3 Association with a financial incentive

Within healthcare, national and local reports and inquiries continue to describe failings in care delivery (Francis, 2013; Kirkup, 2015). A huge amount of time is invested in collecting data to offer assurance that policies are adhered to and steps have been taken to improve patient safety and service quality. Such activities are often undertaken to demonstrate compliance with a financial target. The very nature of financial indicators means that they draw attention to what can be measured and define cut-off points for what constitutes compliance, which displaces important but unmeasured aspects of performance (Smith, 1995; Hood, 2006; Mannion and Braithwaite, 2012; Brewster et al., 2016; Wallenburg et al., 2016; Franco- Santos and Otley, 2018; Dixon-Woods, 2019).

The CQUIN audit led to a bounded representation of practice, which meant that the association of the tools with a CQUIN resulted in a narrow focus that aligned with the predefined criteria of the targets. The outcome measure of compliance with the target was distal; the chains of re-representations which contained workarounds to address the complexities and inefficiencies of work practices that healthcare workers had to confront were not visible. The focus on compliance data deleted useful knowledge for maintenance and spread of implementation. The implication for practice is that the association of a financial incentive with the implementation of a standardised tool seemingly reinforces the linear ‘easy’/‘just do it’ message of implementation, rather

than acknowledging the messy, complex, multi-actor work that is actually required.

9.3 Methodological strengths

This research allowed insights into the interpretation, implementation and use of standardised tools in secondary care in the NHS. The ethnographic methodology was well suited to studying the complexity. It allowed me to zoom in and out to capture the whole picture as the external drivers were interpreted, implementation strategies designed and the tools were used in clinical practice. Accordingly, I achieved a comprehensive picture, from the executive board to the clinical frontline, without neglecting the subtle factors of the tools in use or the more overarching external and organisational factors, as well as the relationships between these.

Other strengths of the study include the time spent at each case site. This was sufficient to allow me to immerse myself in the case sites in contexts from the executive board to the clinical frontline and contributed to a nuanced insight of the local interpretation, implementation and use in clinical practice of the sepsis screening tool and Sepsis Six care bundle. The theoretical approach to the design, data collection and analysis allowed the key actors to be traced and the two actor-networks and relationships between them to be identified. The theoretically-based methodology may now be applied to other settings.

9.4 Methodological limitations

This research has offered new insights into the implementation of standardised tools in the healthcare setting. Defining the networks did present challenges. Across the two case sites there were multiple actors involved in the implementation and use of the tools, and this presented some methodological challenges. Westside particularly was a large organisation with many clinical settings and an extensive infrastructure and governance for quality improvement and assurance. Moreover, during fieldwork, sepsis was receiving political and media attention and evidence-based practice was

developed and updated. As a result, the field was extremely dynamic and the opportunity to generate data was potentially limitless. Regular meetings with my supervisory team and the research questions guided rigorous and pragmatic decisions on where to start and stop data collection.

Studying two complex systems presented some conceptual challenges. Taking an ethnographic methodological approach, I intended to tell the story of my interpretations of the field as experienced by various participants. Despite taking steps in the research design to put boundaries around fieldwork through the selection of embedded units of analysis, I focussed on particular issues that I found pertinent and interesting whilst neglecting others. The decision to shadow healthcare workers whose responsibility it was to respond to referrals of deteriorating patients was informed by the literature, preliminary observations to 'set the scene' at each case site, professional experience and an awareness of the time available for fieldwork over the course of the PhD. However, by not basing myself on an inpatient setting I may have missed useful insights prior to the arrival of the clinical decision maker. Nevertheless, shadowing the clinical decision makers did involve periods of time observing activity in the inpatient setting when they were assessing patients. One such occasion is presented as a snapshot in section 5.4.2. I acknowledge that my narrative presents a snapshot of a particular time and particular places. In relation to the clinical context, for example, my focus on secondary care may mean that my findings lack transferability to other contexts, such as primary care. However, it was beyond the scope of this research to explore the implementation of care bundles in other settings. Further research could explore if and how social practices in different clinical specialties influence the use of standardised tools.

Related to the conceptual challenge of capturing a moment in time and place is that ANT does not conceptualise networks as relatively stable associations between entities. Rather, ANT sees the actions of networks as effects of sociotechnical interactions, not *a priori* facts. As such, observations in the field were not stable and indisputable, but empirical realities which were the

temporary effects of the sociotechnical process of translation (Callon, 1986; Sarker et al., 2006). However, the goal of this research was not to provide an account that is considered to be the definitive truth and transferable to other settings, but to provide an inductively derived account to better understand implementation of care bundles in secondary care.

As advocated by Yin (2018), to increase the generalisability of the findings, a comparative case study approach was used. A limitation of the study design was the selection of only two case sites; a wider understanding of the interpretation, implementation and use of care bundles might have emerged with the addition of further case sites. Chapter 4 explained that the cases were selected because they predicted both similar and contrasting results for anticipated reasons. In addition, the use of embedded units of analysis added to the wider understanding of the phenomena under study. The screening tool and Sepsis Six, as contextual examples of standardised formal tools, yielded interesting findings. However, at the time of fieldwork, sepsis care was under the influence of financial targets, evidence-based practice, political and media interest, all of which had an impact on the implementation of the tools. This means that the findings cannot be generalised to formal tools that are not under the influence such external and high-profile drivers. In addition, the CQUIN was a financial driver unique to the English NHS. Whilst sepsis care improvement is driven by financial incentives in the healthcare systems of other countries, the targets differ. This may limit the generalisability of the results to a contextual setting other than the English NHS. Future research into formal tools not under such influences using the same methodological, conceptual and analytical approach would offer additional insights.

