Organisational resilience in UK acute hospitals: an exploratory case study and empirical analysis.

A thesis presented for the degree of Doctor of Philosophy (PhD)

Eleanor Murray, MA, MSc

Centre for Patient Safety and Service Quality,

Department of Surgery and Cancer,

Imperial College London.

2013

Declaration of Originality

I, Eleanor Jane Murray, can confirm that the work carried out and written in this thesis was my own work, unless otherwise declared in the document.

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Acknowledgements

I am extremely grateful to both of my supervisors; Alison Holmes, for her inspirational and innovative approach and Charles Vincent, for his wisdom and clarity of thought. Both have been extremely encouraging, supportive and enthusiastic, for which I am truly appreciative. Particular thanks to Ewan Ferlie, who has provided invaluable inspiration, guidance and challenge in the organisation studies field.

It is a privilege to work across the Centre for Patient Safety and Service Quality (funded by the NIHR) and the Centre for Infection Prevention and Management (funded by the UK-CRC) and to be given the opportunity to pursue relatively uncharted multidisciplinary research with such enthusiastic and supportive colleagues. I have learnt a great deal from everyone in both Centres. Thank you to the NIHR for funding this project.

I am indebted to all health services staff who participated in all of my studies, especially all those who gave up their time to participate in interviews and complete questionnaires and to the Infection Prevention Society, Federation of Infection Societies and Govtoday for their generous support in providing access to conference delegates for questionnaire completion.

Thank you to Siddarth Mookerjee for helping with the systematic review search strategy, Sally Hargreaves for acting as a double blind reviewer in my systematic review and Federica Secci for her sound advice on conducting a systematic review.

Finally I would like to thank my family for their love and continual support.

This work is dedicated to Paul for his love, patience and encouragement throughout and to Thomas for keeping me smiling.

Abstract

Organisational resilience in healthcare is important if hospitals are to recover effectively from unexpected events, such as infection outbreaks and manage successfully the continuous pressure from hospital associated infections. Yet studies of resilience in hospital organisations are rare and organisational resilience theory is insufficiently developed. The aim of this thesis is to examine organisational resilience in UK acute hospitals, through a case study and empirical analysis. The objectives are to investigate what is known about the concept, associated factors and application of organisational resilience to hospitals, to explore theoretically and empirically the two contexts for organisational resilience (expected conditions and unexpected events) and finally to design and test a tool to measure organisational resilience in the context of an unexpected event.

A multi-methods approach was adopted to examine organisational resilience. A literature and systematic review were carried out to establish the evidence-base for organisational resilience. These reviews informed two health care studies of organisational resilience; a micro and meso-level case study exploring an unexpected infection outbreak and a macro-level study assessing the system response to infections as continuous stressors on routine practice. The case study informed the design and testing of an organisational resilience questionnaire.

The key contributions to the literature were: firstly a novel multidisciplinary resilience questionnaire from which a framework of organisational resilience constructs was developed; secondly, a modest theoretical contribution of an intermediate resilience category within a framework that identifies levels of resilient practice and associated sensemaking characteristics; and thirdly, a positive example of ICT-enabled national surveillance programmes that increased hospitals' resilience to infection through the enrolment of clinical leaders in self-surveillance.

In conclusion, this research has generated novel, empirically-derived theoretical developments to this field of study that facilitate the measurement, application and improved conceptualisation of organisational resilience.

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1 Chapter 1. An introduction to organisational resilience in the context of infections in acute hospital care in the UK

1.1 Introduction and Context for this Work

In this chapter, I review the history and evolution of the concept of organisational resilience, referencing earlier work on resilience. I define and outline the contextual role that hospital-acquired infections will take in the thesis. I examine the macro-level methodological issues in designing the thesis and propose the use of two social science theories; sensemaking and Foucauldian governmentality theory to inform the study of organisational resilience in two qualitative studies.

1.2 History and evolution of the concept of organisational resilience

1.2.1 Resilience foundations

Organisational resilience research can be contextualised within the broader field of resilience studies which dates back to the 1970s. Recent reviews of resilience literature(1;2) identified a number of resilience perspectives; ecological, individual, socio-ecological/community, organisational and supply chain (2) disaster and infrastructure resilience.(1) The multidisciplinary foundations of these perspectives span a range of disciplines including ecology,(3-5) child(6-8) and family(9) psychology, economics(10), engineering(11) and information technology.(12)

1.2.1.1 Ecological influences

The discipline of ecology generated an early definition of resilience relating to the survival of complex systems which was proposed by Holling in 1973.(10;13) This definition describes the amount of disturbance a system can absorb without incurring a change in its state.(13) Over the last thirty years, the ecological perspective has broadened as the impact of human, social and political dimensions have been understood and incorporated. Resilient factors in identified in this broader context include: working with change and uncertainty; nurturing ecological, social and political diversity to reduce risks and increase choice; extending options for learning and problem solving; and building opportunities for networks, cross-institution links and self-organisation.(14) Many of these factors are relevant to and overlap with descriptions of resilience in other disciplines and contexts.

1.2.1.2 Multidisciplinary influences

Disciplines such as information technology draw on a combination of the individual, organisational and extra-organisational levels to explain potential system vulnerabilities and stressors in the face of unexpected and stressful events.(12) In the field of economics, the concept of social resilience was coined in 2000, when it was related to social capital and economic factors.(15) Both the fields of economics and engineering have sought to develop a quantifiable approach to measuring resilience using systems perspectives, in order to assess the associated dimensions of robustness, redundancy (untapped or excess capacity), resourcefulness and rapidity in the event of disasters impacting on communities.(10;16;17) These macro-level perspectives contrast with the micro-level perspectives developed in areas such as child and family psychology, where the emphasis is on the individual capacity and capability to develop resilience, assessed using a selection of qualitative and quantitative methodologies. Resilience in these fields is demonstrated as behavioural competence: self-esteem, self-worth and connectedness in an adverse context.(6-9)

1.2.2 Gaps in resilience research

Well recognised challenges and gaps exist in the resilience literature. The multidisciplinary development in the area of resilience, with the complications of overlapping and related meanings from different disciplines has rendered some definitions of resilience so broad that they become meaningless. The etymology of the term resilience derives from ‘resilio’ meaning rebounding. Opinions differ as to whether a definition of resilience should be based on the concept of rebounding or be adapted to incorporate broader meanings. For example, some definitions are seen as interchangeable with the concepts of adaptability, vulnerability, sustainability and stability.(10) Criticism exists of definitions that have become too broad and are considered to have gone beyond the innate meaning.(10) Several issues fuel this dilemma. These include the lack of clarity about resilience as a concept and the aggregation of resilience characteristics into frameworks or models that have not been tested empirically.

1.2.2.1 Inadequate empirical testing

A further problem is that few of the models or frameworks based on theoretically determined resilience characteristics have been tested empirically. The multi-faceted nature of most resilience models requires complex empirical studies to test them. These might involve

longitudinal design to assess the process of resilience, commitment from multiple agencies to assist with a macro-level analysis and cross-cutting methodologies that gather data from all levels of the enterprise to ensure adequate coverage of the phenomenon's characteristics. The nature of unexpected events is that research may often be undertaken retrospectively with limited input from those involved at the time. These requirements appear to have limited the number of studies undertaken and those that have occurred have relied heavily on retrospective third-party documentation to inform their reviews.(18;19) It is only more recently, as a result of several large-scale disasters, such as the 9/11 terrorist attacks in the USA and the Asian tsunami that more detailed analyses have occurred, often instigated and funded by governments to address concerns about social, economic and business continuity.(20)

1.2.2.2 Conceptual clarity of resilience

The lack of clarity about resilience as a concept is reflected in questions such as: whether resilience operates prior to or post the disturbance;(10) what the nature of the 'rebound' is; whether a system returns to the previous equilibrium or to a new state;(21) the extent to which resilience is time-limited; whether the catalyst is an ongoing disturbance, unexpected event or disaster; whether resilience can be quantified; what characteristics resilience encompasses; and whether these characteristics can be understood in a consensual model?

1.2.3 Development of organisational resilience

Organisational resilience began to emerge as a concept in its own right around the late 1980s and early 1990s from the resilience literature. In the late 1980s as organisation studies began to explore concepts of organisational change and culture, the term 'adaptation' referring to the capacity of an organisation to adapt and respond began to be used as a proxy for organisational resilience.(22) By the early 1990s, the term 'organisational resilience' had begun to be referenced in the literature.

1.2.3.1 Definition of organisational resilience

The definition of organisational resilience that I will adopt in this thesis is defined by Hollnagel as:

'the intrinsic ability of a system (organisation) to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.'(23)

This definition from resilience engineering encompasses most aspects of current organisational thinking on resilience. It reflects many of the facets inherent in recent work by Vogus and Sutcliffe from an organisational theory perspective, who comment on resilience as 'the maintenance of positive adjustment under challenging conditions such that the organisation emerges from these conditions strengthened and more resourceful.'(24)

There are key aspects of this definition that are relevant. The first is the use of the terms: expected and unexpected conditions. Expected conditions are those in routine practice where despite occasional or even continuous stressors on the system, required operations can be sustained with varying levels of adjustment to the system. Unexpected conditions denote those where routine practice is interrupted by an unexpected event, change or disturbance often requiring major adjustments to the system, depending on the level of reliable functioning within the system.

The second aspect is the use of the phrase, 'prior to, during or following changes.' Different emphases are placed on these different stages in the literature. Proponents of an anticipatory phase to an event consider that preparedness practices are crucial in sustaining required operations.(1) Others consider that organisational resilience precludes risk management related anticipatory activities.(25) There are different emphases on adjustment following changes. One perspective is that organisational learning from the change or disturbance is important and will assist the organisation in developing new capabilities and capacities to cope more effectively with future incidents.(26)

The third aspect is the use of the phrase, 'sustaining required operations.' I consider this phrase inadequate, as sustaining required operations may be sufficient in the context of minor changes or disturbances but in the context of major, unexpected disturbances, the organisation may need to significantly change its existing practices in response to learning from the altered conditions.

The fourth aspect of the definition is, 'the intrinsic ability of an organisation to adjust its functioning.' This phrase reflects a systematic theoretical perspective which is typical of recent organisational resilience literature where the key to resilience is to *adjust* to harmful influences. In contrast, the structural theoretical perspective is based on a linear cause and effect model where one disruptive event is a disturbance on an otherwise stable system, reflecting a static state of organisation where the key to organisational resilience is about being able to *endure* harmful influences. The structural perspective, which is increasingly

critiqued,(27) is reflected in earlier organisational resilience literature from the late 1980s and early 1990s and underpins older human error investigation models.(28)

1.3 Providing a context: the use of hospital-acquired infections in acute hospitals in the UK

1.3.1 Hospital-acquired infections: an acute hospital context

I intend to use a 'tracer study' approach, using hospital-acquired infections in acute hospitals in the UK as the 'tracer issue', i.e. the area of contextual focus of my thesis to explore how organisational resilience can be understood. The term 'tracer study' refers to a methodological framework (relying on non-probability sampling) for sampling participants/data, elucidating processes and describing activities over time, either prospectively or retrospectively.(29) The framework usually pertains to one organisational theme or 'tracer issue.' This is defined as a specific subject area that can be used to examine a theoretical topic empirically, serving to narrow down the scope of an inquiry and provide a rich seam of primary data.(29) In this case, I chose hospital-acquired infections as a tracer issue for a number of reasons.

Firstly, from an organisational resilience perspective, hospital-acquired infections serve as a stressor on hospital organisations and elicit an organisational response. These type of infectious organisms have the capacity to stretch the organisational capacity to cope, and as such, serve as a useful mechanism for testing resilience in organisations under expected conditions and unexpected conditions

Secondly, a tracer issue was chosen as it is a useful method for studying complex organisational processes(29) such as the impact of infections on hospital function. Hospital-acquired Infections can impact a number of processes at different levels in the hospital: at patient-level through the effect of antibiotic-resistant organisms causing adverse patient outcomes; at team level, with ward closures as a result of infection reducing bed capacity and the necessity for more complex treatment protocols; and at organisational-level as revised or new processes are required to respond rapidly and manage unexpected circumstances.

Thirdly, as I intend to study resilience across whole organisations, hospital-acquired infections are relatively unique compared with other potential stressors, in testing clinical and managerial systems under expected and unexpected conditions. Hospital-acquired infections have the potential to impact on the whole organisation and require a co-ordinated

approach. I considered other stressors, e.g. economic, environmental, technological, political and social, such as recent healthcare reform changes, adverse weather conditions and the transition to telemedicine, but these did not fulfill the 'unexpected conditions' to test resilience in an organisation, to the same extent as infections. I will examine and justify my use of infections and associated infection prevention and control strategies as a tracer issue in more detail in Chapter 2. At this stage, as a precursor to Chapter 2, I would like to define the types of infections in UK hospitals that will be focused on in this thesis and explore their impact on acute hospitals in the UK.

1.3.2 Defining hospital-acquired infections (HAI)

This thesis will focus on hospital-acquired infections (HAI) which are defined as 'infections developing after 48 hours of hospitalization or stay at a healthcare facility that were not present or incubating at the time of admission.'(30) The two categories that are relevant to this thesis are bacterial HAIs and viral HAIs.

1.3.2.1 Bacterial HAIs

Bacterial HAIs are the predominant pathogens that have been monitored by the UK government as the focus on healthcare-associated infections has increased in recent years. The types of bacterial HAI encompass a broad list including skin and surgical site infections, urinary tract infections, pneumonia, bacteraemia, and hospital associated diarrhoea. While the types of infections are diverse it has become increasingly common for these infections to be caused by antibiotic resistant pathogens. Two key issues exist for hospital organisations in the control of bacterial HAI; routes of transmission and methods of control. Routes of transmission include the use of devices, the provision of care, hand hygiene and failure of isolation. Public health campaigns have focused on routes of transmission as being one of the most effective ways to improve the rates of HAI. Methods of controlling HAI include interventions such as effective hand washing, appropriate use of devices, the use of aseptic technique in the practice of care, new technologies to reduce the spread of infection and improved isolation techniques.

1.3.2.2 Nosocomial viral infections

Viral infections that can be transmitted nosocomially in acute healthcare, are defined as the development of symptoms compatible with a viral illness after a period of hospitalization that is as long or longer than the indicated periods of time.'(31) The incidence of nosocomial viral infections in hospitals is less well reported than for bacterial infections, but one US

study found that more than 5% of nosocomial infections in hospital are viral and that nosocomial viral infection increases the duration and costs of hospitalisation.(31) From an outbreak perspective, viral HAIs include those that can cause epidemics (Norovirus in the UK) and pandemics (global Severe Acute Respiratory Syndrome (SARS) and swine-origin influenza A/H1N1). One viral HAI, Norovirus is the most common cause of infectious gastroenteritis (diarrhoea and vomiting) in England and Wales and nosocomial transmission of Norovirus has posed a significant challenge in hospitals in the UK in recent years. A key issue for hospital organisations in controlling nosocomial transmission of Norovirus is aggressive infection control measures.(32)

1.3.3 Impact of hospital-acquired infections (HAIs)

Hospital-acquired infections (HAIs) have a significantly adverse impact on patient health. The impact of infections such as methicillin-resistant *Staphylococcus aureus* (MRSA),(33) vancomycin-resistant *Enterococci* (VRE) and *Clostridium difficile* (*C.difficile*) can cause serious human suffering, including longer lengths of stay, long-term disability or death. The impact for healthcare organisations includes an increased threat to immune-compromised patients, increased drug and treatment costs, increased ward closures, the potential for carriage via hospital workers, increased antibiotic resistance and increased morbidity and mortality.

1.3.4 Impact of infections on UK acute healthcare

In the UK, a conservative estimate by the National Audit Office (NAO) was that the cost to the NHS for hospital-acquired infection was £1billion per year.(34) The HAIs that have become prominent in the UK the last two decades have included MRSA, *C.difficile*, Vancomycin (or Glycopeptide)-resistant Enterococci (VRE or GRE) and gram-negative bacteria. Of these, MRSA as a proportion of all *Staphylococcus aureus* causing blood stream infections rose from about 2% in 1990 to more than 40% in 2000.(35;36). The overall rise is MRSA since 1993 is shown in Figure 1.1.

Figure 1.1. Voluntary and Mandatory MRSA Bacteraemia Reporting 1993-2008

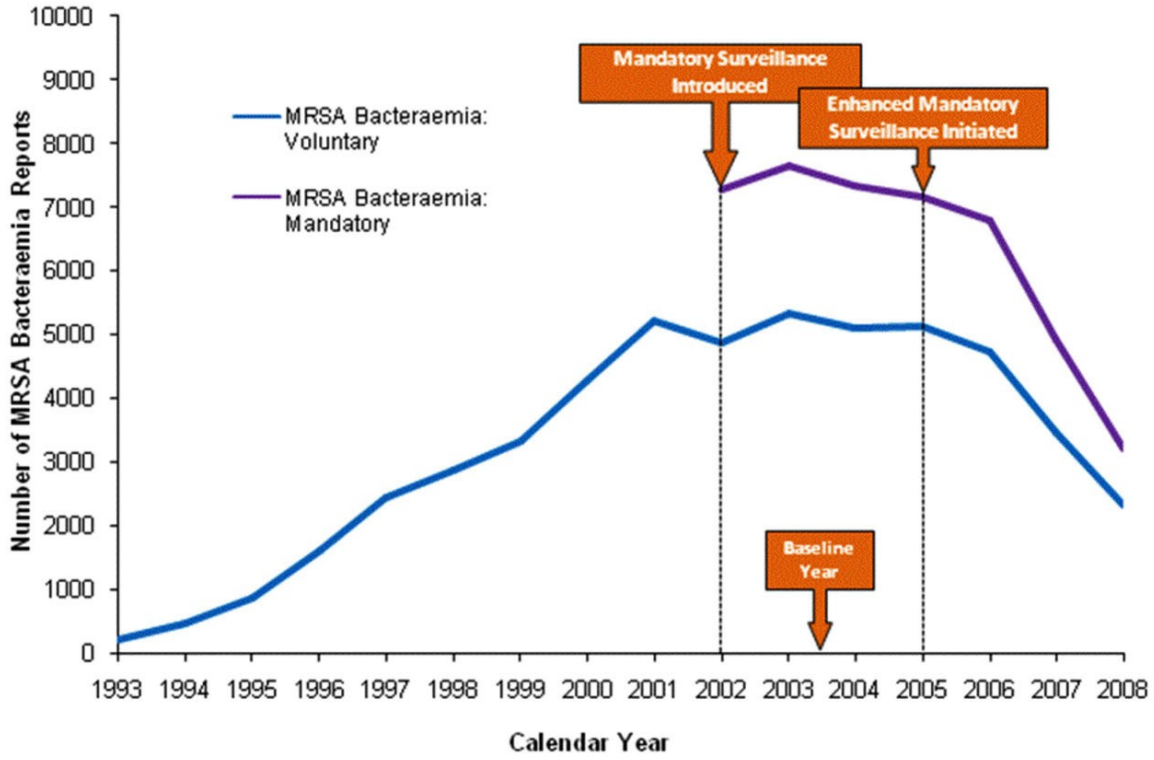


Image courtesy of UK Health Protection Agency. Pearson et al. (2009) Impact of mandatory surveillance on the measurement of meticillin-resistant *Staphylococcus aureus* bacteraemia in the English NHS: comparison of mandatory and voluntary surveillance reporting systems http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317132089460 (Accessed 27 May 2012)

With incidence and mortality due to MRSA infections rising in the early 2000s, both the USA and UK have made concerted efforts to document MRSA infections and have had success at decreasing bacteraemia rates in recent years. The Health Protection Agency documented 1185 reports of MRSA bacteraemia in England in 2011 showing an almost 84% reduction since 2002.(30)

Figure 1.2 *Clostridium difficile* infection (CDI) reports 2004-2012

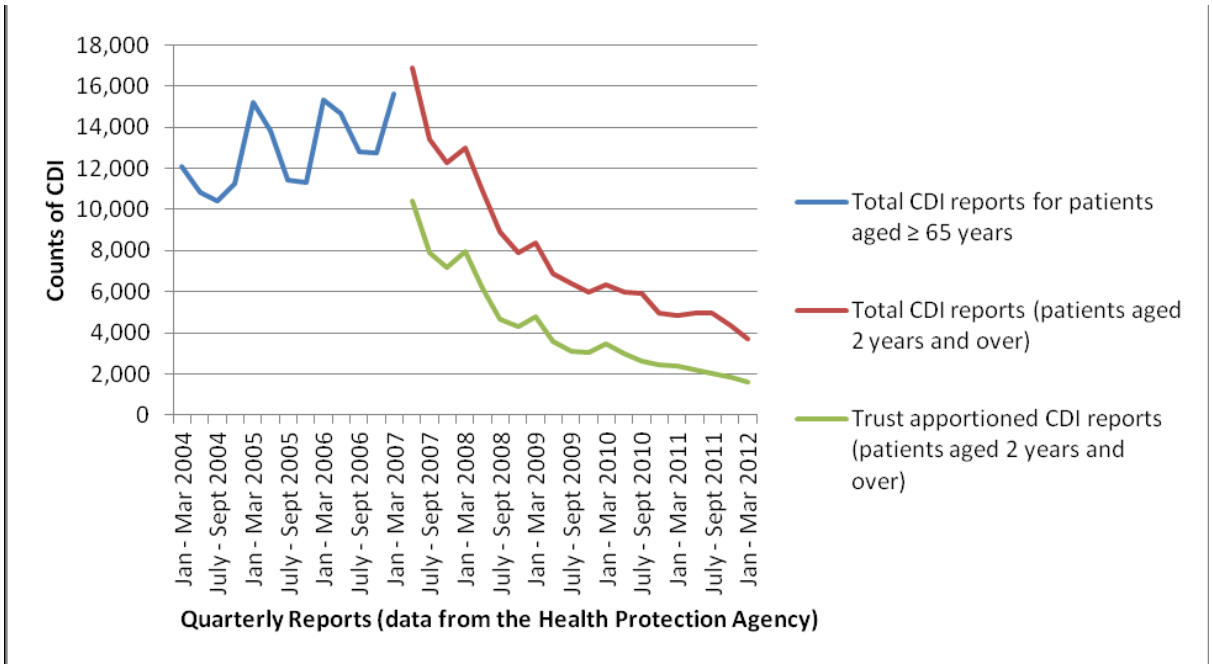


Image from the UK Health Protection Agency *C.difficile* Quarterly Reports

This steep rise in MRSA bacteraemias, shown in Figure 1.1 was reflected by a similar rise in *C.difficile* infections up until 2007-8 (see Figure 1.2) with an eight-fold increase in isolates and fourteen-fold increase for *C.difficile* toxin in laboratory reports to the Communicable Disease Surveillance Centre (CDSC).(37)

A further issue has been the rise of Norovirus which is one of the most infective organisms seen in health and social care establishments.(38) Whilst this is usually a community-acquired virus which spreads rapidly in community settings, nosocomial transmission can occur in hospital. Figure 1.3 highlights the increasing burden of Norovirus for the NHS and other organisations (although this is partly due to increased Norovirus testing).(38) The cost for the NHS is estimated to be in excess of £100 million (2002-3 figures) with approximately 3000 hospital admissions per annum.(39).

Figure 1.3. Laboratory reports of norovirus 2000 - 2011. England and Wales

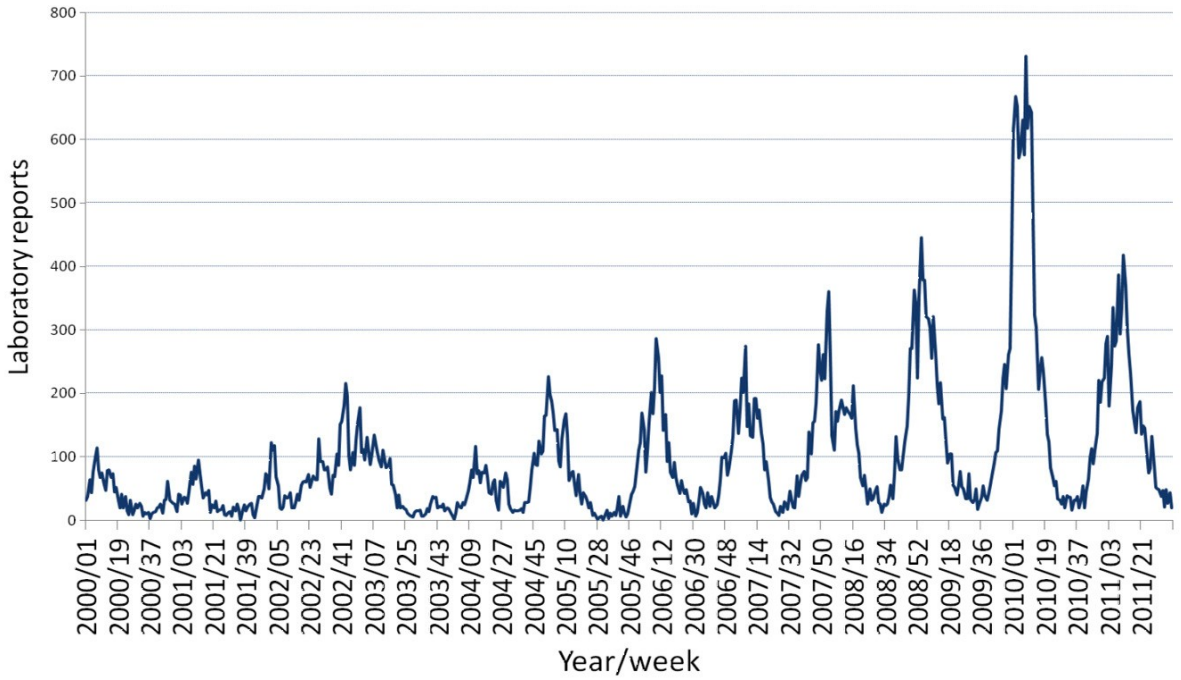


Image from the UK Health Protection Agency: Norovirus Working Party. 'Guidelines for the management of norovirus outbreaks in acute and community health and social care settings.'(38)

1.3.5 Summary

To summarise, increased rates of hospital-acquired infections (expected events) and sudden outbreaks of hospital-acquired infections (unexpected events) have had a significant impact as stressors on acute hospitals in the UK over the last decade. Both as expected and unexpected events, hospital-acquired infections stretch organisations' capacity to cope and as such, serve as an excellent 'tracer' issue for assessing organisational resilience in acute UK hospitals. The impact of hospital-acquired infections has been felt clinically, financially and organisationally in the UK, as hospitals have struggled in some instances to respond effectively to a range of hospital-acquired infections. The use of hospital-acquired infections as a tracer issue and valuable source of primary data to inform the study of organisational resilience will be explored in more detail in the next chapter (Chapter 2).

1.4 Methodology

I will use this methodology section to examine the macro issues that arise from my choice of methodological approach. The micro-level methods that relate to each theoretical/empirical study will be addressed in detail within each chapter owing to the diversity of quantitative and qualitative methods that were chosen.

1.4.1 Mixed methods research

I adopt a mixed methods approach for this thesis which involves qualitative (in-depth interview-based case studies and documentation analysis) and quantitative (primary statistical analysis of survey data) methods. I chose a mixed methods approach for the following reasons:

1.4.1.1 As the concept of organisational resilience has been researched through multiple paradigms, to adopt a range of qualitative and quantitative methods that reflect these paradigms to ensure a comprehensive examination of the concept;

1.4.1.2 To establish a detailed multi-level understanding of organisational resilience in healthcare using in-depth inductive and exploratory techniques and then to test specific findings using deductive, statistical techniques in order to generalise the findings to a broader healthcare population;

1.4.1.3 To build on the increasing evidence for the relevance of mixed methods to understand the complexity of healthcare and the growing evidence and benefits of its use in the healthcare context;(40) and

1.4.1.4 As a researcher, to develop "methodological bilingualism"(41)p45 through the attainment of methodological competence in qualitative and quantitative designs.(42)

Mixed methods approaches using different ontological positions in the past have been presented as incommensurable(43). Denzin outlines the paradigm wars throughout the course of the 1980s and 1990s between advocates for quantitative or qualitative positions based on adherence to different paradigms. Denzin notes that during this period, support for mixed methods approaches was variable. (44) Oakley describes the contextual and cultural distinctions that influenced her commitment to scientific-based research and randomized

control designs over qualitative methods in healthcare. She describes the divergence between qualitative and quantitative methods and the difficulties she found in mixing methods.(45)

More recently, mixed methods approaches which draw on both positions are increasingly recognised as possible(40;46) and there is a growth in the use of these methods in health services research.(40) Fulop is a key proponent of this approach, arguing that researchers from different paradigms should be able to work together to address one research problem, although only if they are not functioning at extreme ends of their particular paradigm. She advocates mixed methods for health service delivery and organisational research as an area of applied research that draws on a range of disciplines and perspectives. (40)

The overall study will draw on methods from the functionalist and interpretive paradigms – see Table 1.1. The key to mixed methods is to recognise the contribution and limitations of contributions from different disciplines. Given that the study of organisational resilience has rarely been applied to healthcare(18;47-52), the intention is to take:

- a functionalist stance to examine and synthesis the literature
- an interpretive stance using underpinning theories to explore organisational resilience at micro and meso-level in a case study organisation and at macro-level across governmental, advisory, and regulatory agencies in the healthcare system
- a positivist stance to develop and analyse findings from an organisational resilience questionnaire to develop a robust organisational resilience measurement tool.

1.4.2 Multidisciplinary research

This research is multidisciplinary, reflecting the diverse field of organisational resilience in which at least three disciplines contribute to the literature; engineering (resilient engineering), organisation studies and disaster management which tend towards different ontological and epistemological positions. Given the broad multidisciplinary base, both interpretive and functionalist perspectives have relevance for the study of organisational resilience. Interpretive theories extend and elucidate the dynamic and systemic nature of resilience through the examination of complex change(53) and consideration of the broader implications of interventions, the context they occur in and the interaction between those interventions and other components of the system.(54) The functionalist theories support the quantification of the concepts of organisational resilience through the use of empirical

and statistical techniques that support testing of the concept and generalisability of the concept across different settings.

Table 1.1. Methodological Structure of the Thesis

Chapter	Description	Epistemology	Methodology	Predominant Theory
1	Introduction			
2	Infection prevention and control as a tracer issue	Functionalist	Narrative	Organisational Resilience
3	Organisational resilience literature review	Functionalist	Quantitative/qualitative synthesis	Organisational Resilience
4	Systematic Review of organisational resilience factors in unexpected infection events	Functionalist	Quantitative synthesis	Organisational Resilience
5	Interview/ Document Study of Rising Infections	Interpretive/ Interactionist	Inductive thematic analysis	Foucauldian governmentality
6	Case Study of Unexpected Infection Outbreak	Interpretive/ Interactionist	Qualitative content analysis/thematic analysis	Sensemaking
7	Design and Development of organisational resilience questionnaire	Positivist/Functionalist	Quantitative/qualitative synthesis	Organisational Resilience
8	UK survey, testing and development of revised resilience questionnaire	Positivist/Functionalist	Principal components analysis	Organisational Resilience

1.4.3 Use of social science approaches to interpret organisational resilience

1.4.3.1 Candidate theory selection

Organisational resilience theory, as defined in 1.2.3.1 is a relatively new concept and the literature is disjointed and ontologically diverse. The publication of several seminal works in the organisational studies(55;56) and resilience engineering fields(56;57) have influenced the theoretical development of organisational resilience, whilst highlighting a number of, as yet unresolved, theoretical inconsistencies. As such, comprehensive conceptualisation and detailed empirical studies are lacking in the literature. Complementary theories within organisational studies research have developed at the same time that can assist in the understanding of organisational resilience. These theories help to provide an organisational

context or develop key organisational concepts that enlighten our understanding of organisational resilience as an emerging theory.

To address this issue in this thesis, I consider a range of complementary social science theories; complexity theory; sensemaking; neo-institutional theory; and Foucauldian governmentality and analyse the relevance of these related theories to the theory of organisational resilience. I will take each theory in turn, discussing its key attributes and why it was either discarded or retained for use within the thesis.

1.4.3.2 Complexity theory

In the first instance, I considered theories that might elucidate the study of organisational resilience at micro and meso-level within a hospital organisation. I considered complexity theory as a dynamic model of organisations that might be relevant to the study of organisational resilience and contextually, relevant to hospitals as complex adaptive systems. Complexity theory, which evolved in the natural sciences, is applied at micro-level and then aggregated up to inform theory at meso and macro level. In the 1990's, a body of literature developed which applied complexity theory to an organisational context and was extended in the 2000's to consider its applicability to a business or management context and provide detailed theoretical focus on specific contexts, e.g. the public sector(58) and healthcare.(59) It has been defined as, 'a network of elements (agents) that exchange information in such a way that change in the context of one element change the context for all others. Complexity is the result of the interaction of elements that only respond to the limited information they are presented with.'(59) However, complexity has different definitions in different fields(60) and therefore it can be easier to recognise the characteristics of complexity theory, rather than attempting to identify a unifying definition. There are several key characteristics of complexity theory which appear superficially to resonate with organisational resilience theory as they can be related to the 'adjustment in functioning' described in the definition of organisational resilience that an organisation undergoes as a result of changes or disturbances: systems dynamics (the non-linear interactions between actors and related feedback loops that can amplify or dampen the effects of small changes, either creating more extensive change in system behaviour or reducing the impact on other actors(61)); bifurcation (the point at which there is an abrupt change in system behaviour when a system reorganises and assumes a qualitatively different state(61)); and self-organisation (where actors interact with other actors using local information in a local context resulting in a system with no central controlling force (62)

which develops in unknown directions and with unknown speed(63)). However, the literature highlights the practical difficulties of attempting to map prospectively the micro-level interactions between agents(62) which would be almost impossible in the rapidly evolving scenario of an unexpected event and would require extensive observation beyond the scope of a PhD. A further issue is that as a theory, a complexity approach assists in explaining what happened and how it happened, drawing on mathematical logic and principles, but is less forthcoming in explaining why human actors behaved in a particular way. For these reasons, I chose to adopt a sensemaking approach over a complexity theory approach, as sensemaking addresses the cognitive and behaviour factors at a micro-level which I considered essential in explaining the response of participants in an unexpected event.

1.4.3.3 Sensemaking Theory: Weick

In this thesis I chose to examine organisational resilience using the contribution of sensemaking theory to explain how organisational actors and teams think and behave in particular ways in response to an unexpected event. I considered that the micro-level focus of sensemaking would provide new perspectives for understanding organisational resilience in a complex health setting, as the literature suggests that individual and team resilience has an impact on meso-level resilience.(24) I specifically identified Weick as a major proponent of sensemaking theory (see Appendix B for a summary of sensemaking literature). His work provides a detailed explanation and empirical examples of the cognition, behaviour and actions that result from an individual or teams' sensemaking in unfamiliar or unexpected situations.(64) Despite this, associations between organisational resilience and sensemaking are tentatively made in Weick's work.(55) One of the more specific descriptions of the association between resilience and sensemaking in Weick's work is described as, "resilient action that enables recovery from setbacks is built out of a broad repertoire of action and experience, the ability to recombine fragments of past experience into novel responses."(55)p3 I aim to use a sensemaking lens to examine organisational resilience at micro and meso-level, drawing on the specific characteristics of sensemaking to elucidate the study of organisational resilience during unexpected events.

1.4.3.4 Neo-Institutional theory

In the second instance, I considered theories that might elucidate the study of organisational resilience across the acute hospital system. I evaluated the use of neo-institutional theory as an approach to consider the broader macro-level institutional forces that influence meso-level organisational elements and micro-level individual elements in acute hospital

responses to rising infection rates. Neo-institutional theory has currency as one of the main theoretical perspectives to understand organisational behaviour, therefore warranted consideration as a candidate theory. New institutional theory draws on Scott's conceptualisation of three broad types of institutional structures; regulative (rule setting and monitoring), normative (prescriptive and evaluative) and cultural-cognitive (classification systems, assumptions and premises).(65) Each of these structures contributes to the maintenance of an institutionalized social order and within any particular institution each of these structures plays a greater or less role. The emphasis within institutional theory has focused on rationalized environmental influences, assessing how different institutional structures, e.g. beliefs and practices shape organisations. More recently, the impact of broader societal forces, such as religion, the economy and the state have been referenced in relation to organisations and organisational fields.(66)

I found that institutional theory provided some explanations for the function of organisational resilience within the healthcare infection setting. For example, institutional theory helps to explain how regulatory processes, e.g. the infection prevention and control elements within the Health and Social Care Act 2006, are diffused and adapted within organisations. However, as Hasselbladh and Kallinikos state, 'institutionalism needs to abandon the bird's eye view of the field, and come closer to the social and cognitive means and procedures underlying rationalized beliefs and schemes of action.'(67)p700. I concur with their view that a detailed understanding of practices within delineated social fields, such as health or work is required, rather than the neo-institutional promotion of structural isomorphism. A further issue is that neo-institutional explanations of the means by which beliefs and practices are given form and become diffuse and stable are not adequately developed. Empirical work detailing organisational performance principles, devices of control, procedures, rules of conduct, objects and roles as components of formal organising are limited.(67) Foucault's work on governmentality(68) addressed this shortfall. Foucault defines domains of action by linking central institutions (e.g. clinics, hospitals) with delineated social fields (e.g. health).(69-71) His work addresses the organisational processes and procedures that define knowledge, including the construction of subjects and objects, positions of authority and the criteria of truth.(67)

A further critique of neo-institutionalism is the absence of technology as a principle mode of regulation in conjunction with socio-cultural modes.(72) In relation to the case study I examined, I found technology to be a critical structural factor, alongside socio-cultural processes and therefore found neo-institutionalism to be inadequate, as it is currently

conceptualised, to explain this phenomenon. Instead, the Foucauldian perspective on surveillance(73), combined with Zuboff's elaboration of electronic surveillance mechanisms(74), provided a basis for understanding the role of technology by the state to remotely monitor infections, with the aim of reducing them.

1.4.3.5 Governmentality theory: Foucault

My decision to use Foucault's work on governmentality to inform the study of organisational resilience at macro-level arose from an iterative approach between the early data and the case. An exploratory process of reading, discussing and analyzing the early data with my supervisors, led to the realization of the pivotal role of electronic surveillance programmes to achieve resilience in acute hospitals, particularly in the context of Zuboff's work as an example of electronic surveillance.(74) Zuboff draws on Foucauldian governmentality theory to explain the effects (both intended and unintended) of the introduction and extension of electronic surveillance in the workplace through the development of information communication technologies (ICTs). The impact of electronic surveillance on vertical (hierarchical) visibility and horizontal (peer-level) visibility is explored from a Foucauldian perspective in Zuboff's work.(74) Zuboff's work provided an early exemplar for my application of Foucauldian governmentality theory to electronic surveillance mechanisms in infection prevention and control, at both macro-level from a government perspective and micro-level using an embedded case study.

I have chosen a Foucauldian lens to apply concepts of power, discipline and self-organisation to better understand the role of surveillance in strengthening organisational resilience to infective organisms in acute hospitals in England. I combine Foucault's earlier work describing the in-depth surveillance and control that defined the disciplinary society(73) with his later work describing governmentality(75) and the technology of the self(76) to create a conceptual framework that enables exploration of the role of national electronic surveillance programmes and the enrolment of clinical leaders in self-organisation under surveillance, during the implementation of an infection prevention and control health reform programme by the UK government from 2004 to 2011.

1.4.4 Anticipated contribution of thesis

I intend this thesis to contribute to a number of different fields, reflecting the multidisciplinary conceptualisation and application of organisational resilience in the literature. I consider there to be three main audiences for this thesis: academics from the different disciplines that this thesis contributes to including resilience engineering and organisation studies; infection

control practitioners and managers in healthcare who are interested in understanding more about the practical application of organisational resilience in acute hospitals; and policy makers who are interested in applying the learning from previous unexpected events to future policy development and initiatives, not only in healthcare, but potentially more widely. I will take each of these areas in turn, relating the contribution of this thesis to the relevant audiences.

There is a diverse academic audience for this thesis, as organisational resilience is studied from the perspective of several different disciplines. Hence this thesis is written to appeal to several academic audiences that are rooted in different academic traditions, operating with different epistemological positions. These traditions are: organisational studies, which adopt an interpretive epistemology; resilience engineering which draws on systems thinking and adopts a functionalist epistemology and disaster management which considers emergencies within the community context and tends towards interpretive approaches. In chapter 3, I undertake a literature review which maps themes from the organisational literature onto these three traditions. The thesis aims to integrate organisational resilience research across disciplines by drawing on key elements from each discipline. For example, the organisational resilience questionnaire, the subject of chapters 7 & 8, aims to integrate the tradition of resilience studies within engineering, which emphasise the structural and process elements of resilience, with the cognitive and behaviour elements of resilience that are the focus of organisation studies literature. I have positioned chapters 5 & 6 within the organisation studies literature, using a sensemaking and Foucauldian governmentality perspective as I considered that these theories (as described above) provided the most relevant frameworks for bringing new, if modest academic contributions to the organisational resilience literature.

The second audience is that of practitioners and managers in acute hospitals. With the recent impact on health services of pandemic flu(77), adverse weather conditions(78;79) and Norovirus outbreaks(80), practitioners and managers are seeking to understand how they can make health services more resilient in the face of unexpected events. In particular, from an infection control perspective, the management of outbreaks has centered on clinical, epidemiological and biological solutions. Only recently have organisational approaches been considered and further multidisciplinary research is required to build an evidence-base to demonstrate the potential impact of organisational and behavioural interventions.(81) This thesis adopts an organisational and practical perspective to the study of resilience. This is evidenced in the systematic review in chapter 4, in which the literature on

organisational resilience interventions to reduce the impact of outbreaks in the acute health-care setting is reviewed. A further practical application is the aforementioned organisational resilience questionnaire in chapters 7&8 which provides practitioners with a tool through which the resilience of their organisation to infection outbreaks can be measured and managers with a mechanism to identify shortfalls in practice for remediation.

The third audience is policy makers who are interested in learning lessons from previous unexpected events, .e.g. outbreaks to inform future resilient practice and government bodies seeking to inform healthcare policy development. Independent policy think tanks are studying resilience from an organisational perspective within healthcare[1] and from a cross-government and cross –industry perspective(82). These policy makers are interested in the potential impact of infection outbreaks and antimicrobial resistance on system resilience and lessons for emergency management. The systematic review in chapter 4 identifies organisational resilience themes across infection outbreaks, with the aim of identifying generic learning from comparable events. From a governmental policy perspective, the study in chapter 5, which evaluates hospital resilience from a system perspective, identifies a series of factors at macro-level that contributed to resilience at meso and micro-level. These factors can help inform policy decisions about healthcare and design system-level interventions that can effect resilient change.

1.5 Conclusion

In conclusion, I have examined the evolution of the term 'organisational resilience' and described the context for my study of organisational resilience; infection prevention and control in UK acute healthcare. I have presented the macro-level methodological considerations that have influenced the design of this thesis, which reflect the multidisciplinary nature of organisational resilience literature and identified the anticipated contribution of this thesis to the different fields that contribute to organisational resilience research. I have made my case for the candidate theories used within the thesis and the rationale for discarding other potentially relevant theories. In the next chapter, I proceed to justify in more detail my choice of infection prevention and control as a tracer issue in this thesis.

[1] Website: http://www.resilienthealthcare.net/About_RHCN.html

2 Chapter 2. Infection Prevention and Control (IPC) as a tracer issue

2.1 Introduction

This second introductory chapter provides the rationale for the use of infection prevention and control (IPC) as a tracer issue, examining IPC in the context of expected and unexpected conditions. It forms the basis for three subsequent chapters: informing the use of infection outbreaks for the systematic review; identifying an unexpected event to inform the resilience case study at micro and meso-level; and contributing to the focus on expected conditions in the study of resilient government interventions at macro-level. I conclude this chapter with a description of the aims and objectives of the thesis and an outline of the thesis structure.