9.5 Final reflections

In conclusion, this research provides valuable insights how organisations in secondary care interpret and implement standardised tools and how they are used in clinical practice. Undertaking this PhD followed a 20-year career as a nurse in the NHS and built on and fuelled my passion for studying the

implementation of quality improvement to deliver the safest possible care to patients. It is hoped that this research will provide the grounding for further study for me to continue my passion as an Implementation Scientist and Registered Nurse.

Re-submission note

On 18th May 2020 I commenced at Nottingham University Hospitals (NUH) in an 8a part-time post as Clinical Academic in Patient Safety Implementation. To maintain close links with the University I continue to work part-time as a Research Associate in Nottingham University Business School. One project at NUH, under the academic leadership of Professor Carl Macrae, is undertaking an evaluation of the implementation of the National Early Warning Score. The theoretically-based methodology applied in this research is providing grounding for further study on the role that tools play in the implementation of evidence-based interventions in healthcare.

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Appendix I. Journey from nurse to doctoral researcher

In the development of this work to date I have become an integral part of the study myself. The NHS is a complex environment that is under constant change, but it is also an environment that I am very familiar with, having worked as a nurse in a variety of roles for 25 years. My interest in the field of quality improvement stems from a number of perspectives. When working as a Practice Development Nurse responsible for implementing change across an organisation, behaviour of healthcare workers was frequently a barrier to change and certainly to its sustainment. I became fascinated with individuals' drivers for change and what in a complex clinical environment strengthens and reaffirms the underpinning culture. In addition, when working as a bank nurse, I am aware that change initiatives driven by external drivers are often not understood and seen merely as a 'tick-box' exercise undertaken as part of the routine. As I work across a trust, it is apparent that the context regarding clinician engagement has an impact on why some wards embrace change and other resist it.

Whilst in post as a Nursing Lecturer on undergraduate courses I saw an advertisement for a Health Foundation PhD. This seemed an ideal opportunity for me draw together my clinical and practice development experience and expand my understanding of Improvement Science in order to explore my observations in this field further. The project was open, so, given my background in Acute and Critical Care and recent reports related to inadequate care, I chose the implementation of a sepsis care bundle as the focus for my study. In October 2014 I commenced my doctoral studies.

At the outset of this PhD, I knew little about Improvement Science but, based on my curiosity as a Practice Development Nurse, I was excited to explore more complex methods of quality improvement. From the beginning I was guided towards considering the sepsis care bundle as an example, rather than

the main focus of my work, and to consider the sociological literature in order to develop a theoretical framework that could be explored over the three years. At an early stage, I took the opportunity reflect upon my own ideas regarding quality improvement.

January 2015

As a nurse who has experienced the NHS over two decades, how do I interpret quality improvement and standardised care? Reflecting back on my time as a Practice Development Nurse, for some of which I did not work clinically, I became blind to some of the issues facing frontline clinical teams. I would plan the implementation of a new policy using the Plan, Do, Study, Act cycle, engaging the Senior Nurses and gaining some feedback from clinical teams before progressing with implementation. In this role I attended organisational meetings and gained an understanding of the wider external drivers. As a result, this became my focus and justification for another change in practice. I understood the financial and reputational consequences of failure to the trust.

Once back in practice as a bank nurse, from a professional and personal perspective I do not question the importance of quality care on every occasion; this simply is my goal as I leave home for a clinical shift. The nature of my work involves a diversity of patients, a demanding fast pace and a large volume of paperwork balanced against often difficult communication challenges, including the provision of information and frequently emotional support to distressed patients and families. Can this work be standardised and measured? Perhaps my criteria for quality care cannot always be standardised and captured in a quality metric? For me, as a registered nurse, providing safe and quality care equates to prioritising my workload in order to provide care to those patients I am responsible for. However, in many instances there is an underlying anxiety regarding the paperwork to be completed that influences my prioritisation, perhaps resulting in the prioritisation of more organisational goals than of professional aspirations. Reflecting on this, I ask myself, when

did this underlying anxiety creep in? How, as a Practice Development Nurse, did my focus shift? Was it a simple case of no longer walking in the shoes of a frontline nurse?

Postscript, January 2019

As I bring my study to a close and reflect on the demanding process of recounting my findings and interpretations, I am struck by the shift in the level of my thinking. Four years ago, my view of quality improvement, quality metrics and standardisation was drawn from very personal and practical experiences. Now I take the view that there are multiple perceptions of quality improvement. Staff in organisations are under the influence of external drivers and internal motivations that influence the implementation of tools. Some staff are not engaged or aware of tools, whilst other are focussed and driven to ensure tools are complied with. In the words of the late Professor Bob Wears, ‘nothing is impossible to the man who doesn’t have to do it himself’.

Appendix II. Ethics approval letter

Nottingham University Business School

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16th November 2015

To whom it may concern,

RE: Understanding clinician's interactions and use of structured improvement
Chief Investigator: Dr Stephen Timmons
Co-Investigators: Ms Charlotte Overton, Professor Justin Waring
UoN Sponsor Reference: 15091 NUBS REC reference: 201516005

I am writing as chair of the Nottingham University Business School Research Ethics Committee (NUBS REC) to confirm a favourable ethical opinion for the above research on the basis of the documentation submitted below. This opinion was given on 4th November 2015.