In this chapter, I aim to answer the question, 'Why is infection prevention and control a pertinent tracer issue?' A tracer issue is defined as a specific subject area that can be used to examine a theoretical topic empirically, serving to narrow down the scope of an inquiry and provide a rich seam of primary data.(29) For this thesis, the tracer issue is infection prevention and control as it relates to nosocomial transmission and hospital-acquired infections (HAI) as outlined in Chapter 1. Firstly, I will explore the relevance of the organisational resilience definition for establishing infection prevention and control as a tracer issue. Secondly, I will examine infection prevention and control strategies, as they pertain to the organisational resilience definition. Thirdly, I will discuss the implications for the study of organisational resilience and outline how infection prevention and control will be used as a tracer issue within this thesis.

2.2 Aligning organisational resilience with infection prevention and control

I refer to the definition of organisational resilience that I use for this thesis (outlined in the introduction) to examine the two conditions that are relevant to the use of infection prevention and control as a tracer issue. The definition I use is,

'the intrinsic ability of a system (organisation) to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.'(23)

The reference to 'expected' and 'unexpected' conditions in the definition provide the basis for the use of infection prevention and control as a tracer issue in this study. In Hollnagel's definition, the first element of resilience relates to expected conditions or 'business as normal.' To achieve resilience in expected conditions, the organisation has to adjust its routine functioning to cope with occasional or continuous stressors on the system.(83) The second element of resilience relates to unexpected conditions where high anticipation and rapid response are essential elements of organisational function to prevent less frequent, but potentially disastrous disturbances.

For the purposes of this thesis, I propose that the mechanisms for the organisation to 'adjust its functioning' are based on the organisation's ability to mobilise infection prevention and control strategies at individual, team and organisational level and to respond to and/or influence strategies at governmental level. Table 2.1 sets out the proposed approach for aligning expected and unexpected conditions with infections and the associated infection prevention and control strategies.

Table 2.1 outlines three infection criteria and examples of organisms that might be hospital-acquired or be transmitted in the hospital (nosocomial). These organisms have different underlying etiologies, different levels of impact on an organisation and require different strategies to deal with them effectively. In the case of expected conditions, the bacterial (mainly antibiotic resistant) organisms that constitute this group can cause localised outbreaks within organisations, placing occasional, and in some institutions, continuous stress on their function. If unchecked, increasing incidence of these organisms can impact more widely in the hospital organisation(84;85), and as in the specific examples of MRSA and CDI, have a national impact.

For the purposes of this research there are two levels of unexpected events; significant disturbances and extreme disturbances. Significant disturbances include epidemics which can be defined as the expansion of an epidemic strain of bacteria or viruses resulting in significant spread nationally.(86). Extreme disturbances mainly relate to pandemics which can result from extensive spread of novel viral agents caused by the antigenic shift to new virus strains or subtypes. The impact of rapid nosocomial transmission amongst patients

and staff during these unexpected conditions, usually as a result of infectious viral agents being brought into hospital from the community, can cause rapid organisational dysfunction.

Table 2.1. Examples of organisms and infection strategies aligned with expected and unexpected conditions

Conditions	Criteria	Examples of organisms (hospital-acquired/nosocomial transmission)	Adjust organisational functioning (infection prevention and control strategies)
Expected	Occasional or continuous stressors (localised outbreaks)	• Meticillin-resistant Staphylococcus aureus (MRSA) • Clostridium difficile infection (CDI) • Vancomycin/Glycopeptide Resistant Enterococcus (VRE/GRE) • Meticillin-sensitive Staphylococcus aureus (MSSA)	Strategies to address increasing incidence include: • Local unit changes • Organisational strategies • Governmental interventions
Unexpected	Significant disturbances (Organisation outbreaks or epidemic)	• CDI • VRE/GRE • Norovirus	Strategies to address serious disturbances include: • Emergency planning • Cross-organisation co-operation • Government directives • Cross-government collaboration
	Extreme Disturbances (Pandemic)	• Severe Acute Respiratory Syndrome (SARS) • Swine-origin influenza A/H1N1	

I will use the terms 'expected conditions' linked to 'continuous stressors' and 'unexpected events' throughout the thesis to explore organisational resilience in different contexts through the infection prevention and control strategies that are adopted by hospitals in response to each scenario.

Next, I will review key aspects of the infection control strategies that have been adopted by acute hospital organisations and the government in the UK in response to both expected conditions and unexpected events. In this thesis, I have defined expected conditions as the increasing incidence of specific bacterial infections in the UK from 1990-2009 which served as continuous stressors on the resilience of acute hospitals. I have defined unexpected conditions as acute hospitals' responses to significant and unexpected local outbreaks, viral epidemics and to the impact of global pandemics that have occurred over the last decade.

2.2.1 Expected Conditions

In response to the increasing incidence of government monitored bacterial infections in hospitals between 1990 and 2009, specifically MRSA, *C.difficile*, GRE, MSSA, the

government implemented a series of significant shifts in policy in an effort to halt the rise of these infections in acute hospitals. These have included the transition from policy development to operational intervention, from issuing guidance to influencing legislation and the trend towards prioritisation of money and resources to infection prevention. Organisations have developed their own strategies and adopted the government's interventions, but widely varying incidences of infection across different NHS acute hospitals are still evident, despite lower overall rates in the UK.

2.2.1.1 Policy development to operational intervention

Traditionally, the Department of Health's role involved formulating policy to address health issues. This role is evident in infection policy from the 1980s to 2003, when hospital Trusts received a series of Health Service Guidelines and Circulars from the Department of Health with recommendations for change. However, from 2003 onwards as specific, measured infection rates continued to rise, the Department of Health adopted an increasingly interventionist response. This was reflected in the adoption of measurable clinical targets against which acute hospitals were closely monitored, the use of DH improvement teams and Healthcare Commission inspectorates to investigate hospitals who were perceived as failing, the introduction of the 'Towards Cleaner Hospitals and Lower Rates of Infection Programme' and the support of the 'cleanyourhands' NPSA campaign. This transition suggests that the traditional policy approach did not work with infection control. The growing interest from the media and the public in the apparent failure by the NHS to control infections and the effect this had on politicians may have played a significant part in this.(87;88)

2.2.1.2 Legislative transition

The shift from guidance to legislation by the Department of Health over the last twenty years represents a further change. The data on infection levels in 2003 indicated that the Department of Health's strategy of issuing guidance to Trusts was failing to work, resulting in a transition towards developing legislation to address infection problems. In 2006 the Health Act incorporated a code of practice for the prevention and management of infection(89) which required managers to meet minimum standards and in 2008, the Health and Social Care Act(90) was introduced, extending the requirements for infection prevention to health and social care.

2.2.1.3 Performance management

The government introduced a range of increasingly stringent enforcement mechanisms to ensure hospitals adopted new policies. The step changes involved moving from recommendations for implementing infection prevention and control teams and practices in the early 1990s to setting clear objectives in 2000, to introducing clinical targets for the first time in 2004 and legislation in 2006. The trajectory of MRSA blood stream infections (BSIs) began to fall finally in 2008.

2.2.1.4 Resource commitments

NHS policy guidance in 1995 stated that implementation of the guidance by Trusts should incur 'no financial or manpower implications'(91) By 2003, the Department of Health reflected in its guidance 'Winning Ways' that healthcare-associated infections had not been afforded such a high priority as some other aspects of healthcare in England.(36) Infection control departments were considered a 'Cinderella service' with pressures on microbiologists and a shortage of infectious disease experts.(36) This situation changed, driven in part by the criticism of previous policies by the National Audit Office (NAO) reports in 2000(34), 2004(92) and 2009(93) with significant investment in cleaning programmes, education, inspections, improvement teams, ICT staffing and campaigns from 2004 onwards. These changes were influential in affording infection prevention and control a higher status in hospitals, particularly with the appointment of a key leadership role, the DIPC on Trust Boards.

2.2.2 Unexpected Events

I will review three studies that discuss the unexpected impact of 3 different organisms that caused rapid nosocomial transmission in acute hospital settings to understand:

- The infection factors that create an unexpected event;
- The level of impact of the unexpected event; and
- The organisational response.

The three studies were selected from the systematic review described in Chapter 4. These studies met the inclusion/exclusion criteria for unexpected infection events in healthcare, but failed the quality assessment as they were narrative descriptions of unexpected events. However, I have used them here as they offer insightful narrative and thematic accounts of unfolding events and help to explain the value of using infection outbreaks as a proxy for unexpected conditions.

One study relates to the unexpected impact of a newly identified viral strain of norovirus in a university hospital,(94) the second to a hospital emergency response to novel Influenza A (H1N1) pandemic(95) and the third to a clinical review of severe acute respiratory syndrome (SARS).(96) The studies have different perspectives; the norovirus study focuses on the epidemiology of a new viral strain, the H1N1 study focuses on the antimicrobial stewardship approach and the SARS study focuses on a disaster management approach. However, as outlined in Table 2.2, there are a series of infection factors that cause an outbreak to become an unexpected event. These factors can cause the hospital to be insufficiently prepared to either anticipate the outbreak or respond to the extent of the outbreak.

Table 2.2 Examples of infection outbreaks that illustrate the potential for infection outbreaks to serve as a proxy for unexpected events.

Infection identified in study	Infection factors that create an unexpected event	Level of impact of the unexpected event	Positive aspects of organisational response
Norovirus	New strain of virus. Rapid spread from index case to other wards. Very few virions (<100) required to establish acute infection. Secondary nosocomial transmission frequently observed.	63 cases of acute gastroenteritis in patients and staff between Feb-Mar 2001	Immediate infection control measures. Isolation of patients. Sick HCWs excluded from work. Published guidelines. Patients' transfer between wards restricted. Infected patients nursed together.
H1N1	New strain of virus. Early cases in pandemic resulting in independent hospital response. Inadequate testing until later in outbreak.	Large surges of patients and worried well. Over 1,000 patients between May-Dec 2009	Rapid multidisciplinary team response. Clinician-led response. Triage guideline implemented. Use of web technology for outbreak information. Cross-department collaboration. Antimicrobial stewardship programme (ASP). Streamlined anti-viral drug usage.
SARS	New strain of virus. Beginning and end of outbreak is unclear. Unclear illness presentations. Uncertain diagnostic criteria.	Large surge of unanticipated critically ill patients.	Multidisciplinary crisis team. Rapid communication and information. Use of web technology for outbreak information. Isolation of affected patients.

Key: ILI – Influenza-like illness, HCW – Healthcare worker. Nosocomial – Hospital-based

Despite the shortfalls in anticipation and response, all studies had identified positive organisational responses that had facilitated the care and throughput of patients. All studies also identified areas of problematic practice, which included: silo working, breakdowns in communication, individual concerns being prioritised over organisational needs, insufficient leadership at the front-line, inadequate staff support, distrust between teams and political barriers. However, post-outbreak, all studies reported learning from the challenges and positive practice that occurred during the outbreak. Some had identified innovative practice

that resulted from the outbreak which was embedded in routine care. Others had found solutions to the challenges that were faced and identified ways to improve preparedness for future outbreaks or other types of unexpected event.

My review of these three studies provides empirical evidence for the use of infections as exemplars for the study of unexpected events from an organisational resilience perspective. The outbreaks, particularly those involving a new strain or sudden surge in patient numbers, place an unexpected and sudden strain on hospital resources, testing the resilience of the whole organisation and its capacity and capability to respond.

2.3 Discussion and Implications

In this chapter, I have examined the potential for hospital-acquired and nosocomial transmission of infections to serve as a tracer issue for organisational resilience. The evidence suggests that infections serve as a useful tracer issue for both continuous stressors during expected conditions and as unexpected events on a hospital organisation. In either scenario the hospital has to respond to prevent extensive transmission or spread. The continuously evolving nature of infectious diseases means that there will be new strains of existing infections and new infections that test the overall ability of acute healthcare to cope, particularly when hospitals are often coping at maximum capacity already.

How a hospital responds to either expected, but stressful conditions or an unexpected event, is critical in the study of resilience. Depending on the impact and extent of the infection in the hospital, the organisational approach and the strategies that it adopts will determine whether it is able to deal effectively with the problem.

In this research, I will use primary research to explore hospital responses in the context of expected conditions and unexpected events. In Chapter 5, I assess the impact of two organisms, MRSA BSI and CDI as continuous stressors on acute hospitals in England and the response of hospitals and the government to address the problem over a decade. In Chapter 6, I use an organisation-wide Norovirus outbreak as an empirical example of an unexpected event that had a significant impact on an acute hospital Trust and examine the hospital's response to this outbreak.

2.4 Aims and objectives of the thesis

The overarching aim of this thesis was to examine organisational resilience in the UK acute hospital context, focusing on infection prevention and control as a tracer theme. In order to achieve this aim, the objectives were as follows:

- to investigate what is known about the concept and associated factors of organisational resilience and the application of organisational resilience to UK acute hospitals
- to explore theoretically and empirically the two contexts for organisational resilience (expected conditions and unexpected events) in the hospital infection context and;
- to design and test an organisational resilience tool to measure organisational resilience in the context of an unexpected event

These objectives define different elements of study and draw on a range of methodologies and underpinning theoretical perspectives to achieve them. Each chapter states specific aims and outlines the specific theoretical and methodological approach that is relevant for that chapter.

2.5 Structure of the thesis

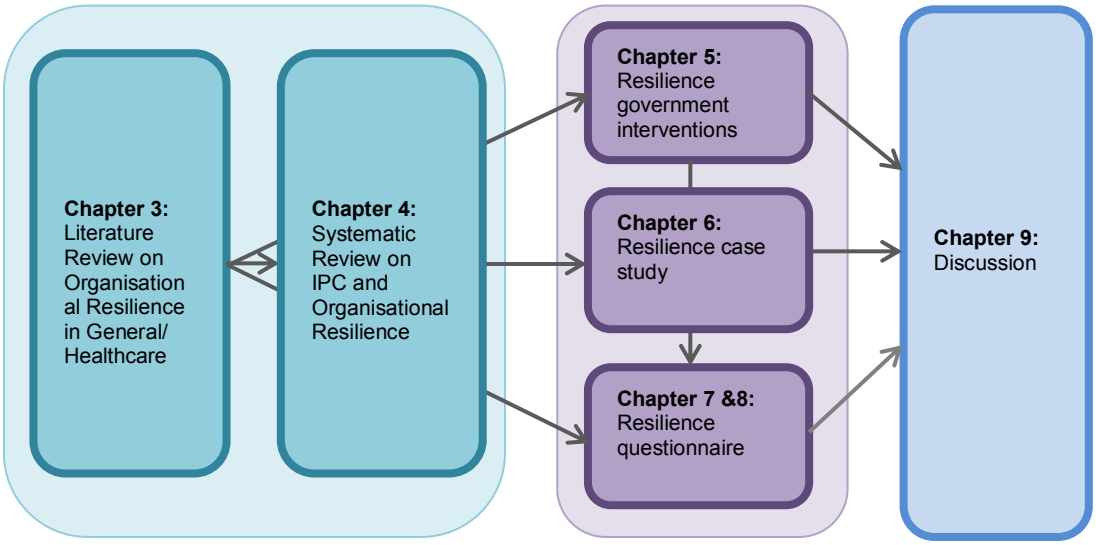
The thesis comprises eight subsequent chapters, outlined in the PhD 'road map' in Figure 2.1.

The thesis begins with an introductory chapter which provides the empirical context for the theoretical and empirical chapters. Chapter 2 provides the rationale for the use of infection prevention and control (IPC) as a tracer issue for organisational resilience, examining IPC in the context of expected and unexpected conditions. Two background chapters follow. Chapter 3 is a literature review of organisational resilience, evaluating how and to what extent organisational resilience is developed conceptually and empirically in the current literature. This provides the context and evidence-base for Chapter 4, which addresses gaps in the resilience literature. Chapter 4 is a systematic literature review of IPC strategies for dealing with unexpected events, with the creation of a framework of resilient factors that derive from infection outbreaks. All three chapters serve as an introduction to the theoretical/empirical chapters, providing an assessment of the strengths and weaknesses of

the organisational resilience literature and the utility of IPC as a tracer issue for an improved understanding of organisational resilience.

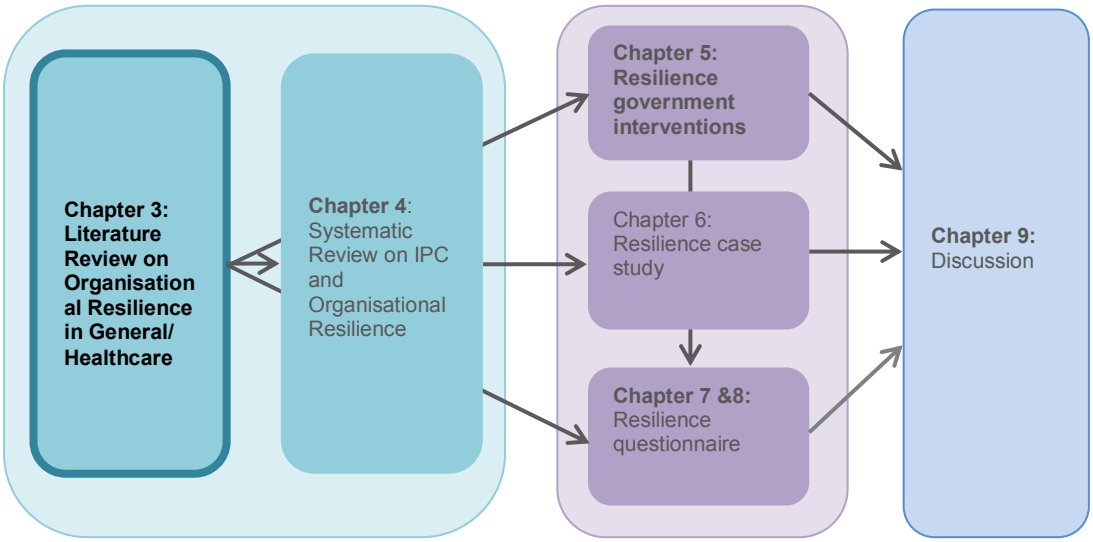
Chapters 5-8, the theoretical/empirical chapters, examine the concept of organisational resilience in an IPC context, addressing theoretical gaps in the literature and utilising underpinning theoretical perspectives to provide an in-depth understanding of each case. Chapter 5 assesses organisational resilience at macro-level examining the impact of government interventions on rising infection rates in acute hospitals. Foucauldian governmentality theory is adopted to assess the effectiveness of a national surveillance strategy utilised by the government in increasing organisational resilience in hospitals. Chapter 6 assesses organisational resilience at micro-level using a case study of an unexpected infection event. This chapter draws on sensemaking theory to provide a novel and detailed perspective of the cultural, cognitive and behavioural factors that contribute to or detract from resilient practice which are insufficiently conceptualised in the sensemaking or resilience literature. Chapter 7 & 8 describe the design and development of an organisational resilience questionnaire and then present a revised questionnaire based on the analysis and findings from a survey using the questionnaire. This chapter addresses a significant gap in the organisational resilience literature, namely the lack of effective measures of organisational resilience. Finally, Chapter 9 concludes the thesis, with a discussion of the findings, limitations, challenges and implications for clinical practice, policy and future research identified during the research. The conclusion summarises the key contributions of the thesis.

Figure 2.1 PhD 'Road Map'



3 Chapter 3. A Literature Review of Organisational Resilience

In the following two chapters, I examine organisational resilience, using the theoretical and empirical literature. In the first of the background chapters, Chapter 3 I undertake a theoretical literature review of organisational resilience research. The purpose of this review is to assess the strengths and weaknesses of theoretical development in the organisational resilience field. I take an in-depth review of the healthcare-related resilience theory to understand the extent of this literature and examine the underpinning theories which characterise the field. In the second of the background chapters, Chapter 4, I adopt a contrasting approach. I undertake an empirical systematic review, specifically focusing on healthcare studies of infection outbreaks as a proxy for unexpected events. Using thematic analysis, I identify cross-cutting conceptual resilience themes within these infection studies and use these as a basis for comparison with the concepts that were identified within the theoretical literature review of Chapter 3. This process informed the development of the theoretical/empirical studies in this thesis.



3.1 Introduction

The aim of this literature review is to answer the question, 'how and to what extent is 'organisational resilience' defined theoretically in the recent literature?' To achieve this, the following objectives will be met:

- To critically appraise the current state of organisational resilience literature through a literature review
- To assess healthcare-focused organisational resilience literature as a context for the research studies in this thesis.
- To identify gaps and areas for future research in the organisational resilience literature.

The literature review is designed to outline the conceptual breadth of the field and provide a basis for future theory development.(2)

Existing literature reviews of organisational resilience have been assessed and the gaps that were identified informed the development of this literature review. The focus of one recent review (2012) was to assess resilience literature from the context of small and medium enterprises (SMEs).(2) This touched on organisational resilience, alongside resilience in the fields of ecology, psychology, physical systems and disaster management but as a result of the breadth of this review, there was insufficient focus on organisational resilience. A further review published in 2012 attempted to combine a review of the literature with an integrative model of organisational resilience, but lacked methodological rigour.(97) A systematic literature review published in 2011 reviewed all resilience literature to understand the key concepts that are relevant to public health and disaster planning.(1) However, the main focus of this review was on communities and populations, rather than organisational resilience. Some grey literature exists, such as an evidence-based guide for practitioners commissioned by the Chartered Institute of Personnel and Development (CIPD), Business in the Community (BITC) and the Institution of Occupational Safety and Health (IOSH).(98) However, this evidence-based guide focuses on a practitioner perspective, to explore what businesses leaders can learn from the literature. In summary, there is a gap in the literature, which this research addresses, for a robust and current review of organisational resilience literature.

3.2 Methods and Scope

A literature search was undertaken using OvidSP to search EMBASE, Medline, HMIC and PsychInfo (n=59) and using the Web of Knowledge to search the Web of Science with conference proceedings (including Science Citation Index Expanded, Social Science Citation Index and Arts and Humanities Citation Index), Medline and CABI (n=65) in November 2012. Search terms were ‘resilience’ and associated abbreviations combined with either ‘organisation’ or ‘organization’ and associated abbreviations to take account of the frequent

use of the American form used in articles. Owing to the diverse nature of the literature, extensive hand searches of cited references from the articles generated within these electronic searches were conducted as was a search using Google Scholar. Date limits were applied to the preliminary search to identify the last 20 years of literature from 1992-2012. This did not reduce the number of retrieved articles, reflecting the more recent use of the term 'organisational resilience'. These dates were chosen as the term 'organisational resilience' came into use at the beginning of the 1990's, when there was a transition from its use in ecology to use in organisations. Prior to that, the few articles that addressed resilience-related topics used the term 'adaptation' rather than resilience. As Woods(99) notes, adaptability cannot automatically be labeled as 'resilience' as resilience incorporates the broader capability of a system to handle disruptions and variations. The few key articles that comment on capability in addition to adaptability issues have been identified using hand searches and incorporated into the literature review.

Overall, 124 articles were retrieved using database searches (see Figure 3.1). Each of the 124 articles was reviewed against the classification criteria outlined in Table 3.1.

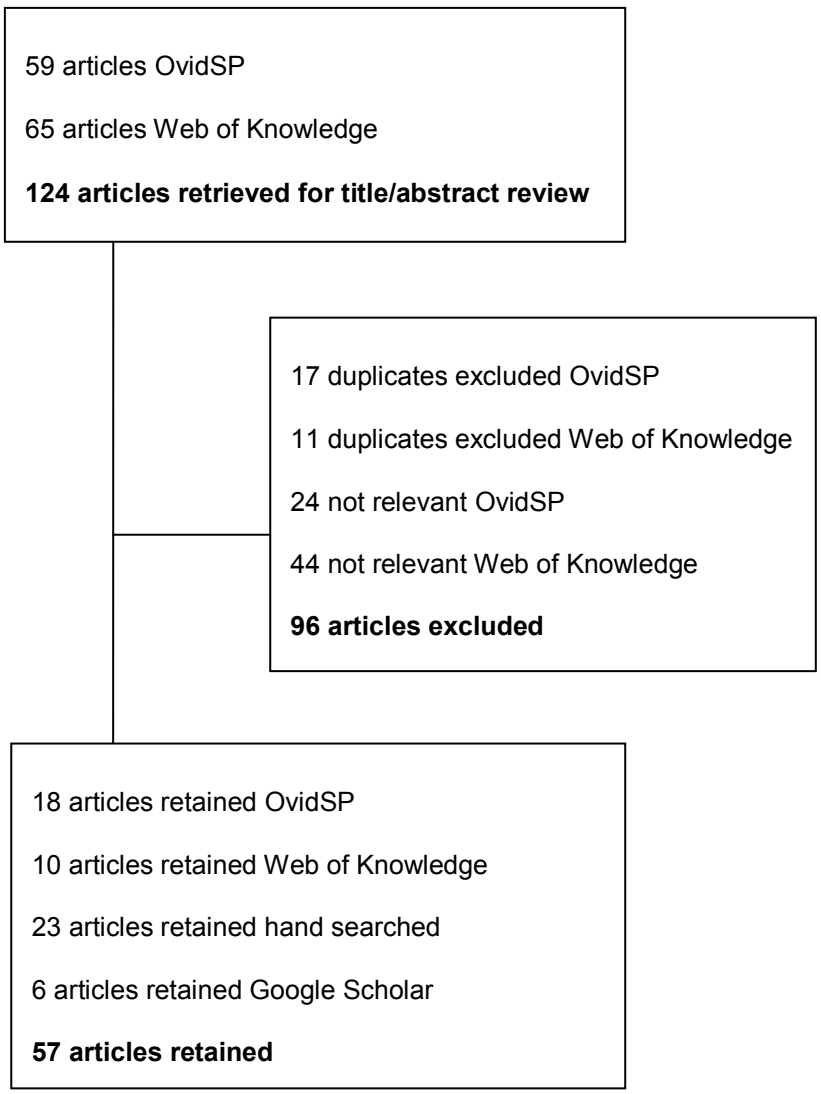
Table 3.1 Classification criteria for literature review

Research focus	Organisational Resilience
Resilience focus	Unexpected event/Continuous stressor
Methods	Theory building/Empirical/Measurement
Organisational Resilience Concepts	Concepts identified through full text review of included articles

The main criterion for inclusion in the review was a focus on organisational resilience. The subject area of each article was included so that the extent of healthcare-focused research in comparison to other subject areas was understood. Articles were included if they covered the impact of unexpected events or the impact of occasional or continuous stressors, or both. Methodological criteria included theory building, empirical and measurement to illustrate the extent to which organisational resilience research is conceptually or empirically focused. Organisational resilience concepts were not pre-stated. Instead, an exploratory approach was employed, identifying key organisational concepts within the full text review of retained literature to build a picture of the nature of organisational resilience studies to date.

A duplicates search across both databases identified 28 duplicates in total. The remaining 96 articles were screened for relevance to organisational resilience, using the title and abstract. 68 articles were excluded because they either a) related to another area of resilience, e.g. ecology, information technology or b) were insufficiently robust e.g. a non-peer reviewed paper, a patent, a practitioner book. 28 articles were retained. Extensive hand searching was undertaken in these articles for relevant cited references (n=23) and further cross-checking was undertaken on Google Scholar to identify relevant peer reviewed research that had not been identified through the search process (n=6). A full text review was undertaken of the 28 retained papers and the 29 papers identified through hand searching and Google Scholar.

Figure 3.1 Review process



3.3 Results

I report on the results of the literature review, a total of 57 organisational resilience papers. These papers are described in Table 3.2, both from a methodological and conceptual perspective.

3.3.1 Multi-disciplinary approaches to organisational resilience

I identified literature in three main disciplines; organisation studies, resilient engineering and disaster planning, detailed in the headings in Table 3.2 and **Error! Reference source not found.**. I found that organisational resilience research is at the juncture of all three disciplines. Engineers, safety scientists and psychologists discuss high reliability organisations and the concept of adaptation at the juncture between organisation studies and resilient engineering. The majority of adaptation research focuses on the impact of continuous stressors on organisations whereas high reliability research relates to both expected and unexpected conditions. Another shared area is between organisation studies and disaster planning. The juncture between these disciplines relates to the fields of crisis management and emergency planning. The focus of much of this research is on the impact of unexpected events on organisations.

Figure 3.2 Interrelated disciplines associated with the organisational resilience literature



Table 3.2 Concepts and Methodologies in the organisational resilience literature.

Author (s)	Year of Publication	Database	Area of focus	Resilience focus		Method			Organisational Resilience Concepts																					
									Organisation Studies								Resilience Engineering							Disaster planning						
				Unexpected event	Continuous stressor	Theory building	Empirical	Measurement	Org. learning	Org. change	Org. development	Org. structures	Org. culture	Cognition/Behaviour	Trust	Leadership	Communication	Performance	Preparedness	Innovation	Improvisation	Adaptation	Monitoring	Crisis mngt	Reudundancy	Recovery	Policy making	Competitive advantage
Meyer(22)	1982	HS	Healthcare	✓		✓	✓	✓	✓			✓		✓								✓			✓			✓
Virany *et al(100)*	1992	HS	Technology		✓		✓		✓									✓				✓							
Acar and Winfrey(101)	1994	HS	Systems		✓	✓			✓				✓					✓	✓			✓							
Anderson(102)	1994	Ovid	Education		✓	✓			✓									✓									✓		
Hind *et al (103)*	1996	Ovid	Psychology		✓		✓	✓		✓																			
Diamond(104)	1996	Ovid	Technology		✓	✓				✓										✓									
Bourrier(105)	1996	HS	Nuclear Power		✓		✓					✓						✓											
Horne and Orr(106)	1997	GS	Organisations		✓	✓		✓	✓	✓			✓	✓			✓	✓											
Mallak(107)	1998	Web	Healthcare		✓	✓	✓							✓															
Mallak(108)	1998	Web	Organisations		✓	✓								✓							✓	✓							
Weick *et al*(109)	1999	HS	Organisations	✓		✓			✓			✓		✓				✓				✓		✓					
Paton *et al*(110)	2000	HS	Organisations	✓		✓								✓				✓											
Carthey *et al*(111)	2001	HS	Healthcare		✓	✓		✓						✓													✓		
Comfort *et al*(112)	2001	HS	Education	✓		✓	✓		✓	✓												✓	✓				✓		
Weick and Sutcliffe(113)	2001	HS	Organisations	✓		✓	✓						✓	✓	✓	✓			✓		✓	✓							
Coutu(114)	2002	Ovid	Organisations		✓	✓							✓			✓					✓	✓							
Fiksel(115)	2003	HS	Systems		✓	✓						✓	✓					✓				✓							✓
Hamel and Valikangas(116)	2003	HS	Business		✓	✓				✓		✓						✓	✓			✓							✓
Riolli and Savicki(12)	2003	Web	Information Technology		✓	✓				✓		✓	✓	✓				✓											

Author (s)	Year of Publication	Database	Area of focus	Resilience focus		Method			Organisational Resilience Concepts																				
									Organisation Studies								Resilience Engineering							Disaster planning				
				Unexpected event	Continuous stressor	Theory building	Empirical	Measurement	Org. learning	Org. change	Org. development	Org. structures	Org. culture	Cognition/Behaviour	Trust	Leadership	Communication	Performance	Preparedness	Innovation	Improvisation	Adaptation	Monitoring	Crisis mngt	Reudundancy	Recovery	Policy making	Competitive advantage
Starr *et al(117)*	2003	HS	Business		✓	✓				✓								✓	✓	✓			✓					✓
Sutcliffe and Vogus(118)	2003	GS	Organisations		✓	✓			✓			✓		✓		✓						✓							
Weick and Sutcliffe(18)	2003	HS	Healthcare	✓			✓							✓		✓							✓							
Dalziell and McManus(119)	2004	HS	Systems	✓		✓				✓								✓				✓		✓	✓	✓			
Vera & Rodriguez-Lopez(120)	2004	Ovid	Humility		✓	✓			✓							✓		✓											✓
Aguirre & Dynes(52)	2005	HS	Healthcare	✓		✓	✓		✓			✓	✓	✓										✓					
Sheffi & Rice(20)	2005	GS	Telecoms	✓			✓						✓					✓	✓			✓		✓	✓	✓			✓
Gittel *et al(121)*	2006	Ovid	Aviation	✓			✓			✓	✓							✓						✓					✓
Hollnagel *et al*(56)	2006	GS	Engineering	✓	✓	✓				✓		✓				✓			✓			✓	✓		✓				
Lee and Trim(122)	2006	Ovid	Retail		✓	✓			✓					✓	✓														✓
Luthans *et al(123)*	2006	GS	Human Resources		✓	✓				✓				✓				✓				✓					✓	✓
McDonald(124)	2006	HS	Aviation		✓		✓			✓												✓							
Lalonde(125)	2007	Ovid	Organisations	✓	✓	✓					✓													✓					
Perry *et al*(49)	2007	Web	Healthcare		✓		✓							✓				✓											
Välikangas(27)	2007	Web	Biotechnology	✓			✓		✓			✓											✓							
Vogus & Sutcliffe(24)	2007	Web	Organisations		✓	✓			✓									✓					✓						
Weick & Sutcliffe(55)	2007	HS	Organisations	✓		✓	✓						✓	✓	✓	✓			✓		✓	✓							
McManus *et al*(126)	2008	GS	Organisations	✓		✓	✓			✓		✓					✓			✓		✓		✓					
Paton *et al*(127)	2008	Web	Policing	✓					✓									✓				✓							

Author (s)	Year of Publication	Database	Area of focus	Resilience focus		Method			Organisational Resilience Concepts																				
									Organisation Studies								Resilience Engineering							Disaster planning				
				Unexpected event	Continuous stressor	Theory building	Empirical	Measurement	Org. learning	Org. change	Org. development	Org. structures	Org. culture	Cognition/Behaviour	Trust	Leadership	Communication	Performance	Preparedness	Innovation	Improvisation	Adaptation	Monitoring	Crisis mngt	Reudundancy	Recovery	Policy making	Competitive advantage
Reason(128)	2008	HS	Healthcare	✓	✓	✓	✓		✓				✓	✓		✓		✓										
Seville *et al* (129)	2008	Ovid	Organisations	✓		✓	✓										✓							✓		✓		
Crichton *et al*(130)	2009	Ovid	Organisations	✓		✓			✓		✓								✓									
Huber *et al*(28)	2009	Web	Chemicals		✓		✓		✓	✓												✓						
Jeffs *et al*(50)	2009	Ovid	Healthcare		✓	✓	✓					✓		✓		✓	✓											
Powley(131)	2009	HS	Education	✓			✓																					
Rerup(51)	2009	HS	Pharma	✓		✓	✓		✓			✓										✓						
Smith & Fischbacher(132)	2009	HS	Risk Management	✓		✓				✓												✓						
Somers(133)	2009	Ovid	Organisations	✓		✓					✓	✓										✓		✓				
Sullivan-Taylor & Wilson(134)	2009	Ovid	Aviation/ Leisure	✓		✓			✓										✓									
Tillement *et al*(135)	2009	Ovid	Rail	✓			✓							✓			✓											
Denhardt & Denhardt(136)	2010	Ovid	Organisations		✓	✓				✓	✓					✓		✓		✓		✓						
Størseth *et al*(137)	2010	Web	Petroleum		✓	✓	✓						✓	✓			✓				✓	✓			✓			
Burnard & Bhamra(138)	2011	HS	Organisations	✓		✓			✓	✓												✓						
Chan(139)	2011	Web	Business		✓		✓	✓				✓										✓						✓
Hollnagel *et al(57)*	2011	HS	Engineering	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓	✓	✓	✓	✓					
Lengnick-Hall *et al*(140)	2011	Ovid	Human Resources	✓		✓					✓			✓											✓		✓	
Linnenluecke *et al*(78)	2012	Ovid	Extreme weather	✓	✓	✓				✓												✓				✓		
Huber *et al*(141)	2012	Ovid	Aviation		✓	✓	✓	✓		✓												✓	✓					

Table 3.3 Healthcare-focused organisational resilience literature

Author	Date	Theoretical basis	Definition of Organisational Resilience?	Description of study
Meyer(22)	1982	Environmental adaptation Two concepts discussed in Weick(142): the stimulus-response paradigm and the variation-selection-retention mechanism	"Resiliency occurs when responses create negative-feedback loops that absorb jolts' impacts and loosen couplings between organizations and their environments." p520	**Adapting to environmental jolts** A model of adaptation to environmental jolts based on empirical data relating to a doctors' strike. Adaptations occurred in three phases: anticipatory; responsive; and readjustment. Ideologies and strategies were found to exert strong influence on organisations' adaptations and slack resources and structures imposed weak influence.
Mallak(107)	1998a	Three concepts discussed in Weick (19): (1) bricolage; (2) attitude of wisdom; (3) virtual role system	"the ability of an individual or organization to expeditiously design and implement positive adaptive behaviours matched to the immediate situation, while enduring minimal stress." p149	**Measure aspects of resilience in healthcare** Six factors explaining over half the instrument variance were found, following a survey of nurse executives, including: goal-directed solution seeking; avoidance; critical understanding; role dependence; source reliance; and resource access.
Carthey *et al*(111)	2001	Safety management: system's resistance to hazards (+) versus vulnerabilities (-)	"the system's intrinsic resistance to its operational hazards. Some organisations will be more robust in coping with the human and technical dangers associated with their daily activities." p29	**Institutional resilience in healthcare systems** Use of cultural drivers; commitment, competence and cognisance and institutional principles, policies, procedures and practices; to move organisation from vulnerability towards resistance to hazards. Checklist for institutional resilience (CAIR)
Weick and Sutcliffe(18)	2003	Behavioural commitment(143) Sensemaking (64;113)	"a cultural mindset about risk, danger, and safety that was anchored by a process of behavioral commitment that shaped interpretation, action, and communication." p74	**Hospitals as cultures of entrapment** Strong behavioural commitment to unsafe care, driven by cultural mindset. Clinicians exhibited high autonomy and choice, leading to justification and rationalization of poor results – a culture of entrapment.
Aguirre and Dynes(52)	2005	Mindfulness(109)	"the dynamic planning that is needed, planning which facilitates changes in the structures of the social organizations at risk and that bring about increases in resilience……and which reflect a culture of mindfulness."p4	**Institutional review of disasters in acute hospitals** Hospitals responses to disruptions reflect social construction of disasters, distinct from magnitude of impact of a hazard. Disaster planning should be guided by; mindfulness, pre-vision and structural transformation to address imagined or real demands
Perry *et al(49)*	2007	Risk, safety and human factors(144)	"safety, reliability, and resilience can best be achieved not through attempts at increasing procedural invariance (e.g. the rigid enforcement by technology of policies and procedures) but through the situated management of fluctuations in important organizational relationships and work practices." p3416	**Factors undermining resilient performance in healthcare** Assess organisation role in undermining organizational resilience using empirically derived factors: imposition of tighter control over work practice, increased standardization, negative trade-off between procedural compliance and clinical urgency.
Reason(128)	2008	Mindfulness(109)	"institutional resilience is an emergent property of the mental and technical skills of those at the sharp end,"p262	**The Human Contribution – Achieving Resilience** Suggests an approach that moves from human as hazard to human as hero. Institutional resilience requires individual and collective mindfulness. Constraining human variability to reduce errors and increase reliability paradoxically undermines safeguards of human adjustments to imperfect situations.
Jeffs *et al(50)*	2009	Safer Systems(145;146)	"to inform strategies that build clinical and organisational resilience through a multi-level framework derived from the collective theoretical and empirical work." P75	**Building clinical and organisational resilience** Multi-level safety trade-offs and tensions occur that can be addressed by: organisational processes and policies that maximize clinical scope of practice, foster collective responsibility for identifying safety threats, develop clinical appreciation of dynamic nature of patient safety in the work environment.

3.3.2 Organisational Resilience Concepts

I have identified 20 key concepts that are commonly used to explain aspects of organisational resilience within the literature. As Table 3.2 demonstrates, the majority of studies identify one or more organisational concepts that contribute to resilient practice, but these concepts are often not interrelated in a meaningful way. Given the breadth of theorising in relation to organisational resilience (43 out of 57 papers), I found that the number of cohesive theoretical models are limited and those that exist are largely focused on unexpected events, rather than expected events in the context of continuous stressors. In terms of the context of theoretical development, it is often sector-specific and the lack of measurement can prevent generalization to other sectors.

3.3.3 Empirical studies

In the literature review, 27 of 57 studies were empirical, the remainder was either theoretically or measurement focused or combined both. A review of the literature highlighted a number of issues with the empirical research on organisational resilience. In the 1990s and early 2000s, a paucity of empirical studies existed at this time, outlined in Table 3.2 . This situation improved over the last decade, as there was increased recognition of the need for more empirical research to test theoretical propositions. The majority of empirical research has been qualitative and few quantitative studies involving measurement have been published. In this review only 7 of 57 studies involved measurement, although recent publications have included statistically based surveys.(147)

Many empirical studies appear to focus on individual concepts relating to organisational resilience, rather than considering organisational resilience as an overarching concept. This may have occurred as organisational resilience is not a clearly defined concept, creating complexities of study design and analysis. There is often insufficient discrimination between the two elements to organisational resilience definitions; unexpected events and expected events (under pressure of continuous stressors) resulting in the use of empirical contexts that fail to reflect this differentiation. There has, and continues to be a reliance on secondary data, rather than primary data as evidence in empirical studies. These studies are often based on the extensive secondary data associated with unexpected events or incidents(18;19;55;57) that are often features of investigations into areas such as aviation, healthcare, the nuclear industry or wild land firefighting crews.

3.4 Discussion

In this literature review, I set out to answer the research question: how and to what extent is organisational resilience defined conceptually and empirically in the current literature?

I begin by discussing the results to determine how and to what extent organisational resilience is conceptually defined and secondly, I will assess how and to what extent organisational resilience is empirically defined. I will conclude the discussion by identifying gaps in the literature, explore in the conclusion how these gaps might be addressed by future research and assess the implications for the research in this thesis.

3.4.1 Ontological diversity within the literature

A key issue for studying organisational resilience conceptually is the diversity of concepts that are loosely coupled under the umbrella of organisational resilience. This is evident from the results of this review, where the breadth of organisational resilience concepts reflects the range of ontological positions of multiple disciplines. In simplified terms, I consider that the organisational resilience literature reflects an ontological differentiation between:

1) An objectivist, critical perspective which draws on positivist epistemology. This perspective informs the study of organisational resilience in the physical and natural sciences including disciplines such as engineering, material science, risk management and disaster management. Organisational resilience is understood as a system property defined as the adaptive capacity of the organisation to overcome vulnerability in response to hazards and return to its existing state. Concepts from the resilience literature that reflect this position include the terms: adaptation, performance, preparedness, redundancy, structures, crisis management and competitive advantage.

2) A subjectivist or constructivist perspective which draws on interpretivist epistemology. These perspectives inform the study of organisational resilience in the social sciences including disciplines such as organisation studies, psychology, economics, sociology and public administration. Organisational resilience is understood as an organisational response defined as the capacity and capability of the organisation to respond and recover positively and incorporate learning from disturbances so as to develop an improved state. Concepts that reflect this position include the terms: organisational learning, cognition, behaviour, trust and organisational culture.

Traditionally, organisational resilience studies favour one of these positions, for example, Vogus and Sutcliffe propose that analytical separation should be drawn between the first critical position, a reliability approach that anticipates and mitigates error by design and the second constructivist position, a resilient approach that attempts to monitor for anomalies and manage these once they emerge. (24) These ontological differentiations, whilst overlapping to a greater extent than this simplified differentiation suggests, create difficulties in forming a unified conceptual definition of organisational resilience. However, in the last decade the literature has begun to converge; there is an increased recognition that incorporating alternative ontological and epistemological perspectives provides a more complete picture of the structural and social aspects of organisational resilience.(57;125;128)

3.4.2 Organisational resilience concepts

Organisational resilience concepts are related to the terminology and ontology of specific disciplines as shown in Table 3.2. Typically, of the three main disciplines that contribute to organisational resilience studies (Figure 3.2), organisation studies papers will relate organisational resilience to concepts such as; organisational learning, organisational change, cognition, behaviour and trust. Resilience engineering concepts relate organisational resilience to concepts including; communication, performance, preparedness, innovation, improvisation, adaptation and monitoring, whereas disaster management relates resilience to concepts such as crisis management, redundancy, recovery, policy making and competitive advantage. A few concepts are evident across disciplines, such as leadership. This conceptual diversity and the multi-disciplinary nature of the field impede the theoretical development of organisational resilience as an overarching concept. The lack of a cohesive field is reflected in the lower number of specific studies of organisational resilience.