The School REC operates according to the University of Nottingham's *Code of Research Conduct and Research Ethics,* and the Economic and Social Research Council (ESRC) *Framework for Research Ethics.*

The documents reviewed and approved are:

Document Name:	Version No:	Date
Consent form	1.0	12/10/15
Covering Letter & e-mail - Trust 1	1.0	12/10/15
Covering Letter & e-mail – Trust 2	1.0	12/10/15
Information Sheet – Trust 1	1.0	12/10/15
Information Sheet – Trust 2	1.0	12/10/15
Interview questions topic guide	1.0	12/10/15
Poster Service User	1.0	12/10/15
Poster Non-Service Users – Trust 1	1.0	12/10/15
Poster Non-Service Users – Trust 2	1.0	12/10/15
NUBS REC Ethics Review Checklist	1.0	16/10/15
NHS RD Form	1.0	12/10/15
Protocol	1.0	12/10/15

The following conditions apply to this favourable opinion:

1. Management permission ("R&D approval") must be obtained from each host organisation prior to the start of the study at the site concerned.
2. The research must follow the protocol agreed and any changes will require prior NUBS REC approval.
3. The appropriate NUBS REC documentation must be completed at the end of the research project.

For further information about the School's Research Ethics Committee or approval process, please contact the Research Ethics Officer, Adam Golberg at adam.golberg@nottingham.ac.uk or +44 (0)115 846 6604.

Yours sincerely,



Dr Amanda Crompton
Chair of Nottingham University Business School Research Ethics Committee
Assistant Professor in Public Policy and Management

Appendix III. Interview questions topic guide

Interview questions topic guide

Can you tell me what your role is in the Trust?

How long have you been in post?

Can you tell me what you know about the sepsis care bundle?

Can you tell me what you understand your role to be in the sepsis care bundle?

Can you tell me what you do when completing the sepsis care bundle? Have you encountered any problems related to the sepsis care bundle?

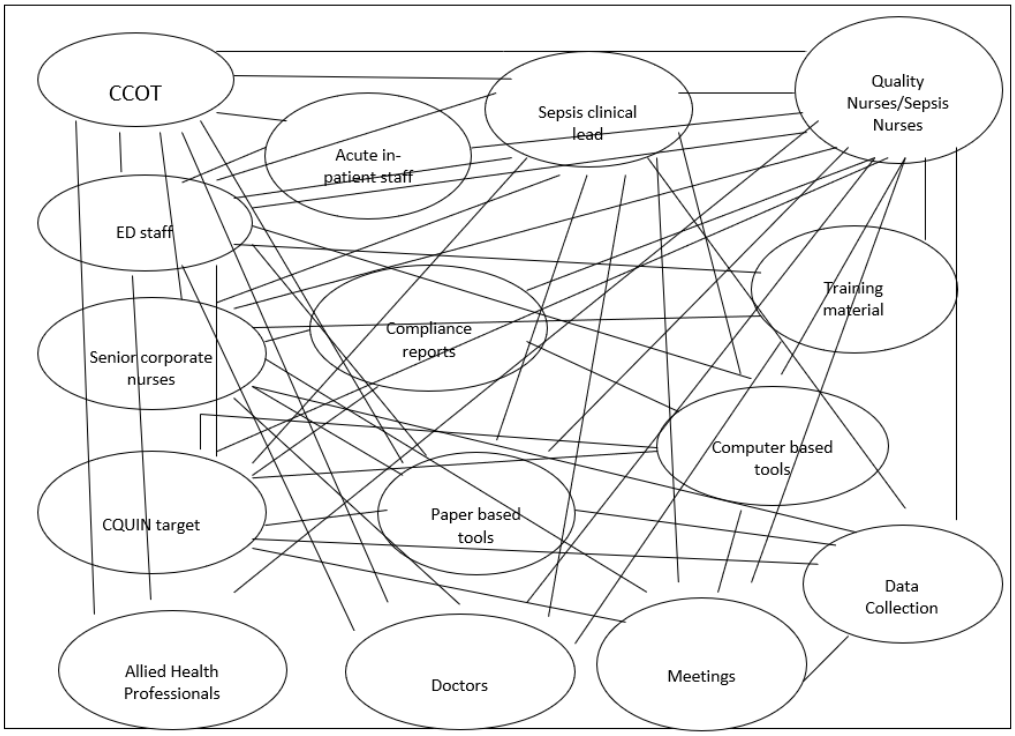
In your experience are there any aspects that of sepsis care bundle that are worrisome to people?

Is there anything in your day-to-day practice that makes it easier or more difficult to complete the sepsis care bundle?

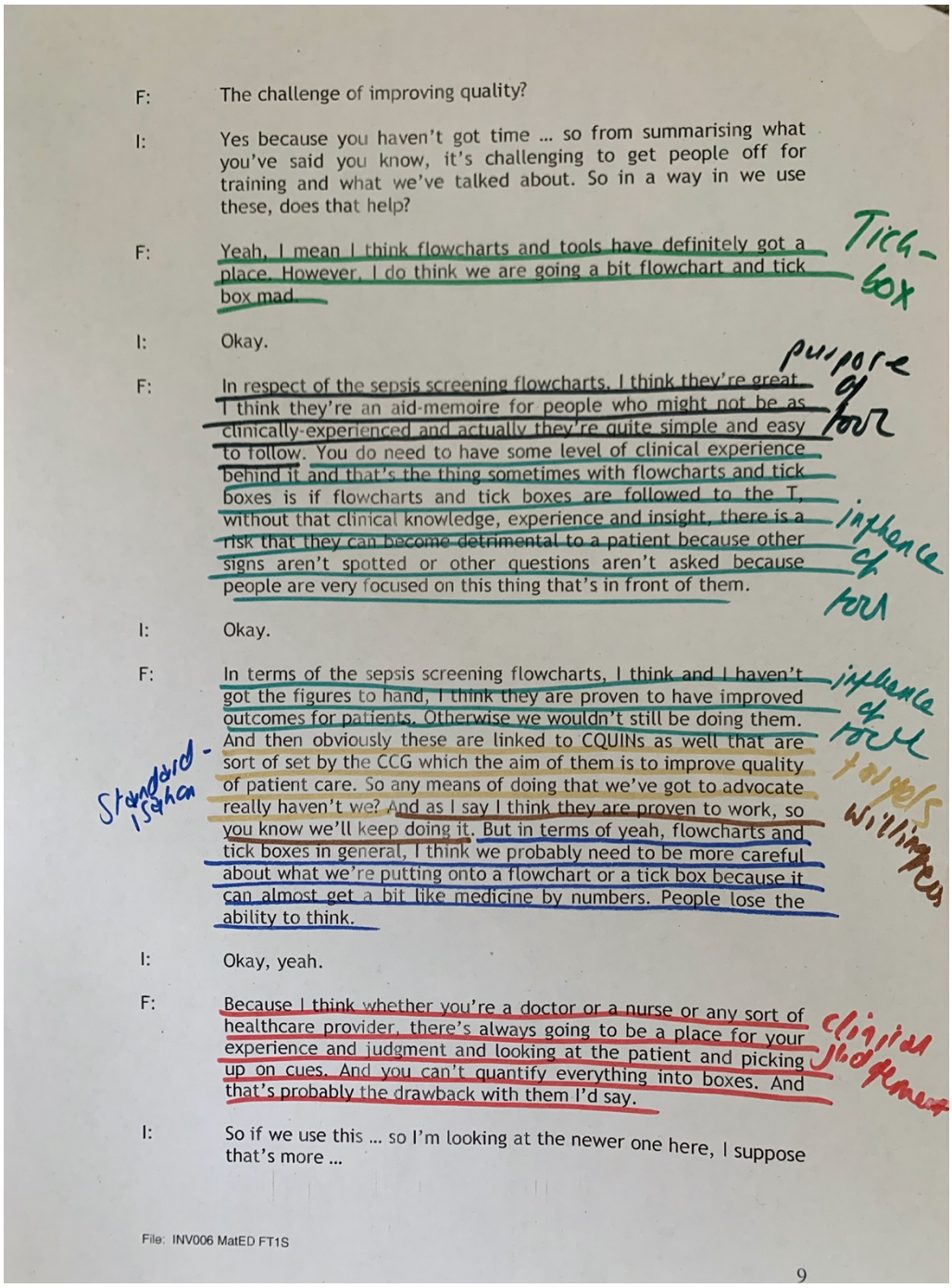
Can you tell me about your experiences of how other healthcare staff doctors/nurses/healthcare assistants complete the sepsis care bundle?

Can you tell me about your experiences of how bank/agency/locum healthcare staff doctors/nurses/healthcare assistants complete the sepsis care bundle?

Appendix IV. An example of the formation of an actor-networks traced to examine implementation of the tools in clinical practice



Appendix V. Examples of open coding



F: The challenge of improving quality?

I: Yes because you haven't got time … so from summarising what you've said you know, it's challenging to get people off for training and what we've talked about. So in a way in we use these, does that help?

F: Yeah, I mean I think flowcharts and tools have definitely got a place. However, I do think we are going a bit flowchart and tick box mad.

I: Okay.

F: In respect of the sepsis screening flowcharts, I think they're great. I think they're an aid-memoire for people who might not be as clinically-experienced and actually they're quite simple and easy to follow. You do need to have some level of clinical experience behind it and that's the thing sometimes with flowcharts and tick boxes is if flowcharts and tick boxes are followed to the T, without that clinical knowledge, experience and insight, there is a risk that they can become detrimental to a patient because other signs aren't spotted or other questions aren't asked because people are very focused on this thing that's in front of them.

I: Okay.

F: In terms of the sepsis screening flowcharts, I think and I haven't got the figures to hand, I think they are proven to have improved outcomes for patients. Otherwise we wouldn't still be doing them. And then obviously these are linked to CQUINs as well that are sort of set by the CCG which the aim of them is to improve quality of patient care. So any means of doing that we've got to advocate really haven't we? And as I say I think they are proven to work, so you know we'll keep doing it. But in terms of yeah, flowcharts and tick boxes in general, I think we probably need to be more careful about what we're putting onto a flowchart or a tick box because it can almost get a bit like medicine by numbers. People lose the ability to think.

I: Okay, yeah.

F: Because I think whether you're a doctor or a nurse or any sort of healthcare provider, there's always going to be a place for your experience and judgment and looking at the patient and picking up on cues. And you can't quantify everything into boxes. And that's probably the drawback with them I'd say.

I: So if we use this … so I'm looking at the newer one here, I suppose that's more …

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I: So we view this as like a formal tool and then clinical practice is like the work practices, so it's kind of how they come together really.

F: How they meet. I think again it comes down to education and I think a lot of what I'll say will be down to that. Because you can train anybody to follow a step-by-step flowchart, I think the key and what's very difficult to quantify is how you expand that knowledge so staff can apply it to their specific patient group. And I think I mean just looking at the sepsis pathway in front of us you know, you've got heart rate up as an indicator, the key for me is having education to see well was there any other reason why? And to have that broad scope of knowledge and then to hone in on using that as a guide, as opposed to ticking the box, no, no, no and concluding that therefore it's not a trigger so it's fine. I think that that's an area that still needs work and again my opinion is that comes back down to educating staff to use it as a tool and not as the answer as such.

I: Right, kind of the map?

F: Yeah.