A further issue is the limited number of theoretical studies that consider how resilience concepts are linked, interrelated or correlated. Those that do exist have often not been tested empirically using primary data(22;55;97;138) with a few recent exceptions. (20;147) Of the organisational concepts that are described, there are relatively few concepts that are shared across disciplines; leadershipbeing an example of an exception.

Within disciplines, varied terminology has developed to describe the same concept. For example, within organisational studies, sensemaking has been described as mindful

attention, heedful interrelating and collective mind. Theoretical frameworks suffer from the same problem. Different disciplines use varied terminology to describe broadly similar phases and structures, reflecting disciplinary preoccupations. For example, adaptation may be used in the natural sciences but improvisation and flexibility may be used by social scientists to describe the same concept. The result is that multidisciplinary work on organisational resilience is less evident, as academics are working within their own paradigms in separate disciplines.

3.4.3 Organisational resilience models in the literature

Few conceptual models exist in the literature and those that do focus on resilient performance in relation to unexpected events.(20;22;138) Of those relating to unexpected events, these models have some similarities; most comment on an anticipatory, preparedness stage and all describe a detection/initial response phase and a full response phase which includes adjustment, recovery and learning. One of the earliest models is Meyer's adaptation to environmental jolts model which is based on empirical healthcare research.(22) This model, which describes three phases of anticipation, response and readjustment, defines 'resiliency' as an organisational outcome that occurs when the impact of jolts on the organisation are absorbed. A recent model which concentrates on the detection and response to an unexpected event is Burnard & Bhamra's model which reflects an ontological position influenced by the discipline of operations management, cybernetics and complex systems theory.(138) This model focuses less on anticipation and preparedness and more on the process of monitoring that enables detection, response and adjustment to an event. The third model is based on research undertaken by Sheffi since 2002 on supply chain disruption funded by the UK government and presents a typical profile for organisations facing significant disruption.(20) The model describes three phases of preparation, response and recovery in response to disruption that are linked to organisational performance. Organisations that are able to maintain or improve their performance following an unexpected event are considered resilient, although the outcome will depend on the nature and impact of the disturbance, the degree of anticipation pre-event and the extent of mitigation post-event. Both Meyer's and Sheffi's models are empirically based and are built on detailed research in US healthcare and global industry supply chains respectively. Whilst the models assist in the development of theory on organisational resilience by defining the stages of an unexpected event and proposing the nature of the organisational response, several issues exist.

The first issue is that these models are structurally rather than behaviourally focused. Each model defines a systems response, outlining a relatively linear process (although with some feedback loops), which potentially underemphasizes the behavioural complexity of the response to the disruption. Whilst Meyer assesses cultural influences, such as values, ideologies, traditions and myths, the cognitive and behavioural characteristics of individuals and groups are less well developed.(22) Sheffi & Rice also acknowledge the importance of corporate culture, recognising the benefits of questioning prevailing wisdom and encouraging 'maverick' information.(20) The most developed from a behavioural perspective is Burnard & Bhamra's model(138) which briefly refers to mindfulness, in their description of the detection, activation and enhanced monitoring that characterises the early phase of the event, but behavioural factors are not well developed in relation to the other phases of the event. The organisational response phase in the models is defined as a set of positive and negative organisational adjustments, with insufficient assessment of the cognitive and behavioural capacity and capability within the organisation.

The second issue is that the models mainly focus on unexpected events. Models that conceptualise resilient functioning during expected conditions(103), for example, in the presence of a continuous stress are less evident in the resilience literature(97), despite this scenario being much more prevalent than an unexpected event. In place of models, resilience in the face of expected events are described by resilience audits,(103;111;117) resilient behaviours,(55;106) resilience principles,(108) resilience mechanisms,(24) characteristics of resilience, (115) resilience questions,(117) resilience capabilities(23) and resilience factors.(12) The search for a model of resilience during expected events continues. In a recent book(83), Hollnagel acknowledges the lack of resilience models for expected events and argues that the focus of resilience research should be on expected rather than unexpected events, with the aim of increasing the number of things that go right (resilience) rather than to reduce the number of things that go wrong (safety). He proposes a mechanism for measuring resilience, a Resilience Analysis Grid that focuses on four measures of resilience: the ability to respond; the ability to monitor; the ability to anticipate; and, the ability to learn. These four measures can be aggregated into a resilience profile.

In summary, I have identified that the conceptual literature on organisational resilience is diverse and disjointed. The contribution of several disciplines with different ontological positions has contributed to this situation. Of the conceptual models that exist in the literature, these are structurally rather than behaviourally focused and the focus is on the

effect of unexpected conditions, rather than expected conditions and empirical testing has not taken place.

Few resilience models exist and these are largely based on unexpected events. The strengths of these resilience models are the similarities in terms of key phases of an unexpected event: anticipation/preparedness; response to the event; and, adjustment/recovery post-event. A further strength is that the theory development is based on detailed multi-method empirical studies. The gap in the literature highlighted by these models is the development of a cognitive and behavioural lens on an unexpected event. Models have not developed yet for expected events, and numerous elements of resilience have been conceptualised but these lack cohesive, incremental theoretical development.

3.4.4 Polarised positions within the resilience literature

I have found that a feature of the organisational resilience literature is a polarization between reports of high resilience organisations(128), low resilience organisations(18;28) and comparisons of low and high resilience(20;52;55;121;126;131) when empirical examples are used. High resilience organisations are often interchangeably described as high reliability organisations (HROs).(55) Features of high reliability organisations described by Weick and Sutcliffe(55) is that they are able to maintain organisational resilience, defer to expertise, remain sensitive to front-line operations, track small failures and resist oversimplification. Weick and Sutcliffe consider the features of low resilience organisations are those that violate the latter five principles. This situation may exist as the organisations that are identified retrospectively as dramatically failing or becoming highly reliable (often in response to the way that they have dealt with unexpected events) are more easily identifiable and potentially perceived as more interesting to study. A few articles exist that take a more nuanced approach to resilience and recognise the dynamic nature of organisational resilience. Tillement(135) assesses the dynamics between occupational groups in a rail transport system and identifies the asymmetric power relationships and professional rivalries between occupational groups which negatively impact on organisational resilience but does identify that the management of unexpected events in a strong networked community can positively impact on organisational resilience.

3.4.5 Trade-offs

Trade-offs are a feature of all resilience literatures; resilient engineering, organisation studies and disaster planning. Trade-offs refers to the dynamics between competing priorities within a system and are fundamental to the function of organisational resilience. The most

pertinent trade-offs are discussed in more detail in this section, which examines the nature of system dynamics, trade-offs and their relationship to resilience. The method by which organisations manage the trade-off between competing priorities at every level of an organisation and in response to unexpected events or continuous stressors will contribute to how resilient that organisation's practices are. McDonald argues that 'resilience seems to reflect the tension between stability and change in organisational and operational systems, mediated by the notion of appropriate adaptation.'(124)p156 There are two elements to trade-offs; the first relates to how discriminatory a judgment is in relation to the trade-off and the second relates to the criterion for decisions or actions that occur along the trade-off spectrum.(99) The effect of each of the trade-offs listed below will be discussed in relation to their impact on organisational resilience:

- Performance versus safety
- Flexibility versus stiffness
- Redundancy versus full capacity
- Centralisation versus decentralisation
- Routine versus mindfulness

3.4.5.1 Performance versus safety

I identified that a critical trade-off in the literature is that between performance and safety requirements. Performance requirements to achieve greater effectiveness or efficiency can conflict with safety requirements, for example, as a result of reduced safety margins to achieve cost savings or changed processes that reduce cross checking.(99) Wood comments that in the NHS, 'acute' requirements of efficiency, effectiveness and timely access to care often conflict with 'chronic' requirements such as safety, quality outcomes and equitable treatment. To prevent the systems tensions caused by these conflicts, he argues for a dynamic balancing act where safety is a key priority alongside other system goals and inherent in the culture of the organisation.(99)

3.4.5.2 Flexibility versus stiffness

A further trade-off concerns the degree to which an organisation is able to balance flexible ways of operating with elements of formality and rigidity in its operations and organisational structure. Flexibility involves an organisation's ability to build organic capabilities that permit the identification of threats and ensure a fast response. Organisational forms of flexibility may include informal work practices, distributed decision systems, agile manufacturing

systems, enabling technologies and organisational systems with learning and feedback loops.(124) In contrast, stiffness is a tendency to operate rigidly in the face of disruptive events or persistent strain by viewing them as a burden rather than an opportunity.(20) Stiffness in organisational terms can include slow and bureaucratic decision making processes, technology limitations, rigid organisational designs and defensive risk attitudes.(24) If the balance is in favour of stiffness, then the organisation's resilience will be eroded as it lacks the capability to respond and adapt quickly to new and changing circumstances.

3.4.5.3 Redundancy versus full capacity

A third trade-off in the literature between redundancy and full capacity refers to the reservoir of resource the organisation has available to respond to an unexpected event. Redundancy is defined as keeping some resources in reserve to be used in case of disruption whereas operating at full capacity means there are no slack available to call on in case of an unexpected event.(20) Resilient organisations appear to 'deploy more of their financial, cognitive and relational resources in response to emerging and manifest threats.'(24)p3421 A dilemma facing organisations that attempt to secure slack is that narrowing performance margins encourage managers in organisations to secure organisational performance through extensive protocols and procedures, clearly delineated job roles and accountability constraints.(148)A meta-analysis conducted in 2004 found a positive relationship between slack (redundant financial) resources and firm performance. The results suggested that organisations used slack to improve performance, which contrasts with the view that increasing slack may cause organisational inefficiency. Unsurprisingly, there was a stronger relationship in studies that were controlling for industry, which were largely people-intensive service organisations, e.g. healthcare, compared with the control, capital-intensive manufacturing industries, which suggests that organisations should achieve levels of slack that are sufficient for high performance in their own sector.(149)

3.4.5.4 Centralisation versus decentralisation

Another component of the resilient debate is the extent to which a centralised or decentralised system constrains or supports resilient functioning in organisations. A centralised system is one characterised by a command and control structure. Control is maintained through rules, protocols and regulations and strong disciplinary tendencies to ensure obedience. This rigidity of structure ensures that safety is maintained, but often at a cost to performance targets.(150) The resulting problems are that communication is

discouraged and of the few communication channels that exist, many are one-way from the top to the bottom of the organisation. This type of environment can encourage widespread and routine violations of rules and local adaptation as workers find that rules are impossible to apply as documented in the local environment that they work which can affect safety and reduce resilience.(150) However, in a crisis scenario, adopting a centralised structure can assist in managing the event effectively, as long as the appropriate experts are deferred to within that control structure.(55) Alternatively, the decentralisation of knowledge, functions and control can encourage greater mindfulness as accountability and responsibility in an organisation is delegated further down the hierarchy.(55)

3.4.5.5 Routine versus mindfulness

A key debate about the relationship between resilience and mindfulness is the understanding of routines (repetitive processes and behaviours) compared with mindfulness. Can a resilient organisation operate mindfully and without routine? Or is an element of both required for effective operations? One argument is that they operate as a duality – both routine and mindful practices can occur simultaneously, each informing the other.(151) Weick and Sutcliffe suggest that 'mindless acts are automatic, routine acts are customary' so to prevent automatic and mindless routines, organisations need to regular review and their routines to acknowledge changed circumstances, e.g. feedback from incidents and challenge customary behaviours.(55)p61 Research in healthcare settings has shown that what distinguishes resilient organisations is a concern for routine operations in the face of unexpected events and demands. Whilst this does not preclude the ability to operate mindfully, the maintenance of key routines in difficult circumstances ensures continuity and consistency of operations that enables mindful responses to the event.(152)

I have examined some of the key characteristics of the organisational resilience literature, reflecting on the strengths and weaknesses of the research field to date. In the next section, I extract and assess the healthcare-specific literature to provide a context for the research studies in this thesis.

3.5 To assess healthcare-focused organisational resilience literature

I examine the healthcare-focused organisational resilience literature identified in this review (n=8) as a context for the research studies in this thesis (see Table 3.3). I identified few points of coherence in this small and disjointed literature. I will examine the points of cohesion and divergence and identify areas for future research.

3.5.1 The value of healthcare-focused organisational resilience research

Across all healthcare-focused articles, there is a general acceptance that acute healthcare is a useful area to study organisational resilience as a result of its complexity, uncertainty and fast-paced practice with the capacity for disruptions and unexpected events. The complexity arises from the multiplicity of interactions between human, technical, structural and systems factors operating at different levels with the health system and uncertainty from uneven demand for health services, particularly from emergency and urgent cases.

Aguirre and Dynes concur with using healthcare as a suitable field of study, as "contrary to some other complex organizations, hospitals are in the business of providing normal responses to extraordinary occasions, absorbing abnormal occasions and processing them to try to alleviate and improve people's health."(52)(p11) Disruptions and unexpected events are perceived to occur more often in healthcare owing to the breadth of events that might occur within the system or environmental influences on the system.(52) The majority of studies focus on disruptions to the system, either from hazards, sub-cultures or errors. Both Meyer's and Aguirre and Dynes' study focuses on acute hospitals' responses to unexpected events and these studies found that responses to unexpected events are socially constructed.(22;52) Although Mallak's study refers to crises and incorporates two theoretical constructs built on unexpected events; bricolage and virtual role systems, it is not clear whether the survey tool used in the study was contextualised in terms of crises situations.(107)

3.5.2 Characteristics of healthcare-focused organisational resilience research

Seven of the eight healthcare studies draw on empirical evidence to a greater or lesser extent, either referring to direct primary research(22;49;50;52;107;128) or secondary information.(18) Three studies discuss measurement; Meyer's study utilises regression analysis to understand the relationships between sets of variables relating to an unexpected event, Mallak's study develops scales of individual resilience based on Weick's work on the Mann Gulch disaster(19) and Carthey et al's work develops a checklist for institutional resilience which is untested.(111) The sensemaking perspective(153) is the theoretical basis for four out of eight studies, which refer to aspects of Weick's work such as mindfulness, bricolage and virtual role systems. Chapter 6 of this thesis will build on the sensemaking theories that inform these studies.

Organisational resilience is not clearly defined in the majority of studies and is usually implicitly rather than explicitly stated, as is apparent in the definitions outlined in Table 3.3.

The majority of definitions are cognitively and behaviourally focused, considering mental skills,(128) cultural mindsets,(18), relationships (49)and positive adaptive behaviours(107) whereas two are systems focused, drawing on planning to change structures.(22;52)

3.5.3 Insights from healthcare-focused organisational resilience research

In order to inform the research within this thesis, I identified three features of organisational resilience in healthcare which are evident across these studies. The first is the paradoxical nature of resilience, where the organisational response to an unexpected event or disruption invariably involves efforts by hospital managers to tighten control over the situation, reduce variability and standardise practice. However the process of standardising practice can reduce the individual or team workarounds or shortcuts, what Reason describes as the heroic improvisations,(128) that can preempt or prevent further disruptions or adverse events occurring.(49) Aguirre supports this perspective, arguing that routinisation of practice that has evolved from disruptions increases the reliability and resilience of hospitals. Jeffs counters this argument by proposing that in a culture where shortcuts or workarounds are adopted regularly, a drift towards a new, less safe standard is encouraged and practices with unacceptable tolerances are normalised.(50)

The second feature relates to organisational learning. Aguirre argues that the revised practices which are generated from different types of disruptions are then applied to a broad range of future, potentially unrelated situations or disruptions, so that the distinction between learning from different types of disruptions becomes blurred but informs the mindful practice of hospital staff.(52) Subsequently, empirical studies in different contexts have identified similar findings, that learning from one incident might be applied to other unrelated scenarios, but act as a catalyst for change and improvement.(26)

The third feature relates to the use of Weick's work as a theoretical basis for five out of eight studies. Weick's work focuses on cognitive and behavioural explanations for organisational responses to unexpected events.(142;154) Although Weick only refers to resilience more explicitly in his later works(55), the use of concepts such as sensemaking, mindfulness, behavioural commitment, bricolage and virtual role systems to underpin organisational resilience studies indicates the relevance of his work to this field. Aguirre proposes that hospitals operate as social organisations within the institution of health care and differ in the extent to which they will demonstrate resilience or not in response to a particular disruption, partially based on their capacities, their mindfulness and their responsiveness to hazards.(52) Reason suggests that these differentials will occur as a result of human

factors, based on the capabilities of hospital staff to pre-empt or recover near misses or adverse events successfully and recognise the conditions that might trigger them across the hospital.

To summarise, the healthcare organisational resilience literature is sparse. Of the studies that exist, the use of sensemaking theory, empirical research and behavioural perspectives is evident across the studies. Although two measurement tools exist, one focuses on individual resilience and the other is a checklist which has not been systematically tested.

3.6 Shortfalls and future directions for organisational resilience research

3.6.1 To identify gaps in the organisational resilience literature

In this section, I examine the gaps and problems with the organisational resilience literature. The study of organisational resilience is significantly affected by multiple disciplines developing different perspectives in the field, built on varied ontological positions. This situation generates problems; a diverse and disjointed field of research, conflicting terminologies, inadequate development of theoretical propositions and insufficient empirical testing of models and frameworks that exist. A positive perspective on the diverse literature is that new ideas are generated by different disciplines, which can cross-fertilise other disciplines and has accounted for, in more recent years, the absorption of cognitive and behavioural thinking into structural and systems thinking and a broader organisational and institutional perspective on cognitive and behavioural perspectives. Specific problems in the literature that have been identified are:

- A focus on individual organisational concepts (differentials), e.g. organisational learning, preparedness rather than the development of models;
- A failure to consider in detail the interrelationship between concepts in a tangible and testable manner;
- The inadequate conceptualisation and testing of the different contexts in which organisational resilience operates, limiting the development of generic frameworks and models;
- Inadequate empirical testing of models and frameworks has occurred, although in the last decade the position has improved; and

- Insufficient understanding about what happens in an organisation at each stage of an unexpected event or how organisations respond to chronic stressors over time.

To address these problems, the following gaps in the literature have been identified.

- Measurement studies are needed to test resilience factors across a whole organisation;

- Theoretical and empirical research is needed to explore the extent to which a relationship exists between organisational resilience and broader environmental and regulatory factors, owing to the inadequate theorising on operational systems and their environment.

- Theoretical and empirical studies undertaken at organisational level are needed to develop and test the theoretical concepts outlined in this chapter.

Vogus and Sutcliffe suggest that the paucity of empirical work exploring resilience in organisational theory leaves many avenues open for future research in resilience.(24)

3.6.2 Key areas requiring further research

Building on the previous section which identified many problems and gaps in the literature, empirical studies undertaken at organisational level are needed to test the theoretical concepts, models and frameworks outlined in this chapter. Further theorising is required to develop currently underdeveloped research on organisational resilience generally and specifically in healthcare. McDonald comments that "we do not seem to have a strong empirically based model of how organisations respond, effectively or otherwise, to serious challenges to their operational integrity, such as are posed by serious incidents."(124) The following areas are considered necessary to develop the field:

- Empirical studies, particularly quantitative measurement-based studies, are needed to test organisational resilience concepts, models and frameworks within and across organisations, both in relation to individual events and continuous stressors over time;

- Multidisciplinary research is required that attempts to combine the contributions from different disciplines to create a more comprehensive and cohesive picture of organisational resilience in practice;

- Owing to the inadequate conceptualisation of the interaction between organisations at meso-level, and the influence of external agencies/governments at macro-level, both theoretical and empirical research is needed to explore the extent to which organisational resilience is affected by broader macro-level influences; and

- Research is needed to assess the degree to which resilient organisational responses differ according to the nature of the unexpected event or stressor and comparative studies are required to examine these responses across multiple organisations.

In conclusion, there are significant gaps in the existing organisational literature which would benefit from robust and well constructed theoretical and empirical research, which builds on existing research and takes a multidisciplinary perspective to develop a more comprehensive and cohesive picture of organisational resilience.

3.6.3 Implications for the research studies in this thesis

To inform my research, I have identified three significant gaps in the organisational resilience literature and designed studies that address these gaps and contribute to the future agendas for organisational resilience research. The gaps are detailed below:

1. Insufficient theoretical and empirical basis to explain how organisational resilience operates in particular contexts and under particular conditions;

2. The inadequate conceptualisation of resilient interactions within organisations and resilient functioning in the context of broader macro-level influences; and

3. The need for greater multidisciplinary research that combines structural and behavioural factors in one framework to create a more comprehensive picture of organisational resilience in practice.

I have designed three theoretical/empirical studies (Chapter 7&8 are interlinked), where each study addresses some or all of these gaps in the literature (listed in brackets), as detailed below:

- Chapter 5: The presentation of a positive example of information communication technology (ICT)-enabled national surveillance strategy, applying a Foucauldian governmentality perspective to explore the resilient factors that contributed to a reduction in specific organisms. This is a macro-level qualitative study, assessing

the cross-system interactions between the government, hospital organisations and local actors. (1, 2)

- Chapter 6: The development of an organisational resilience framework built on existing sensemaking literature and utilising a sensemaking theoretical lens to assess organisational resilience during an unexpected infection event. This is a micro and meso-level case study, set in one acute hospital organisation that uses an in-depth qualitative methodology. (1,2)

- Chapter 7: The design and development of a multidisciplinary resilience questionnaire, to address a significant gap in the literature on robust measurement of organisational resilience. This study builds on the qualitative content analysis undertaken in Chapter 6 which analyses an unexpected infection event in a hospital organisation. (1,3)

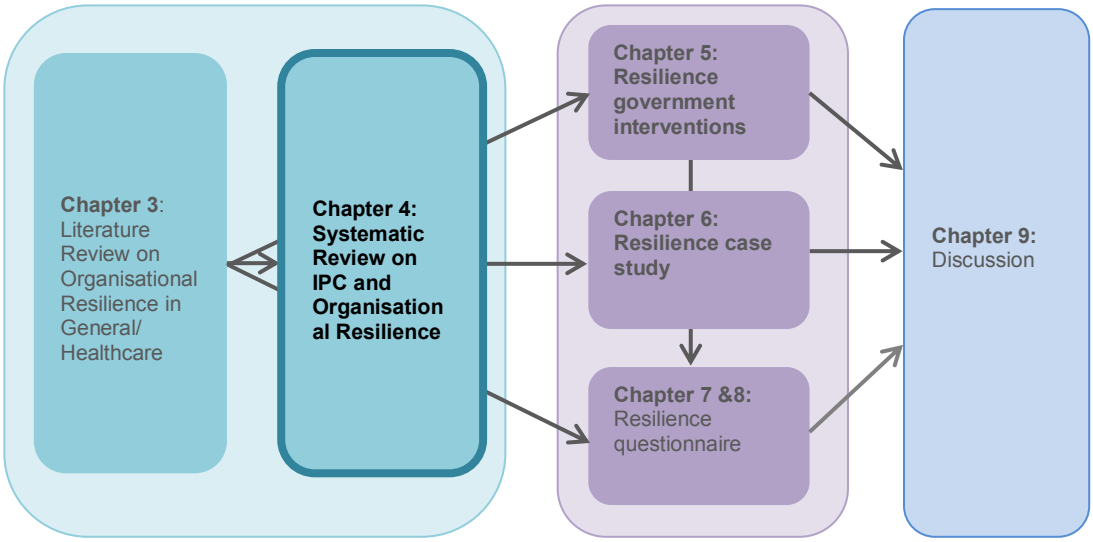
- Chapter 8: The identification of organisational resilience constructs and associated variables relating to an unexpected event which informs the revision of the organisational resilience questionnaire. The methodology involved the analysis of an organisational resilience survey of unexpected infection events using principal components analysis.(1,3)

In conclusion, these chapters build on the findings from the overarching resilience review and the more specific healthcare-focused review and will contribute to key elements of the future research agenda on organisational resilience.

4 Chapter 4. Reducing the impact of outbreaks in the acute health-care setting by organisational resilience interventions: a systematic review

4.1 Introduction

This is the second background chapter, and is a systematic review of the infection prevention and control strategies adopted by acute hospitals to reduce the impact of infection outbreaks. This chapter builds on the resilient concepts identified in the literature review in Chapter 3 and acts as an evidence-base for the exploration of resilient factors in an infection context in Chapter 6.



My literature review (Chapter 3) has highlighted a series of shortfalls in the organisational resilience literature: the diverse range of organisational resilience concepts; the paucity of healthcare-related studies; and a series of untested models for unexpected events. To address these gaps and to achieve a robust look at the empirical literature, the next step is to undertake a systematic review to examine organisational resilience factors in the context of an unexpected infection event in the acute healthcare setting.

This is the first time that the identification of organisational resilience factors within an unexpected event has been attempted in a systematic way. As described in Chapter 2, infection prevention and control is a relevant and useful tracer issue for organisational resilience. This systematic review will focus on one aspect of infection prevention and

control practice – the response to infection outbreaks. Infection outbreaks serve as a 'unexpected event' from an organisational resilience perspective and can constitute 'an abrupt and brutal audit'(55)p3 of an organisation's resilience or vulnerabilities. For this reason, only infection outbreaks that have had a rapid and unexpected impact in an acute health-care setting will be considered within this review.

4.1.1 Organisational resilience interventions

The use of organisational resilience paradigms are recommended for the study of unexpected events in the fields of community-based(110;125;155-157) and governmental disaster management(158;159). Recent studies in these fields recognise the limitations of traditional perspectives on disaster and crisis management which have focused on two trends; disasters as social events and the development of a set of techniques to manage risks and hazards.(125) These studies propose that organisational development, with its understanding of organisational capacities and capabilities should be harnessed to disaster and crisis management to create an amalgamated theoretical and empirical perspective that recognises the key role of organisational resilience.(125) The lessons that can be learnt from this reinvigorated approach should be applied to organisational resilience research in healthcare. The importance of understanding organisational development perspectives in addition to other influences on clinical practice needs to be incorporated further into healthcare research. From the perspective of infection prevention and management(160), this might assist in explaining why a focus on clinical, microbiological and epidemiological practice alone might not halt the progression of outbreaks.

The organisational resilience literature identifies a number of resilient concepts based on theoretical perspectives, individual empirical studies or reviews of the literature. These concepts are identified in Chapter 3, but include strong leadership (136;161) communication,(1;155;162;163), improvisation,(55) innovation,(136;164-166) redundancy, change,(14;119), performance/safety trade-offs(50) and incorporating learning into future preparedness plans.(26) Owing to the few empirical studies in healthcare, it is not clear from the current literature, how these resilient concepts equate to practical resilience interventions during an unexpected event. A further issue is that empirical studies are often based on reviews of individual events, so it is difficult to generalise from these individual studies whether there is a pattern of resilient interventions that relate to unexpected events. For this reason, this systematic review will aim to assess: 1) what resilient interventions exist in an infection outbreak context; and 2) if a pattern of resilient interventions exists across the selected studies, what this adds to the existing organisational resilience literature.

4.1.2 Outbreaks as unexpected events

Hospital outbreaks significantly affect the routine practice of acute hospitals. Acute hospitals dealing with an unexpected outbreak are suddenly faced with a rapid surge in infected patients, huge pressure on limited resources and the potential for nosocomial transmission amongst staff and other patients. Acute hospitals are expected to implement effective interventions, drawing on any emergency preparedness arrangements in place to deliver an effective response. The U.S. has formalised and standardised such preparedness and response approaches in the form of the Hospital Incident Command System (HICS)(167), a system for use in emergency and non-emergency situations. In many other countries, these approaches are less standardised and acute hospitals may draw on national or international guidance but - ultimately - develop their own plans. The robustness of these plans can influence whether the response to an unexpected event constitutes a crisis, or is managed as an escalation of routine practice.

Recent years have witnessed the global impact of outbreaks on acute healthcare. Of relevance to this review is the impact of outbreaks of varying degrees of severity. At worst, viral pandemics, caused by the antigenic shift to new virus strains or subtypes, for example, swine-origin influenza A/H1N1 in 2009, and Severe Acute Respiratory Syndrome (SARS) in 2003 can have a significant impact on the management of acute healthcare.(77;168) The World Health Organisation reported that as of March 2010, 213 countries worldwide had reported laboratory confirmed cases of swine-origin influenza which caused at least 16,813 deaths.(169) By June 2003, a cumulative total of 8,403 probable SARS cases with 775 deaths had been reported in 29 countries.(170) At a national level, outbreaks of Norovirus have a significant seasonal impact in the community and cause further problems if nosocomial transmission occurs in the acute healthcare setting. For example, in the UK, the Health Protection Agency (HPA) reported 1653 outbreaks in the NHS during the 2011-12 Norovirus season, involving 1291 ward/bay closures. Owing to the potentially significant impact on healthcare organisations, infection outbreaks provide an excellent context for studying organisational resilience.

The infection literature in the last decade has typically examined infection outbreaks or transmission of infection within acute healthcare at a Unit or ward level in the acute setting without examining the broader organisational context, to understand the organisational factors that contribute to a successful outcome.(171) The focus of reviews to date has been on clinical, microbiological and epidemiological outcomes, rather than assessing the effect of organisational interventions.(81) Recent systematic reviews have considered the effect of

physical interventions to reduce or interrupt the spread of respiratory viruses across community and acute settings(172), assessed quasi-experimental study designs in the field of infection prevention and control (IPC) under expected conditions(173), and considered the impact of individual interventions in the management of organism-specific outbreaks(174). However, reviews of multifactorial organisational interventions that facilitate preparedness and effective responses to unexpected events are poorly represented in the literature to date. The historical emphasis on clinically focused quantitative systematic reviews has led to a self-fulfilling prophecy where organisational factors are rarely considered. A further constraint is that organisational factors may not easily be assessed using quantitative measurements. Cognitive and behavioural drivers relating to factors such as leadership, sensemaking and adaptation are usually researched using qualitative methodologies which may not meet the rigour of quality assessment used in systematic reviews. For these reasons, systematically reviewing studies of infection outbreaks will contribute to healthcare policy and research on the contribution of organisational interventions to improve infection control practice and provide a much needed context for the development of organisational resilience theory.

4.1.3 Definitions

In this systematic review, I refer to the definition of organisational resilience adopted within this thesis, “the intrinsic ability of a system to adjust its functioning, prior to, during or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.” (57) As discussed in Chapter 2, the unexpected conditions presented by outbreaks and transmission of infection within acute care provide a valuable field of study for the development of understanding of organisational resilience. As described in Chapter 3, although theoretical resilience frameworks exist, relating to the key stages of unexpected events, inadequate empirical exploration of the resilient factors that underpin the unexpected event has occurred to date. I define unexpected events in acute healthcare as an outbreak or transmission of infection within acute healthcare where the outbreak has had a significant and rapid impact, involving an urgent coordinated organisational response to address it. Increasing incidence of infection, where there is a gradual increase in infections over a period of one year or more will be excluded.

I define organisational-level interventions as those interventions that involve a coordinated corporate response, by clinicians and managers to reduce the extent of the outbreak. The interventions may impact across the whole organisation, or be focused on certain wards/Units where the outbreak is occurring. Interventions include changes in leadership,

capacity, capability, communication, environment, education, training, surveillance and equipment provision. As organisational-level interventions rarely conform to randomised controlled trial methodologies, in this systematic review I adopted the approach and methodologies of a recent systematic review of behaviour change to optimise IPC and aimed to include all controlled and non-controlled intervention studies.(175) The parameters of my systematic review are detailed in the Table 4.1 below, following the participants, interventions, comparisons, outcomes and study design (PICOS) format.(176)

Table 4.1 Systematic Review Criteria (PICOS)

Population	Acute care hospitals in developed countries affected unexpectedly by infection outbreaks
Intervention	Interventions that involve a coordinated organisational response
Comparator	Acute care hospitals in routine care provision mode
Outcome	Effectiveness of interventions that involve a coordinated organisational response by measuring: Lower nosocomial infection transmission to staff and/or patients than reported in other studies of similar outbreaks Shorter duration of outbreak Fewer bed days lost per outbreak
Study Design	All controlled and non controlled study designs that contain data.

4.1.4 Research Questions

So, I am going to undertake a systematic review to answer the research question: Do organisational resilience interventions lead to a reduction in the impact of outbreaks in the acute health-care setting? To achieve this, I will address the following aims:

a) To assess the organisational resilience interventions that are used in an outbreak

b) To identify patterns of resilience interventions across selected studies

c) using a) and b) to reveal organisational resilience factors

For the purposes of this research which aims to assess organisational resilience in the UK, I will adopt a resource-rich, developed world focus, to ensure that the healthcare and socio-political context is sufficiently similar to draw consistent conclusions about the type and pattern of organisational resilience interventions. I will focus the systematic review on acute

healthcare, as this is the focus of my research and provides a sufficiently boundaried and consistent context to assess resilience from an organisational perspective.

4.2 Methods

This systematic review was undertaken according to the PRISMA guidelines.(176)

4.2.1 Search strategy

I conducted a search of Medline (including in-process and other non-indexed citations), EMBASE, ASSIA, PsycINFO, Business Source Complete and HMIC as outlined in Table 4.2. The breadth of databases used was to ensure that clinical (infection prevention and control), organisational (organisational resilience) and crisis/disaster management literature was captured. The search was limited to studies published in English between January 1999 and October 2012 as this was the period when there was a rise in rates of hospital-associated infections. Search terms (keywords and MeSH terms) covered three facets; organisational resilience factors, nosocomial infections and unexpected events (disasters/crises). The search strategy was tailored to each database and its indexing system. The design of the overarching search strategy was reviewed by an experienced researcher with practical knowledge of systematic reviews, which resulted in minor amendments. The full search strategy for four databases is included in Appendix A. Terms were first identified through a bottom-up search of relevant infection prevention and control literature. These themes were cross-referenced with a thematic top-down literature review of organisational resilience (described in Chapter 3) that identified six disciplines that contained relevant resilience terms; patient safety, human factors, emergency preparedness, resilient engineering, resilient behaviours and organisational behaviour. A matrix that mapped terms across the relevant disciplines was prepared to inform the development of the search strategy. A sensitivity checking procedure (which involved reviewing and cross-referencing the references of seminal papers) was employed to ensure that recognised, relevant papers were present in the retrieved search papers and the search terms were amended to include any that were absent.(177) Reference lists of retrieved articles were hand searched for relevant papers and grey literature including unpublished literature and non-journal publications from governmental agencies were sought. The final search strategy was run in October 2012.

Table 4.2 Description of databases used for search strategy

Database	Description
Medline	Contains titles and abstracts for life sciences and biomedical literature.
EMBASE	Contains citations, abstracts and indexing of biomedical and pharmacological literature, some of which are not offered in Medline.
Applied Social Sciences Index and Abstracts (ASSIA)	Contains indexing and abstracts of health and social science literature covering health, social services, psychology, sociology, economics, politics, race relations and education.
Business Source Complete	Contains indexing and abstracts for business journals covering marketing, management, accounting, finance and economics.
PsycINFO	Contains indexing and abstracts for behavioural sciences and mental health covering psychology, medicine, law, social work, neuroscience, business, nursing, forensics and engineering.
Health Management Information Consortium (HMIC)	Contains records relating to health and social care management information covering health service policy, management and administration.

4.2.2 Study inclusion and exclusion criteria

For the title and abstract review the eligibility criteria included studies that were:

- in an acute hospital setting;
- involved an outbreak that affected the whole or a large part (>4 wards/Units) of an individual hospital;
- responded to a single, hospital-associated, outbreak-related organism;
- related to the organisational impact on a specific, individual hospital organisation and its coordinated organisational response;
- unexpected events;

- English language papers;
- and developed world studies focused on resource-rich countries.

Exclusion criteria were:

- settings other than acute hospitals; multi-centered hospitals (in different cities), regional hospitals or national hospitals, community, long stay, nursing home, residential, GP or walk-in centre ;
- outbreaks in individual Units/wards or affecting ≤3 wards/Units;
- multiple organisms or non-nosocomial transmission organisms;
- Clinical, microbiological or epidemiological studies;
- Infection transmission that showed increasing incidence over time;
- and developing countries, using the parameters outlined in a recent study of use of behaviour change to optimise infection prevention and control.(175)

Quality criteria were drawn from a previous relevant published systematic review that incorporated evaluation of both controlled and non-controlled robust studies, drawing on recognised guidelines; the critical appraisal skills programme (CASP) tool, Cochrane risk of bias tool and the effective practice and organisation of care (EPOC) model.(175) The data extraction form used by this review was adopted, with minor modifications based on a further recent, as yet unpublished systematic review: systematic review and evidence-based guidance on organisation of hospital infection control programmes (SIGHT).[2]

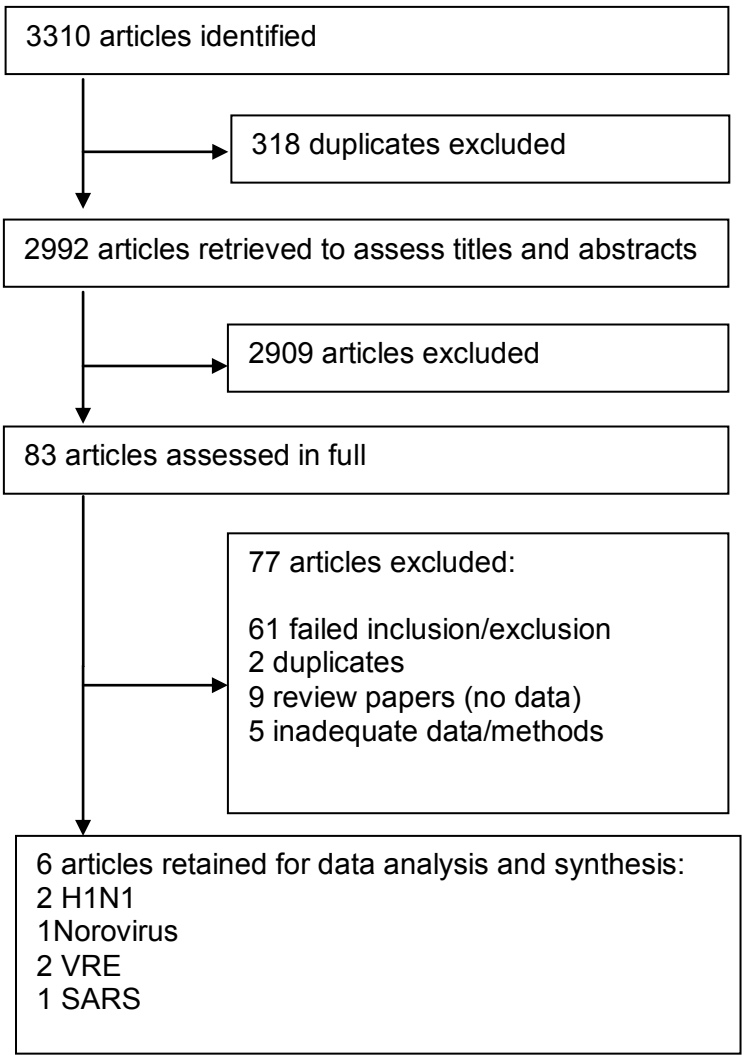
4.2.3 Data extraction

The data extraction process occurred in two stages. The first stage involved the screening of titles and abstracts using a standardised data extraction form against the inclusion/ exclusion criteria. The first reviewer (EM) applied the criteria to all titles and abstracts and a second, blinded reviewer independently assessed a random subset of 310 papers, which

[2]Website:http://www1.imperial.ac.uk/medicine/research/researchthemes/infection/idi/policyorganisationbehaviour/sight/

was 10% of the total papers. The level of agreement between reviewers was tested, resulting in a Kappa coefficient score of 0.620 ($p<0.001$) which demonstrated substantial (.61-.80) level of agreement using Landis and Koch's strength of agreement standards.(178) Discrepancies were resolved through discussion, resulting in non-agreed abstracts progressing to the next stage of the review. The second stage involved screening the remaining 83 articles in full, against the inclusion/exclusion criteria and the quality criteria. The first reviewer (EM) recorded data from the included studies on a standardised data extraction form. The second reviewer independently assessed the subset of 20 (24%) of the 83 articles that were assessed in full against the quality criteria and any areas of contention were discussed and resolved. 6 articles were retained for data analysis and synthesis.

Figure 4.1 Study Selection Process



4.2.4 Data Synthesis

Inductive thematic analysis was used to extract data from all studies that met my inclusion/ exclusion criteria and met my quality assessment standards. This approach relies on continual iterative comparison between the data and theory until the patterns became evident and 'theoretical saturation' is reached in that no new themes emerge.(179) This qualitative analysis approach was based on a similar approach in a previous systematic review, which applied a qualitative 'grounded theory' approach over a quantitative data extraction form, owing to methodological and content inconsistencies of the studies.(177) Organisational resilience-related theory was used as the basis for generating themes and understanding patterns in the data.

4.3 Results

3310 abstracts and titles were reviewed in the first stage, 83 articles were assessed in full. 6 (7.2%) of these 83 met the quality criteria and were included as described in Figure 4.1. The final 6 articles were not subject to meta-analyses as the studies encompassed wide-ranging study designs and organisational factors. All six of the included studies assessed interventions – see Table 4.3. These interventions were all multi-modal organisational responses to four different outbreak organisms; H1N1, Norovirus, VRE and SARS. All studies were either non-controlled designs (before and after or interrupted time series analyses) or quasi-experimental designs (combining clinical, epidemiological and/or financial analyses). All studies used a retrospective design, collating data either during or after the outbreak. Studies were based in tertiary acute centres (4) or acute university teaching hospitals (2). There were 4 European studies (France (2), England and Belgium) and 2 Asia-Pacific studies (Australia, Hong Kong).

4.3.1 Clinical and organisational response to unexpected events

Cheng and colleagues(180) implemented an infection control bundle that involved a coordinated organisational response to the outbreak and assessed its effect on the prevention of nosocomial transmission of swine-origin influenza A/H1N1 in a large 1500 bed tertiary teaching hospital. The bundle contained many elements of resilient organisational practice – see Table 4.3.

Cherifi and colleagues(181) investigated the effect of hospital preparedness and the overall management of influenza A/H1N1 on nosocomial transmission and costs of managing the outbreak in a tertiary teaching hospital. A range of resilient measures are described, including the establishment of a multidisciplinary pandemic task force for strategic decision making and infection control management. A less successful staff vaccination programme, with low nurse take up and moderate physician take up is noted. A low rate of nosocomial transmission was reported, although it was not clear which measures within the bundle of measures were most effective.

Yazdanpanah and colleagues(182) analysed the financial impact attributed to an outbreak of SARS at a university hospital, a designated SARS referral centre, describing the resilient measures taken to manage the SARS patients. Instead of using nosocomial transmission as a marker of resilient practice, this study assessed the impact on the hospital's medical service use. The study found that despite significantly increased costs associated with SARS, no concomitant impact on hospital medical use was found using a time series analysis, although low numbers of SARS patients were involved and the infection measures were described less comprehensively than other studies.

Two studies considered the effect of multi-modal infection strategies on VRE outbreaks, to prevent VRE endemicity in the hospital setting. Lucet and colleagues(183) assessed retrospectively the impact of simultaneous infection control interventions on two measures; the number of VRE-positive carriers and the consumption of targeted antibiotics in a 950 bed tertiary teaching hospital. A reduction in VRE-positive carriers was reported over a four-week period and a decrease in the consumption of targeted antibiotics, following an aggressive and rapid campaign of resilient infection prevention interventions during this time. In contrast, Pearman(184) reported the adverse impact of instituting only standard infection control practices in the first two months of a VRE outbreak, resulting in significant VRE patient colonisation. To prevent the VRE strain from becoming endemic, a package of enhanced resilient infection interventions described in Table 4.3 was instituted from the two-month point onwards and the effect of this on both VRE infections and colonization is reported. The significant cost of these enhanced interventions is reported. To prevent further recurrences, the hospital implemented a programme of long-term resilient measures by implementing a VRE eradication programme.