I: So would you apply that same response to the MEWS chart?

F: Yeah, yeah. And I think you know that was probably one of the earlier ones, especially in this trust, of using that. And I think again the idea behind it is great but I don't feel that it is the answer you know, you can have ... for example I see a patient sometimes who trigger very lowly, they'll probably have a score of 2 or 3, whereas 4 is the point they should contact us and some staff will ring us and say they look dreadful. And that's what I think we need to have, it's to assist not to direct really.

I: Mm.

F: So again it is difficult to clarify that. I don't think it's very cut and dry. But I do think that more background theory needs to go in to make the tools come alive so they can be effective.

I: Right. So if I'm interpreting what you're saying, do you think there's an element of something that's lost by using a different tool?

F: Potentially, potentially. I think a lot depends on the individual, some people will always be inquisitive and always be trying to you know prove well is this the case? Could it be something else? Whereas other members of staff will be like well it doesn't tick the box, therefore it can't be. And I think human beings aren't that cut and dry and they don't always fit into boxes. So I think

I: Okay. So a lot of these tools, kind of the implementation theory behind them is that they're kind of a linear cause and effect, so we just go down it ...

F: Yeah.

I: All you've got to do is tick it.

F: Yeah.

I: In your view, is it as straightforward as that?

F: Well no because ticking a piece of paper doesn't help any patient, it's what you do with that information, as we said before. So if a patient needs oxygen to keep sats of greater than 92, then that's going to initiate further assessment of the patient's chest and what's causing the fact that they need oxygen to keep their sats greater than 92. So it all snowballs once you start down these processes, it should be the beginning point not the start and end point. And again that comes down to education of putting the theory behind the numbers, why these have been selected as the key points for sepsis but it's up to the clinician using that to add the additional information and assessment to bring it to life and make it effective.

I: Okay, yeah. So that's a really interesting point because you may be able to sort of navigate through this as a map but unless you transfer that into the actual work practice ...

F: Nothing will change for the patient.

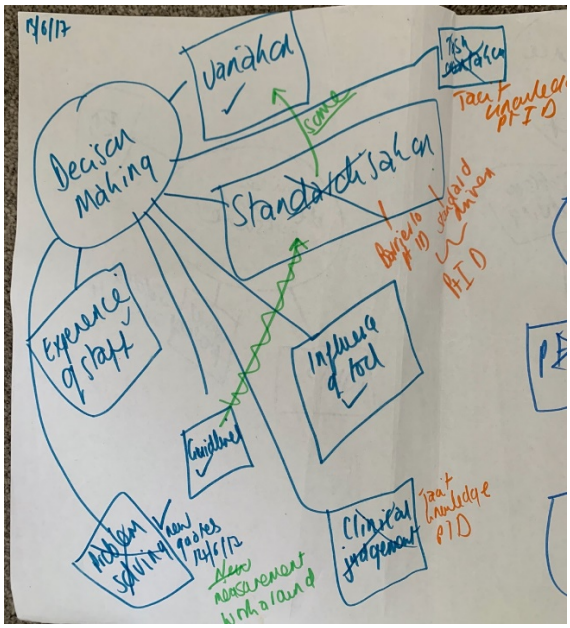
I: And I guess that brings it back to the escalation, which is always done well or ...?

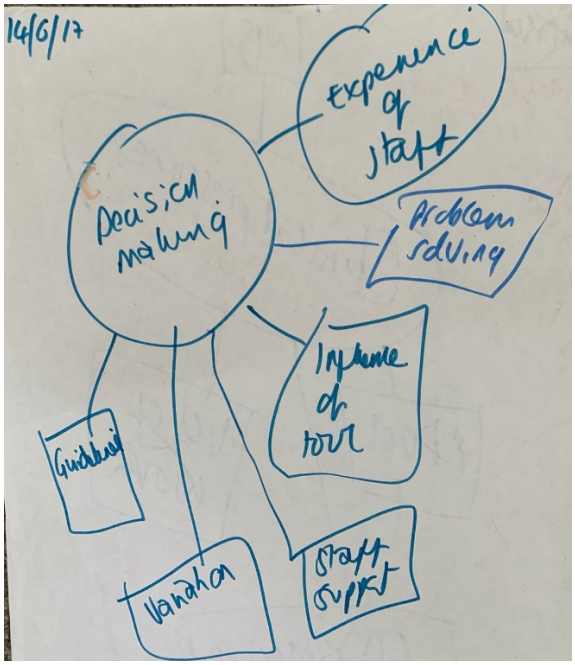
F: Well again it varies a lot, it varies on what information is obtained and what information is processed and what is ... if there's any thought behind using the chart. So if somebody's just saying oh, was the lactate less than 2, greater than 2, less than or whatever, if it used as a paper document then your results will only be sufficient on paper. I am a strong believer in that, it is a guide not the answer. And as I said at the beginning I do something think these things are implemented to be the answer and I don't think human beings are that simple that you can put a piece of paper with some boxes on it and make them better by ticking the boxes. And I think that's where the gap is.

I: Right. Because this tool, this formal tool, requires input.

F: Yeah.