Table 4.3 Intervention Studies

	Study aim and organisational intervention features	Design and Methods	Infective organism, sample size and study duration	Study outcomes
Cheng et al, 2010, (185) Hong Kong	Assessed effect of IPC strategic bundle of measures; open staff forum, education sessions, video demonstrations for PPE, early recognition of index cases, early relief of sick staff from work, observed HH practice, cough etiquette compliance, IPC compliance monitoring, compliance with PPE, contact tracing, screening of patients/staff with URTI symptoms, seven-day medical surveillance for asymptomatic exposed persons, hospital admission policies modified, implementation of isolation facilities and cohorting, increased workload of laboratory, IPC staff and frontline HCWs, rapid molecular diagnostic test with 24 hr turnaround, definitions for community-acquired/ nosocomial infection, standard and transmission-based precautions, oseltamivir for post-exposure prophylaxis.	Quasi-experimental study based on epidemiological analysis of clinical symptoms of exposed persons using retrospective analysis	Influenza virus A/H1N1 836 exposed persons 01/05/2009-08/08/2009	Incidence of nosocomial influenza A infection (0.25 per 10,000 patient days in 2007, 0.14 in 2008, 0.05 in 2009 (first 6 months)) 1 May – 8 Aug 2009: patients positive for S-OIV by RT-PCR (100/311, 32%). Nosocomial transmission of S-OIV for staff and patients i.e. secondary attack rate of exposed persons (4/836, 0.48%) Note: oseltamivir offered as post-exposure prophylaxis. 18 sessions of open staff forum held to prevent acquisition of S-OIV (3698/4976 hospital staff, 74.3%) Significant risk factor of nosocomial infection: not wearing a surgical mask (4/4 vs 264/832, P=0.010) or vice versa (4/4 vs 300/832, P=0.017)
Cherifi et al, 2011,(181) Belgium	Assessed hospital preparedness and response; multidisciplinary pandemic task force co-ordinated response, made strategic decisions and approved weekly action plans, daily data collection and reporting, one site containment, ED and ICU viral zone, dedicated wards, increased staff capacity, clinical pathways, isolation and cohorting, limited admission to restricted areas, prioritisation of cases for immediate care, restrictions on areas used for patient care, environmental disinfection, standard and additional precautions for ILI, IPC training and exercises for areas of need, e.g. use of masks, use of protective equipment.	Quasi-experimental study based on clinical and cost analysis using retrospective analysis	Influenza virus A/H1N1 Cohort of 43 hospitalised patients with confirmed influenza A (521 patients with ILI admitted to emergency ward) 01/06/2009 – 30/11/2009	Nosocomial transmission of S-OIV i.e. secondary attack rate of inpatients with ILI (3/64, 5%) Nosocomial transmission of S-OIV to staff (1nurse) Case fatality rate (1/30, 3%) Note: Neuraminidase-inhibitors (INA) not offered as post-exposure prophylaxis Vaccination taken up by 10% nurses, 60% physicians Total cost estimated at €75,691
Illingworth et al, 2011, (186) UK	Assessed implementation of new infection control strategy; restricting admissions and discharges of affected ward bays, installation of bay doors, division of nursing staff to work in to work solely in affected and or unaffected bays, use of theatre clothing (scrubs) on affected bays, restriction on ancillary staff entering affected bays, IPC nurses responsible for closing bays, enhanced cleaning regime, faster turnaround for Norovirus testing using rapid in-house molecular test, enlarged IPC team with daily visits to adult wards, IPC input to bed management meetings, out of hours 'on call' IPC nursing service provided, improved communication between community IPC team and hospital (daily email and daily bulletin to hospital admitting teams).	Non-controlled before and after study comparing the effectiveness of two infection control strategies using retrospective data from two Norovirus seasons: 2007-08 and 2009-10	Norovirus 2007-08 (50 possible and 42 confirmed hospital outbreaks) 2009-10 (29 possible and 25 confirmed hospital outbreaks) 01/10/2006-31/05/2010	Significant decrease in: ratio of confirmed hospital to community outbreaks (r=0.317, P=0.025) no. of days of restricted admissions on hospital wards per outbreak (r=0.742, P=0.041) no. of hospital bed-days lost per outbreak (r=0.344, P<0.001) No significant change in: no. of patients affected per hospital outbreak (r=1.080, P=0.517) no. of hospital staff affected by outbreak (r=0.651, P=0.105) Cost of bed-days lost 2007-08 (31/41confirmed outbreaks - £367,243) Cost of bed-days lost 2009-10 (24 confirmed outbreaks - £108,962) Note: no change in predominating circulating genotype (GII-4) or major shift in variants present in P2 domain of virus capsid protein
Lucet et al, 2007, (187) France	Assessed multimodal, co-ordinated intervention strategy; creation and twice-weekly meetings of multidisciplinary VRE control committee, index case detected early and control measures instituted in next few days, cohorting of VRE carriers in a	Quasi-experimental study based on clinical analysis of the effect of multi-modal interventions using retrospective analysis	vanA VRE faecium resistant to vancomycin and teicoplanin 39 VRE-positive patients (2 urinary tract infections, 36	Decrease in: proportion of VRE-positive swabs; Week 1(7/10, 70%), Week 2 (7/35, 20%), Week 3 (18/96,18.8%), Week 4 (5/305, 1.6%) consumption of targeted antibiotics between third and fourth quarters of

	dedicated ward, stringent adherence to contact and standard precautions, extensive screening of contact patients and high risk units, division of HCWs to work solely with VRE-positive or –negative patients, restriction on patients entering cohorting area, environmental disinfection, sensitive technique for detecting VRE in stool samples, dedicated team to minimise selected antibiotic use, recommendations to clinicians on antibiotic use, information (information letter, Intranet home page, email updates, information meetings) for hospital staff, hospital staff education programme, electronic tracking of in-hospital transfer and readmission of VRE carriers and contact patients		colonised) 03/09/ 2005 – 01/10/2005	2006 (117DDDs-89 DDDs/1000 patient-days, 24%) After week4, 1 VRE-positive contact patient identified through automatic alert system on readmission to hospital
Pearman, 2006, (188) Australia	Assessed enhanced infection control practices; (after 2 months) creation of daily hospital VRE Executive Group (made strategic decisions, fund allocation, direction of staff), agreement for substantial additional funding, dedicated cost centre to record costs of outbreak, cohorting of VRE-positive and ward contact patients in dedicated wards, dedicated nursing staff for each cohort, increase in IPC staff, patient transfers required approval, equipment sharing between wards halted, ICU isolation rooms doubled, hospital-wide patient screening over one week, admission/discharge screening, developed rapid laboratory provisional identification technique, dedicated VRE ward-cleaning service, environmental cultures to check efficacy of cleaning post-discharge, electronic flagging of VRE carriers/ward contacts' medical records, screening of ward contacts after hospital discharge, special discharge of elderly VRE carriers/ward contacts to residential facilities	Quasi-experimental study based on clinical and cost analysis of enhanced infection control practices using retrospective analysis	vanB VRE faecium resistant to vancomycin and susceptible to teicoplanin 68 VRE-positive patients (4 infected, 64 colonised) 18/07/2001-12/2001	VREF acquisition rate: 28/09/2001 – 31/10/2001 – 33% November 2001 – 2.6% December 2001 – 1.7% VREF carriage rate post-discharge (for ward contacts discharged before being screened 4 times (54/1977, 2.73%) Cost of enhanced infection control practices was AUD$ 2,700,000 (£1,000,000) Note: results of pulsed-field gel electrophoresis showed that all outbreak isolates belonged to a single strain
Yazdanpanah et al, 2006, (189) France	Assessed the additional direct medical costs and missed opportunity costs attributable to SARS; designated isolation areas constructed and equipment set up for suspected SARS cases, 24 hour telephone line set up, dedicated nurse for SARS patients, division of nurses and cleaners between general ID sectors (new staff) and isolated SARS sector (existing staff), additional working hours for physicians ,nurses and construction workers, criteria-based patient assessment, diagnostic testing to detect SARS, specific SARS accounting cost centre, provision of disposable protective equipment	Non-controlled time series analysis using retrospective costs	SARS 3 patients with SARS (1 died), 307 phone calls, 30 outpatients, 10 inpatient admissions Total cost of resources €356,030 03/2003 – 07/2003	Outbreak had no impact on hospital medical service use; no significant difference between observed and predicted use of hospital medical services before, during and after the outbreaks of SARS using time series ARIMA analysis.

Key:
IPC –Infection Prevention and Control
HH – Hand Hygiene
S-OIV – Swine-Origin Influenza Virus
ED – Emergency Department
ICU – Intensive Care Unit
ILI – Influenza Like Illness
VRE – Vancomycin-resistant Enterococci
DDD – Defined daily dose
SARS – Severe Acute Respiratory Syndrome
RT-PCR – Reverse transcription-polymerase chain reaction

Illingworth and colleagues investigated the effect of a new multi-modal infection control strategy on the management of Norovirus outbreaks in an acute teaching hospital, with significant decreases in the number of days of restricted admissions on hospital wards and the number of hospital bed-days lost per outbreak, although no significant change in the number of patients or staff affected per hospital outbreak. The approach taken between Norovirus seasons altered from one that was managed as an emergency, with daily outbreak meetings, entire wards closed and restriction of movement of staff but no formal controls to one that was managed as routine practice, with increased numbers of IPC nurses undertaking daily ward visits, division of nursing staff between affected and unaffected areas and improved communications.

In conclusion, whilst there is evidence of an organisational response in the form of resilient infection prevention interventions that have reduced the impact of the outbreak, some of the studies contain measures that lack statistical robustness. Only one study reports P values for primary measures.(190) Secondary measures, e.g. costs, antibiotic consumption, vaccination rates were reported in five out of six studies, two of which were statistically robust, reporting P values.

4.3.2 Resilient practice

I synthesized the evidence from the studies into emerging organisational resilience themes, to identify patterns of resilient interventions across studies, as shown in Table 4.4. I identified common resilience themes (6 out of 6 studies), despite the variety of infective organisms reported across the studies and these are examined in more detail below:

- ***Communication*** is critical in a crisis situation, to ensure that key messages about the event are heard and understood by staff, but also that those in senior positions respond to feedback from those at the front-line of the organisation.(154) In these studies, internal communications were used to update staff on the outbreak progress (through emails, daily bulletins or open forums), provide background knowledge and information (using the Intranet and information sheets) and to direct staff (using action plans, emails). Externally, communication was used to provide links with partner agencies, such as residential homes and community IPC teams and to provide further information to patients and physicians, e.g. use of dedicated telephone line.

- ***Improvisation***, defined as a system's unplanned but purposeful and speedy response to a complex, turbulent situation,(191) is evident in all studies that reported the division of HCWs between affected and unaffected areas and cohorting of affected patients in isolation areas/rooms. Coping creatively with environmental problems within existing resources(192) is viewed as one component of improvisation and is evident in these examples. Hospitals have rapidly redefined their environment to create infected and non-infected areas and allocated patients according to their infection status or exposure and staff to work in designated areas.

- ***Innovation*** in the context of resilience refers to the organisation's ability to develop new ways of working in response to unexpected events.(136) In these studies, innovation is evident in the development of new means of rapid testing, to achieve faster identification of organisms where the challenge of an unexpected infection outbreak has led to the need to innovate and invest using new technology to achieve faster test results to support the diagnostic process.

- ***Redundancy*** refers to the ability of an organisation to rapidly free up or create capacity and capability. Examples might include physical capacity and human resource capacity and capability.(140) All studies reported the creation of additional HCW capacity, either through the use of additional HCW hours (from existing staff or temporary staff), the creation of 'out of hours' services that had previously not existed or the strategic placement of skilled staff in higher risk affected areas, whilst newer staff, with less experience of IPC guidelines, was placed in lower risk, general areas. One study reported the increase in physical capacity, through the doubling of numbers of ICU isolation rooms.

Other commonly occurring resilience themes were organisational –level adaptation and change to the new conditions though enhanced infection control practices (5/6 studies), the importance of a leadership group through multidisciplinary task forces that co-ordinated and led the outbreak management (5/6 studies), heightened cognition through early recognition of index cases (4/6 studies) and awareness of the trade-offs between performance and safety (4/6 studies). It was notable that minor interventions at clinical level such as environmental disinfection were effective because strong focused leadership was in place at organisational level.

Table 4.4 Organisational resilience factors in an unexpected event

Org Resilience Theme	*Infection Practice*	Cheng[193] (H1N1)	Cherifi[181] (H1N1)	Illingworth[194] (Norovirus)	Lucet[195] (VRE)	Pearman[196] (VRE)	Yazdanpanah[197] (SARS)
Cognition/ behaviour	*Early recognition of index cases*	✓			✓	✓	✓SARS surveillance system nationally, distribution of cases to local referral centres
	Observed practice	✓ HH practice ✓cough etiquette compliance		✓daily IPC visits			
	Wearing personal protective equipment	✓ surgical face mask	✓ masks, protective equipment	✓theatre scrubs			✓disposable protective equipment
Organisation Learning	*Education sessions*	✓ 'just-in-time' education			✓		
	Training	✓ IPC sessions for staff ✓video demonstrations on PPE	✓ IPC unit provided training based on need		✓information meetings		
Leadership	*Leadership group*	✓multi-disciplinary development of strategic IPC bundle	✓multi-disciplinary task force	✓daily outbreak meetings pre-intervention	✓VRE control committee	✓daily VRE executive control committee	
Communication	*Internal communication*	✓ open staff forum	✓weekly action plans	✓daily bulletin to hospital admitting teams	✓information letter, email updates, Intranet home page,	✓direction of staff	
	External communication			✓daily email between community IPC and hospital		✓patient transfers required approval	✓24 hour telephone line set up
Improvisation	*Limited admission to restricted areas*	✓hospital admission policies modified	✓ (patient, staff and visitors)	✓ (students & ancillary staff)	✓ (patients)		
	Division of HCWs to work in affected/ unaffected areas	✓	✓	✓	✓	✓	✓
	Isolation and cohorting	✓isolation facilities and cohorting	✓ED and ICU viral zone ✓dedicated wards/private rooms	✓affected bays	✓dedicated ward	✓dedicated wards	✓dedicated isolation areas
	Ward/bay restrictions /closures		✓restrictions on rooms, routes, buildings	✓IPC nurse control of closures			
Innovation	*Development of rapid testing for faster identification of organism*	✓rapid molecular diagnostic test with 24 hr turnaround	✓home-made RT-PCR for detection of influenza A	✓rapid in-house molecular test for Norovirus	✓sensitive technique for detecting VRE in stool samples	✓rapid laboratory provisional identification technique	✓diagnostic testing to detect SARS
	Clinical pathways	✓definitions for community-acquired/ nosocomial infection	✓definitions for ILI and influenza related mortality		✓antibiotic use recommend ations to clinicians		✓criteria-based patient assessment
Adaptation	*Use of additional precautions*	✓standard and transmission-based precautions ✓oseltamivir for post-exposure prophylaxis	✓standard and additional precautions for ILI		✓adherence to contact and standard precautions	✓enhanced IPC practices ✓equipment sharing between wards halted	✓dedicated equipment for suspected SARS cases
	Control	✓contact			✓Rapid,	× Delay in	

	measures instituted rapidly	tracing and seven-day medical surveillance for exposed persons			aggressive control measures	rapid instigation of organisational measures	
Monitoring	*Data tracking*	✓IPC compliance monitoring ✓incidence of nosocomial influenza A infection	✓daily data collection and reporting to task force		✓electronic tracking of VRE transfers/ readmission	✓electronic flagging of VRE carriers/ward contacts' medical records	
	Screening of patients	✓screening of patients/staff with URTI symptoms			✓contact patients and high risk units Ward contacts post-discharge	✓hospital-wide patient screening over one week ✓admission/ discharge screening	
	Additional costs/Funding	✓widespread provision of alcohol-based hand rub				✓significant fund allocation ✓dedicated cost centre	✓SARS cost centre ✓investment documented
Redundancy	*Increased staff capacity*	✓ increased workload of laboratory, IPC staff and frontline HCWs	✓additional HCW in ED	✓IPC team expanded Out of hours 'on call' IPC nursing service	✓dedicated team to minimise antibiotic use	✓increase in IPC staff ✓ICU isolation rooms doubled	✓dedicated nurse for SARS patients ✓additional hours for physicians, nurses, construction workers
Trade offs	*Performance/ safety trade off*	✓early relief of sick staff from work ✓7-day sick leave for infected staff	✓prioritisation of cases for immediate care			✓special discharge of elderly VRE carriers/ward contacts to residential facilities	✓HCW's assigned only to SARS patients ✓SARS patient care less efficient than other care due to IPC measures
Organisational structures	*Change to existing meeting structures*			✓IPC input to bed mngt meetings			
	Change to existing physical structures		✓One site containment	✓installation of bay doors			✓construction of structures to meet SARS isolation standards
Organisational change	*Environmental cleaning*	✓Ad hoc environment disinfection when confirmed S-OIV	✓Environmental disinfection	✓Enhanced cleaning regime	✓Environmental disinfection	✓dedicated VRE ward-cleaning service ✓environmental cultures to test efficacy of post-discharge cleaning	

Key:
IPC –Infection Prevention and Control
HH – Hand Hygiene
S-OIV – Swine-Origin Influenza Virus
ED – Emergency Department
ICU – Intensive Care Unit
PPE – Personal Protection Equipment
ILI – Influenza Like Illness
HCW – Health Care Worker
VRE – Vancomycin-resistant Enterococci
DDD – Defined daily dose
SARS – Severe Acute Respiratory Syndrome
URTI – Upper Respiratory Tract Infection

4.4 Discussion

In this systematic review, I set out to answer the research question: Do organisational resilience interventions lead to a reduction in the impact of outbreaks in the acute health-care setting? To achieve this, I proposed to address the following aims:

a) To assess the organisational resilience interventions that are used in an outbreak

b) To identify patterns of resilience interventions across selected studies

c) using a) and b) to reveal organisational resilience factors

I found that evidence does exist across these intervention studies to support a reduction in the impact of outbreaks in the acute health care setting as a result of organisational resilience interventions. The impact of these interventions was assessed using primary measures of nosocomial transmission, patient acquisition rate or as a proxy measure, hospital medical service use. However, the evidence is not statistically robust in the majority of studies. Frequently reported infection control practices were identified within the multi-modal organisational interventions reported in the studies, such as the early identification of index cases, the role of isolation and cohorting, the division of staff between affected and non-affected areas which provide useful indicators for practitioners involved in managing infection outbreaks. These practices were mapped to cross-cutting resilience themes; communication, improvisation, innovation and redundancy most frequently occurring, followed by themes of adaptation, change, leadership, heightened cognition and performance/safety trade-offs.

The findings of my systematic review suggest that organisational learning from one outbreak can be applied to inform preparedness for future outbreaks and other crisis responses. Two studies had adopted this approach. Illingworth and colleagues(198) had reviewed the crisis management of previous outbreaks and instituted more robust routine arrangements to integrate outbreak management into everyday practice. These included changes to the physical environment by adding ward bay doors, instituting barrier precautions between bays and increasing the volume and visibility of the infection team on wards and units. Pearman(199) had applied learning from a ‘disaster’ VRE outbreak scenario to implement a VRE control programme that included targeted active surveillance cultures of patients on high risk hospital units, eradication of single-strain outbreaks in hospitals by enhanced infection control practices and contact isolation of known carriers and unscreened ward

contacts of outbreaks. Both studies had adopted a longer-term approach to assess the effectiveness of these practices over several years.

The studies included in my systematic review suggest that a rapid institutional response to an outbreak is critical to effective management of the outbreak. Resilience factors that support a rapid response include: sensemaking (64), the ability to make sense of unusual or unexpected cues by early detection of index cases through surveillance; improvisation and adaptation through aggressive implementation of organisation-wide enhanced control measures and strong, focused multidisciplinary leadership through the creation of a task force or control committee that meets frequently and gives clear direction. When these resilient factors were not implemented immediately, as in the VRE outbreaks of Pearman(200) compared with Lucet(201) the outbreak duration was longer (five months versus four weeks) and the financial impact was greater.

The studies also suggested that a strong, coordinated approach to managing capacity through bed and pathway management during the outbreak was essential. Resilient factors included either having or being able to create redundancy rapidly through increased physical and human capacity and altered physical structures to accommodate increased capacity. Bed and pathway management was critical to ensure isolation policies were maintained strictly and was achieved through division of infected and non-infected patients and healthcare workers into infected and non-infected areas of the hospital.

None of the studies explicitly used organisational resilience terminology, although all studies described interventions that related to resilient practice and were implemented at organisational-level, suggesting that the concept of organisational resilience has yet to be embedded in health care research. The development of generic organisational resilience themes from these wide-ranging studies of unexpected infection events is evidence of organisational-level learning that may be relevant to policy makers and health care leaders. The application of organisational resilience concepts to future work might inform generic learning derived from cross-cutting themes in the study of unexpected events, rather than focusing on organism or organisation-specific learning.

4.4.1 Limitations of the Review

Limitations of the review are that one of the inclusion criteria was studies published in English, although the impact of this is likely to be small;(202) I did this for pragmatic reasons, as there was no budget for translators. In addition, only studies from the resource-rich

developed world are included in this review to ensure that the healthcare and socio-political context is sufficiently similar to draw consistent conclusions about the type and pattern of organisational resilience interventions. In this review, only intervention studies met the quality criteria and these reflected a reliance on weak quasi-experimental designs based on retrospective data. The studies demonstrated the problems with attempting to analyse an unexpected infection event with minimal pre-event research preparation. This is potentially a fundamental issue for researchers owing to the reactive nature of unexpected events. This issue creates a number of difficulties for researchers working in these acute setting/outbreak contexts, such as obtaining prior ethics approval, identifying baseline data and access to participants in an outbreak scenario. Resulting studies suffer from missing data, no baseline assessment, sample bias, use of simultaneous multiple interventions, temporal confounders and inadequate statistical analysis.(173) No qualitative studies could be included, even when inclusion/exclusion criteria were met, as these studies failed to meet the quality criteria. Qualitative articles were typically narrative accounts of outbreaks that had insufficiently defined methodologies and inadequate study designs, but included relevant organisational factors that reflected the resilient factors identified in this review. Organisational resilience factors or frameworks were not explicitly referred to in any of the studies despite using resilience-related search terms. Further methodological work is required in this area, to ensure that intervention and qualitative studies are well designed, rigorously executed and robustly analysed to ensure that statistical and thematic findings respectively can be considered.

4.5 Conclusion

For the first time in the organisational resilience literature, my systematic review has identified organisational resilience factors in the context of an unexpected event in a systematic way. I have identified a set of organisational resilience factors based on resilient interventions that contribute to a reduced impact of outbreaks in the acute sector. This novel approach, which involved the identification of organisational factors from clinical research, has proved to be an effective method for the development of the concept of organisational resilience contextually.