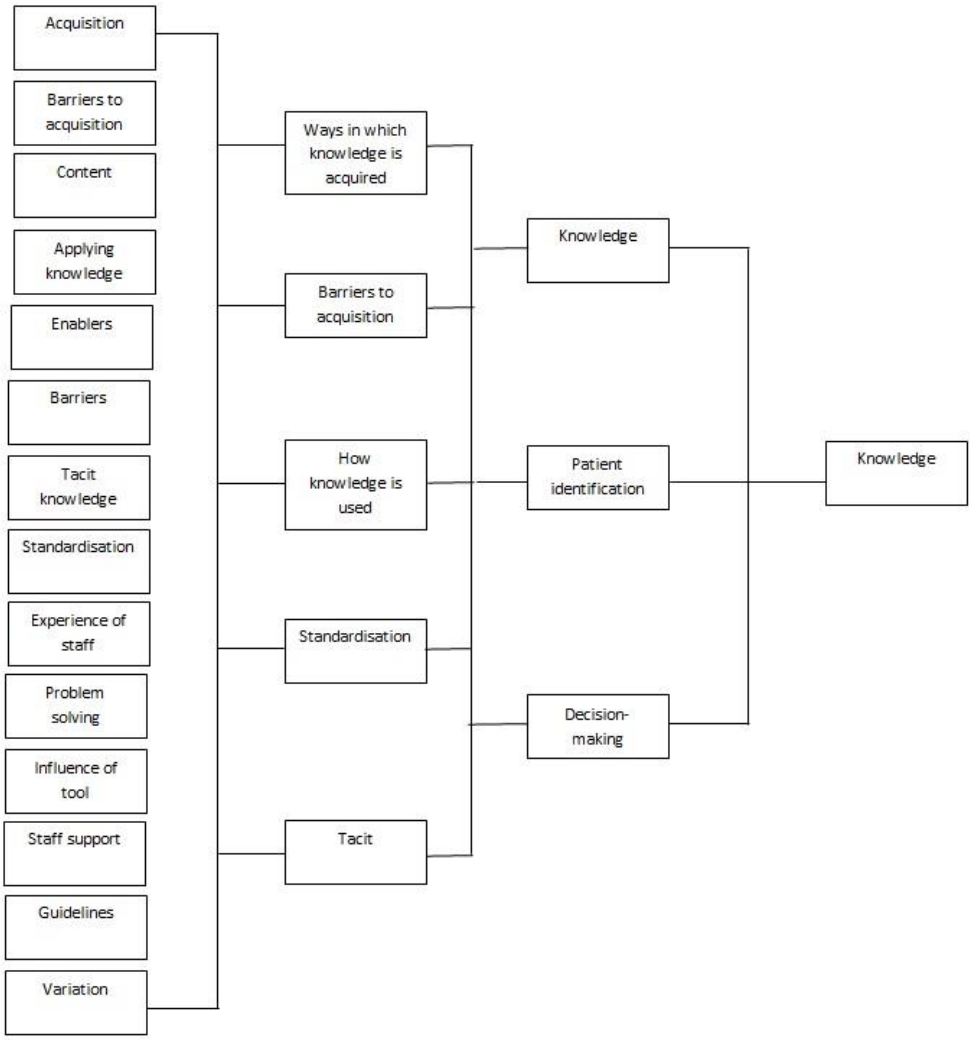
Appendix VI. Examples of axial coding



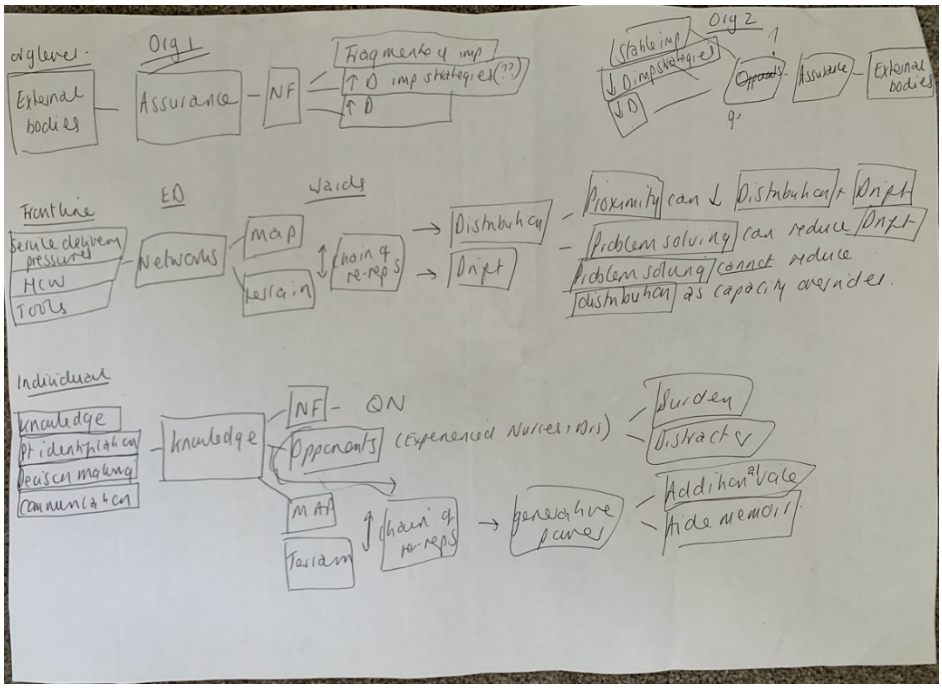


Concept	Categories	Quotes
Decision making Choosing between possible solutions to a problem	**Experience of staff** How experience is used in clinical practice	**Educator ED** 'I mean I'm happy with pneumonia but then again I've been here a long time so I should be good at it, whereas the junior staff I think will probably not want to commit themselves to that.' **NQN ED** 'You wouldn't naturally know it's pneumonia unless that's diagnosed, you'd need a chest x-ray you know. If they come in straight from an ambulance you wouldn't say oh they've got pneumonia you know. At the end of the day you are still only a nurse you know, you're not going to know that just by looking at them. So I wouldn't tick that, I wouldn't be confident in ticking that because that to me is saying that you've just diagnosed that patient.'
	Staff support Actions offered by others commonly in a more senior role	**Band 5 SN ED** 'I think it's a lot of support from the seniors which helps. So if you've got support from your senior staff then that helps you with the quick turnover that we have sometimes. But yeah, I think that's really … it's the support really that helps you through the day.' **Educator ED '**I think they (Matrons) were responding to pressures that they were under, they were under pressures from the Board presumably, who were under pressures from Monitor to improve the four-hour target. And they passed this grief on down the line, as I was doing to the junior staff you know. So we're passing it all the way down there and my mission really is not to put pressure on junior staff, it's to support them and help them feel happy and comfortable.**'**
	Variation Change or slight difference	**Matron ED** 'And nobody knew you know, there's real varying practice between people…. And patients did suffer as a consequence in some cases.'
	Guidelines Statements by which to determine a course of action to streamline processes according to sound	**QSN3** 'So in February this year the International Consortium put together where they look to the definitions of sepsis, so the definition's changed. And then we've got the NICE guidelines in July that were also changed as well. So our definitions, all the SIRS criteria's gone, so that's taken out of there. In this you've got your additional reasons to pick up a tool, like does your patient look sick? So you've got that staff interpretation. They can use

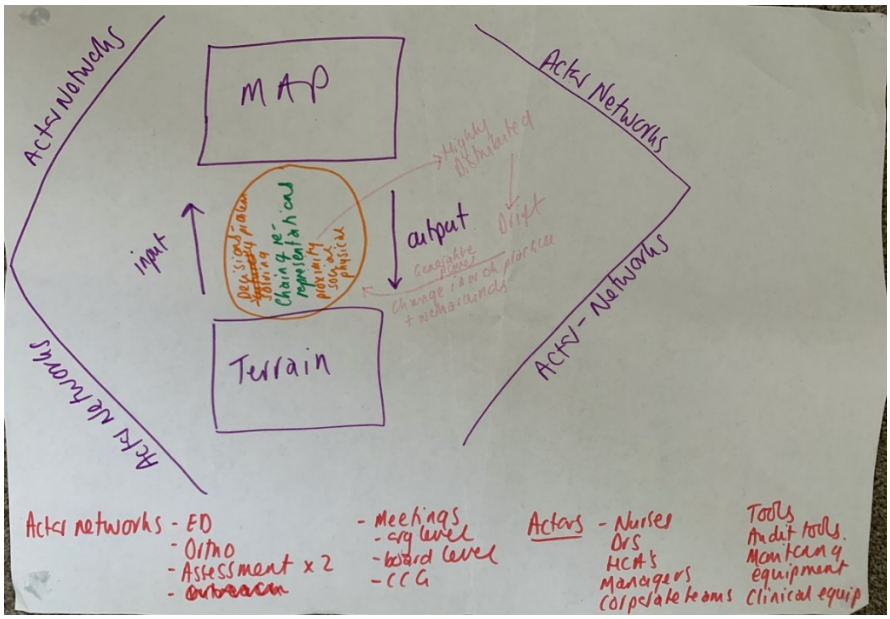
	practice. By definition, following a guideline is never mandatory.	their intuition to identify a patient…..as opposed to a set SIRS criteria.'
	Problem solving Using knowledge to decide the best course of action	**NQN ED** 'It could be a UTI, so yeah I'd be happy to tick UTI. Abdominal pain, that's straightforward abdominal pain, so yeah I would be happy to tick that. Meningitis I wouldn't be happy with ticking that box because again that's saying that I've diagnosed them that they've got meningitis when it could just be an allergic rash or anything. That again, yeah I would tick that, cellulitis, infected wound. I would tick that, I think we've had one of those….Comes under those umbrellas doesn't it, so … no I think that I wouldn't … no I'd be a bit cautious with the septic arthritis but there's three under that umbrella there isn't there, so …'
	Influence of tool The effect of the screening tool on clinical practices and patient care	**CCOT Lead T1** 'I think that's my overall thought on it you know, I think a lot of junior staff would really benefit from them and a lot of staff have said that they've followed the flowchart therefore it's got senior clinicians coming to review the patient.' **Band 5 SN ED** 'if the doctors are busy and they're in Resus with patients that are unwell, then that can be but generally they are pretty good to be fair at saying I think this patient's septic, I've filled this out, what do you think? They will say oh yeah, okay, fair enough. Nip in and see the patient.'

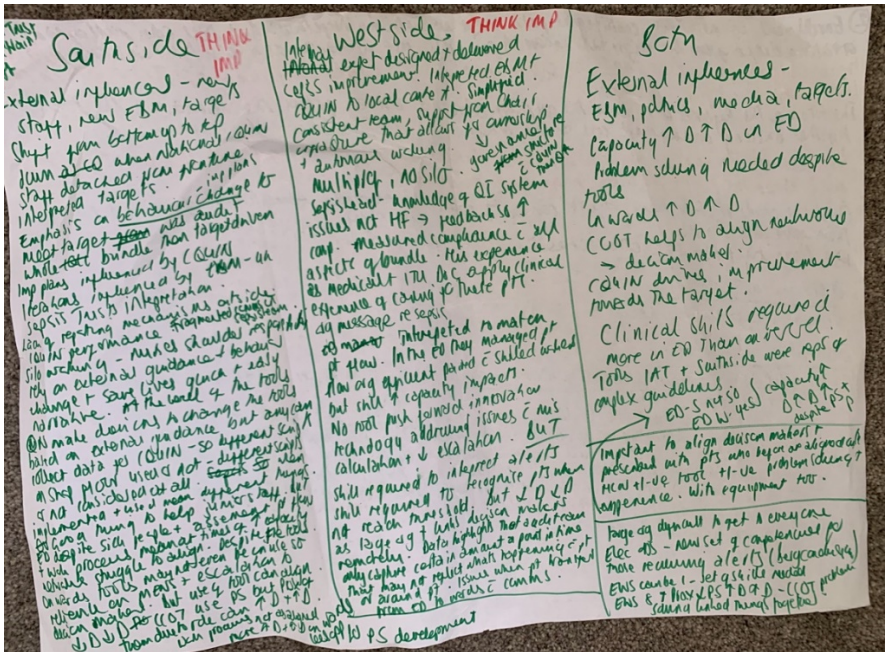

Acquisition
Barriers to acquisition
Content
Applying knowledge
Enablers
Barriers
Tacit knowledge
Standardisation
Experience of staff
Problem solving
Influence of tool
Staff support
Guidelines
Variation
Ways in which knowledge is acquired
Barriers to acquisition
How knowledge is used
Standardisation
Tacit
Knowledge
Patient identification
Decision-making
Knowledge

Appendix VII. Example of selective coding



Appendix VIII. Example of cross-case synthesis





Appendix IX. Participant information sheet



Participant Information Sheet (v.1.5: 09/12/15)

Title of Study: Understanding clinician's interactions and use of structured clinical improvement methods.

Name of Researcher: Charlotte Overton

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. Charlotte Overton will go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Ask us if there is anything that is not clear.

What is the purpose of the study?

The purpose of this study is to understand how front line clinical teams engage with and integrate quality improvement methods into their day-to-day routines in order to produce a clearer picture of the factors that influence, enable or inhibit their implementation. The study will aim to gain each stakeholders perspective on how and why quality improvement strategies are managed amongst the competing pressures of their daily work within the context of the hospital setting.

Why have I been invited?

You are being invited to take part because you have a key role in the implementation of quality improvement initiatives. We are inviting thirty participants to take part.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. This would not affect your legal rights.

What will happen to me if I take part?

The researcher will ask you to take part in a semi-structured interview that will be away from the clinical area and last up to sixty minutes, the interviews will be audio recorded.

Expenses and payments

Participants will not be paid to participate in the study. Travel expenses will be offered for any visits incurred as a result of participation.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks associated with taking part in the study.

What are the possible benefits of taking part?

We cannot promise the study will help you but the information we get from this study may help to create evidence and knowledge valued by clinicians, to produce a clearer picture about the factors that influence, enable or inhibit the implementation of quality improvement methods in healthcare.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. The researchers contact details are given at the end of this information sheet. If you remain unhappy and wish to complain formally, you can do this by contacting Adam Golberg, Research Manager, Nottingham University Business School, adam.golberg@nottingham.ac.uk.

Will my taking part in the study be kept confidential?

We will follow ethical and legal practice and all information about you will be handled in confidence.

All information which is collected about you during the course of the research will be kept strictly confidential, stored in a secure and locked office, and on a password protected database. Any information about you which leaves the hospital will have your name and address removed (anonymised) and a unique code will be used so that you cannot be recognised from it.

Your personal data (address, telephone number) will be kept for two years after the end of the study so that we are able to contact you about the findings of the study (unless you advise us that you do not wish to be contacted). All other data (research data) will be kept securely for seven years. After this time your data will be disposed of securely. During this time all precautions will be taken by all those involved to maintain your confidentiality, only members of the research team will have access to your personal data.

Although what you say in the interview is confidential, should you disclose anything to us which we feel puts you or anyone else at any risk, we may feel it necessary to report this to the appropriate persons.

What will happen if I don't want to carry on with the study?

Your participation is voluntary and you are free to withdraw at any time, without giving any reason, and without your employment or legal rights being affected. If you

withdraw then the information collected so far cannot be erased and this information may still be used in the project analysis.

What will happen to the results of the research study?

The findings of this study will contribute to a PhD due to be completed in September 2017. A report of the findings and recommendations will be provided to the trust. Participants will not be identified in the report. It is anticipated that a number of publications will also be produced. The trust will remain anonymous in the publications and the individual participants will not be identified.

Who is organising and funding the research?

This research is being organised by the University of Nottingham and is being funded by The Health Foundation.

Who has reviewed the study?

All research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests.

Further information and contact details

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Appendix X. Consent form

CONSENT FORM
(Final version 1.1: 12/10/15)

Title of Study: Understanding clinician's interactions and use of structured clinical improvement methods.

Name of Researcher: Charlotte Overton

Name of Participant:

1. I confirm that I have read and understand the information sheet version number 1.5 dated 09/12/15 for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my employment or legal rights being affected. I understand that should I withdraw then the information collected so far cannot be erased and that this information may still be used in the project analysis.
3. I understand that relevant sections of data collected in the study may be looked at by authorised individuals from the University of Nottingham, the research group and regulatory authorities where it is relevant to my taking part in this study. I give permission for these individuals to have access to these records and to collect, store, analyse and publish information obtained from my participation in this study. I understand that my personal details will be kept confidential.
4. I understand that the interview will be recorded and that anonymous direct quotes from the interview may be used in the study reports.
5. I understand that the meetings/staff interactions may be observed and may be recorded and/or field notes made and that anonymous direct quotes from the meetings/observations may be used in the study reports.
6. I agree to take part in the above study.

_____	_____	_____
Name of Participant	Signature	Date
_____	_____	_____
Name of person taking consent	Signature	Date

2 copies: 1 for participant, 1 for the project notes