In terms of future research directions, two issues are apparent. I chose to exclude studies from the developed world as my research is UK-based and the healthcare and socio-political context of the developing world may not be consistent with resource-rich countries. In future, a systematic review is needed that includes resource-poor settings. A further issue

was the lack of robust qualitative research, despite a number of relevant narrative accounts that had inadequate methodologies.

To understand organisational resilience better in the healthcare context, further detailed and robust qualitative research is needed in an empirical context to examine organisational resilience in the context of an unexpected event, and in the context of continuous organisational stressors. This thesis addresses these requirements in the next two empirical chapters, taking a macro-level perspective on the impact of continuous organisational stressors in Chapter 5 and a micro-level perspective on an unexpected infection event in Chapter 6.

4.6 Comparison of theoretical and empirical resilience reviews

My aim at the start of the theoretical and empirical reviews of the resilience literature was to contrast the concepts identified within the theoretical review (Chapter 3) with those concepts that were extracted from the empirical review of healthcare studies that described unexpected infection events (Chapter 4). I found that a comparison of the concepts identified within each review showed considerable overlap, as outlined in Table 4.45. I identified some key issues which have relevance for the thesis: the conceptual focus of unexpected events; the explicit nature of trade-offs; the significance of redundancy; and, gaps in the empirical examples compared with the theoretical literature.

The theoretical focus of unexpected events was partially reflected in the empirical studies. Models for unexpected events in the theoretical literature emphasise three key stages: anticipation/ preparedness, response to the event and recovery post-event. The main focus of empirical studies was the response to the event, with issues such as use of redundant capacity, managing change, rapid adaptation, innovation and improvisation playing key roles. Organisational learning, which in the theoretical literature is usally associated with post-event recovery and improvement, in the empirical studies took the form of training and education sessions as part of the response to the outbreak, ensuring that all staff were conversant with the infection control protocols required to manage the outbreak. There was little discussion of anticipation or preparedness or recovery post-event and hospitals had few strategies in place to deal with these types of unexpected events.

Table 4.5 Concepts identified within organisational resilience reviews

Theoretical general review	Empirical healthcare review
Organisational Learning	✓
Organisational Change	✓
Organisational Development	
Organisational Structures	✓
Organisational Culture	
Cognition/behaviour	✓
Trust	
Leadership	✓
Communication	✓
Performance	✓
Preparedness	
Innovation	✓
Improvisation	✓
Adaptation	✓
Monitoring	✓
Crisis Management	
Redundancy	✓
Recovery	
Policy making	
Competitive advantage	

The concept of trade-offs, which was inherent within the theoretical literature, was more explicit within the empirical studies, particularly the trade-off between performance and safety. The performance/safety dilemma related to the performance requirements to continue elective work and maintain staffing levels, juxtaposed against the clinical need to isolate and cohort patients. Examples of trade-offs included how long staff should remain on sick leave for, which cases to prioritise for immediate care, the balance between admissions and discharges and the appropriate staff/patient ratio for infected patient care.

Redundancy, the capacity to maintain spare resource, was evident in theoretical studies in a commercial context, but was not the subject of healthcare studies. However, in empirical healthcare studies, redundancy was a critical issue across all studies. Having the capacity to rapidly utilise spare capacity effectively, either through increasing staff workload, expanding bed capacity or the creation of dedicated teams was essential to a rapid and effective response to the outbreak. Although the term ‘redundancy’ may be more familiar within the commercial sector, the rapid conversion of redundant capacity was an important feature of the successful management of an unexpected event.

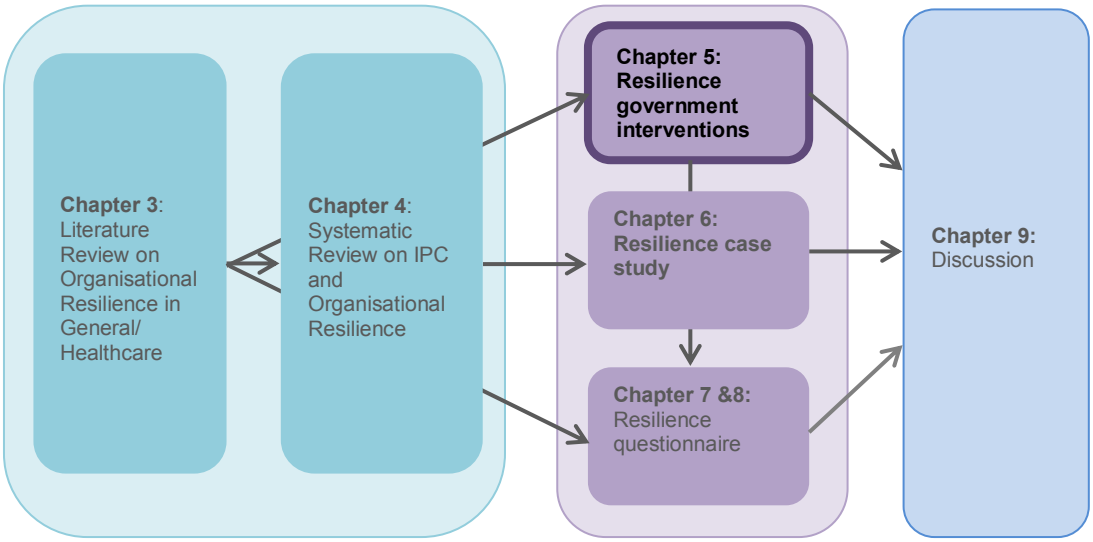
Finally, theoretical concepts that relate to unexpected events that were not evident in empirical studies included the explicit discussion of crisis/disaster management, any link to performance, the preparedness for the outbreak and discussion of recovery strategies. The lack of explicit reference to disaster management may be an issue of terminology. Most hospitals have plans to manage major incidents, but may not explicitly apply these to the management of major outbreaks. The lack of reference to organisational performance may relate to the fact that the empirical studies were authored by clinicians whose focus was on the clinical impact of the outbreak. Half of the studies commented on the financial costs of the outbreak, in terms of additional infection control practices, bed-days lost and resource implications, but there were few references to the impact on operational performance. Preparedness and recovery were not key features of the empirical studies. Most studies acknowledged that the outbreaks were unexpected and few anticipatory plans were in place. Similarly, recovery was implicitly mentioned but only one study explicitly discussed longer-term strategies to prevent outbreaks recurring.(203)

In summary, whilst there was considerable overlap of organisational resilience concepts between the theoretical and empirical reviews, there were key gaps in the theoretical development of the empirical studies from the perspective of an unexpected event. Of particular significance was the absence of discussion of anticipation/preparedness approaches and post-event recovery.

5 Chapter 5. Increasing hospital resilience to infections through the adoption of electronic infection surveillance programmes: disciplinary accountability or democratic transparency?

5.1 Introduction

The first of the theoretical/empirical chapters, this chapter studies organisational resilience across a healthcare system, assessing the effect of macro-level government interventions to reduce rising infection rates on hospital organisations at meso-level and local actors at micro-level. From a resilience perspective, this is a study of organisational resilience during routine, expected conditions, but in the presence of rising infection rates which act as a continuous stressor on the system.



The context for this chapter is the infection control health reform programme led by the UK government from 2004 – 2011 which developed in response to rising MRSA and *C.difficile* rates. I focus on one set of government interventions within the overall reform programme; the use of electronic infection surveillance programmes which relied on the recruitment or adoption of web-based technologies. I trace three elements of electronic surveillance programmes using the effective recruitment of ICT: i) the adoption and development of an enhanced web-based surveillance mechanism to increase visibility of hospital performance on infection rates ii) the enrolment of large numbers of hospital staff in national and local

surveillance and iii) the increase in public visibility of infection rates through government transparency policy agendas.

I apply Foucauldian governmentality theory as a conceptual framework to understand these changes. I identify four Foucauldian themes: i) the erosion of traditional line management by novel indirect control modes ii) the operation of electronic panoptical surveillance systems in health care iii) the role of the surveying centre and its capacity to intervene and iv) the engagement in self surveillance and subjectification of clinical managerial hybrids, and use these to analyse UK infection control reform using an embedded qualitative case study.

I begin by discussing the theoretical links between organisational resilience and surveillance. I discuss the literature on information systems in health and examine the interrelationship with Foucauldian perspectives on organisational power, knowledge and control. I examine these themes in relation to my empirical case, assessing the macro-level role of the national infection strategy and the national infection surveillance scheme and its implications for my embedded case study hospital at meso and micro-level. I conclude by discussing how the study extends the existing knowledge on health care ICT surveillance systems with reference to these four Foucauldian themes and on the broader learning for the study of organisational resilience in healthcare.

5.2 Theory

5.2.1 Resilience and surveillance

With reference to Hollnagel's definition of organisational resilience below, I propose that this study assesses the intrinsic ability of the healthcare system to adjust its functioning following disturbances, in this case rising MRSA and *C.difficile* rates, so that it could sustain required healthcare operations under expected conditions:

'the intrinsic ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions'(23)

I argue that the macro-level national surveillance strategy adopted by the government constituted an 'adjustment' to the system's functioning, as did the meso and micro-level enrolment of clinical leaders in self-organisation under surveillance. I will explore the extent to which this adjustment can be construed as positive, on the basis that Sutcliffe and Vogus contend that if an organisation can maintain positive adjustment under challenging

conditions, one of which includes disruption of routines and ongoing stresses, then the organisation can emerge resiliently.(24)

Acquiring resilient capacity through positive adjustment can involve the realignment of organisational routines and processes to enable the organisation to move forward.(204) I examine the role of surveillance and self surveillance in the construction of new routines and a new governance order, which provides a counterpoise with the established hierarchical model.

5.2.2 Foucauldian perspectives on ICTs in health care

Recent theoretical developments in the analysis of information communication technologies (ICTs) in organizations have built on seminal early work(74;205) that explored and critiqued the informating consequences of technology on knowledge, power and control in organisations. Michel Foucault's key works(68-71;73;75;206;207) particularly his articulation of the disciplinary society, analogised using Bentham's architectural Panopticon, have informed these analyses.

In the last decade, the Foucauldian perspective has increasingly been applied to the health care sector, with empirically-based studies that employ a critical(76) and interpretive perspective on a variety of mechanisms for health sector reform, varying from ICT implementation to the operation of Evidence Based Medicine (EBM). These studies often are contextualised as post-bureaucratic organizational forms or processes that are characterised by indirect 'governance' rather than through traditional line managerial control(208) and reflect a transition from direct, hierarchical and bureaucratic rules towards new indirectly governed 'networked' organisational forms.(209) Post-bureaucratic organisations have been characterised by Foucauldian concepts of governing at a distance(210) and 'disciplined selves.'(211)

Drawing on the established work of Ferlie et al(208) I situate this study as an empirical example of a highly effective ICT-enabled national surveillance strategy that increased the resilience of healthcare organisations to address hospital-acquired infections. I explore the effect of surveillance on a key patient safety issue; increasing infection rates. I present the national surveillance strategy as a positive case within this literature, involving the successful adoption by the government of novel and indirect control modes. I argue that these indirect control modes had a largely positive effect on hospitals' resilient capability through the active

and creative enrolment in self governing and self surveillance by clinical managerial hybrids, who experienced strong identity shifts.

This strategy is not representative of the findings of previous studies of ICTs in health. A number of studies identify tacit clinical resistance and failure of the system to deliver the proposed outcomes.(209;212-214) These studies identify a range of resistant (non-resilient) responses following the introduction of a new system that is seen by local actors to represent and institute new norms through a new knowledge-base, expertise and discourse. These include 'resistive compliance' where local actors put off and displaced using the systems(212), attempts by local actors to imbue the system with locally articulated meanings,(209) local actors failing to use systems, creating their own alternative systems or using systems to legitimise their own professional power(214) and local actors challenging the logic within the system or utilising the same logic to engineer additional resources.(213) McGivern and Dopson argue in their study of Genetics Knowledge Parks (GPKs) that the introduction of standardized quarterly performance reviews constituted a form of 'governmentality' (Foucault, 1991) by controlling the 'space of representation' but despite initial compliance with the reporting system, failed to lead to jurisdiction over GPKs.(215)

A smaller number of studies take a more positive stance, considering how Foucault's later appreciative conceptualisation of self-surveillance, the technologies of self and subjectification(76) can be understood in relation to health care reforms. Waring explores self-surveillance in response to 'patient safety' reforms.(216) He argues, using Foucault's governmentality perspective(68) that doctors engage in adaptive regulation, rejecting managerially dominated safety discourses for internalised professionally dominated self-surveillance. Ferlie et al review Foucault's work on governmentality as applied to subjectification, technologies of self and clinical managerial hybrids in cancer networks, finding clinical managerial hybrids energetically engaging with and influencing institutional change as governing agents and leaders .(208) Iedema & Rhodes(217;218) build on Lyon's (1993) proposition(205) that we should look beyond the constraints of the Panopticon to consider the place for care and trust in surveillance systems by exploring the successful role of clinicians in surveillance and the potentially positive effect on patient outcomes.

This chapter explores the empirical case of infection control in the UK as an exemplar for improving organisational resilience through the articulation of four Foucauldian governmentality themes: the erosion of traditional line management or market control by novel indirect control modes; the electronic Panopticon; the surveying centre with a capacity

to intervene; and self-surveillance and active enrolment in self-governing by clinical managerial hybrids. These themes are explored in the following section.

5.2.3 Foucauldian governmentality themes

5.2.3.1 Erosion of direct control by novel indirect control modes

The first theme, the erosion of traditional line management or market control by the use of novel indirect control modes reflects a shift from direct to indirect technologies of steering. I consider the extent to which conventional direct technologies of steering, either traditional line management exemplified by hierarchical and bureaucratic processes of command and control, New Public Management (NPM) style managerialism of performance management, targets and measurement (Ferlie et al 1996) or market control exemplified by processes of choice, competition and diversity were eroded or at least complemented by novel indirect control modes. These novel control modes which I argue created resilient capability in hospitals comprised of: firstly, the adoption of national surveillance strategies utilising ICT; secondly the enrolment of more people in surveillance, governing, self-surveillance and self-governing; and thirdly, the publication of public sector data to achieve openness and transparency. These indirect modes operate through drawing of committed clinical managerial hybrids into self-governing roles and 'loose/tight' governance regimes that afford high performers 'loose' self-regulation and poor performers 'tight' intervention and supported improvement.

5.2.3.2 Designing the electronic Panopticon

The second theme of the electronic Panopticon derives from Foucault's elaboration on the metaphor of the panopticon, originally conceived by Bentham(219) as an architectural surveillance device or 'Inspection House', to explain the concept of disciplinary power; "panopticism, is the discipline mechanism: a functional mechanism that must improve the exercise of power by making it lighter, more rapid, more effective, a design of subtle coercion for a society to come." (73)p209 Using the infection reform programme as a case study, I explore the extent to which discipline, as a mode of power, operates through the web-based surveillance database which has substituted for the architecture of the panopticon and allows the state to undertake permanent, yet discontinuous assessment, classification and monitoring of infection rates in individual hospitals.

Foucault draws on three panoptic principles that support the exercise of this power; the creation of a conscious and permanent state of visibility, the creation of an effect of

continuous surveillance, even when it is discontinuous in action, therefore unverifiable and the creation of a sense of anxiety in the observed that they assume responsibility for the constraints of power.(73)p201 Building on these principles, the web-based infection surveillance programme can be understood as an artefact, an information panopticon that serves as a mechanism for constructing a field of visibility for the state. (74) Zuboff explores the psychology of visibility and examines the extent to which individuals adapt to the illumination that the information panopticon provides.(74) Zuboff identifies examples where panoptic visibility created a horizontal visibility or 'collectivism amongst peers' in addition to vertical visibility that induced conformity to work standards in the observed. In addition, universal transparency of data removed ambiguity and altered authority relations, if conditions of egalitarian access to data and adequate intellectual skill to find meaning in the data were present.(74) Lyon(220) and Zuboff(74) argue that the panopticon is a starting point in understanding electronic surveillance and that a post-Foucauldian perspective is required(221) to understand the levels of resistance and refusal, whether explicit or passive that is produced by the panopticon. In this chapter I examine the panoptical gaze of the web-based surveillance programme and explore the extent to which it served as a mechanism for democratic accountability and democratic transparency and stimulated an adjustment in hospitals towards resilient functioning.

5.2.3.3 Surveying centre with a capacity to intervene

The third theme concerns the use of a panoptical surveillance tool as a control mode. This use is acknowledged by Power(222) who argues that in a hierarchy of control, surveillance can be understood as a first order control whereas audit has become a second or third order control. As such, in a spectrum of programmatic control, Power considers surveillance as a more coercive strategy at one end of the spectrum, in contrast to a negotiated and consensual regulatory outcome at the other. The use of surveillance is assessed in analyses of the impact of ICT on power dynamics between individuals and organisations(74) or individuals and the state, (220;223) which have drawn on the concept of panoptic power(73) and its application to ICT, referring to the electronic eye (224) or information panopticon.(74) In this chapter, I build on these analyses to examine the government's commitment to surveillance as both a public health and indirect disciplinary control tool, albeit operating indirectly alongside other direct mechanisms.

In addition to the capacity to intervene, I analyse the government's capacity for democratic transparency. In his description of the inspection house, Foucault refers not only to constant

inspections by appointed inspectors*,' but also by the public: any member of society will have the right to come and see with his own eyes how the schools, hospitals, factories, prisons function. There is no risk, therefore, that the increase of power created by the panoptic machine may degenerate into tyranny; the disciplinary mechanism will be democratically controlled.' (73)p207*

The duality of disciplinary power with democratic transparency is fundamental to Foucault's vision, each element acting as a restraining influence on the other. The Panopticon was designed to enable an observer to have maximum visibility of individuals within it, but equally, it was arranged to enable anyone to observe any of the observers. This iterative nature of observation, which ensured that 'the exercise of power may be supervised by society as a whole' (73)p207 was designed to prevent the Panopticon becoming a tyrannical mechanism, with unconstrained and unethical use of power and control. This chapter examines the tensions between these two elements, mediated by professional interests within the policy field of infection control.

5.2.3.4 Self surveillance and active enrolment in self governing by clinical managerial hybrids

The fourth theme relates to the response by individuals to the panoptical gaze. Early Foucauldian conceptions of panoptical power and visibility were described as a means of self-subjection of an individual, a mechanism by which the individual "assumes responsibility for the constraints of power" and "inscribes in himself the power relation in which he simultaneously plays both roles: he becomes the principle of his own subjection."(73)p202 These conceptualisations have been integrated into empirical analyses of disciplinary practice.(225) Subsequent interpretations have focused on Foucault's later works (76;218) arguing that individuals are able to free themselves from the disciplinary power inherent in their existing situation and internalise external surveillance (the use of subjectification) through the development of 'technologies of self' which reflect their own desires and constitute a self-disciplined framework of their own making. Starkey & McKinley contend that small and informed groups of individuals may join together 'to create their own modes of thinking and behaviour within their own communities.'(76)p236 Ferlie et al develop this logic, in their empirical study of clinical managerial hybrids, proposing that these hybrids work together in small teams, align themselves with evidence-based technologies and promote patient centeredness.(208) I will examine the application of subjectification and

technologies of self perspective to the operation of clinical managerial hybrids in the infection control setting, as an example of a system adjustment that leads to increased resilience.

5.3 Methods

In order to investigate this contemporary subject in depth and in its real-life context, a macro-level study of the national infection health reform programme was linked to a single case study in a hospital organisation, serving as an embedded unit of analysis.(226) The research employed an inductive and deductive theorising approach(227-229) to support the development of theory based on the rich qualitative data that resulted from central and local actors' interpretations of the reform programme and surveillance approach. An initial wide ranging literature review assisted in identifying theories that related to health care change which were then compared with the emerging themes from the study data. An iterative process was followed, alternating between theory and data to identify a theory that fitted most closely with the study data. The characteristics of the reform programme were found to be most closely related to a Foucauldian conceptualisation of a state response to local hospital organisations, which were perceived as failing to act on hospital-acquired infections. Having explored Foucauldian governmentality as a theoretical perspective on the data, it became apparent that the infection control reform programme served as a 'tracer issue' for several Foucauldian themes.

In the context of these theoretical debates, this study investigates the surveillance programme within the national infection control reform programme which was identified as an interesting object of study because it preoccupied the state from 2000-2011. An embedded local hospital case study was selected which was perceived by central government as a role model hospital organisation and a leader in infection innovation. This large, acute teaching hospital Trust was selected for the study on the basis of the significant reductions in MRSA bacteraemias that it had achieved and the local innovation around infection that had informed the national infection health reform programme. The Director of Infection Prevention and Control (DIPC) at the hospital was an infectious diseases clinical leader who was well connected through links with central government on expert committees and as an expert speaker.

Data collection and analysis was carried out from 2008 to 2011 at two levels: at macro-level with national state and regulatory organisations that directed or influenced the infection

reform programme and at micro-level with staff from different disciplines and levels with the hospital organisation who were involved in the management and operation of infection prevention and control and in infection-related incidents and outbreaks. The study data was collated from three sources; 1) in-depth semi-structured interviews at national level (18) and local level (22); 2) documentary and web-based analysis at both levels and 3) personal reflections on the unfolding scenario. The interviewees were identified by two different sampling strategies. At national level, criterion sampling was used to identify all the external regulatory and advisory agencies that influence infection prevention and control policy and implementation in healthcare Trusts. At local level, snowball sampling drew on informants' knowledge to identify other informants who would be useful in the study based on their involvement in infection prevention and control.

In order to recognise 'the irredeemable presence of the researcher in the research'(230), the subject position of the researcher in the research is acknowledged, from the perspective of being a former health service manager, having worked in the local organisation in senior management roles, rather than as an observer of it. This perspective provided useful insights into the way national reforms are interpreted and enacted in a local organisation. The data derived from the interviews and personal reflections was supplemented with data analysis of organisational reports and minutes of meetings, policy documentation, legislation, letters and infection control statistics from the DH and national agencies. Thematic analysis was used to explore emerging themes arising from the data and an iterative process of data triangulation was used to ensure that the emerging themes were consistent with the documentary and web-based evidence and personal reflections.

5.4 Empirical Case

5.4.1 The infection health reform programme

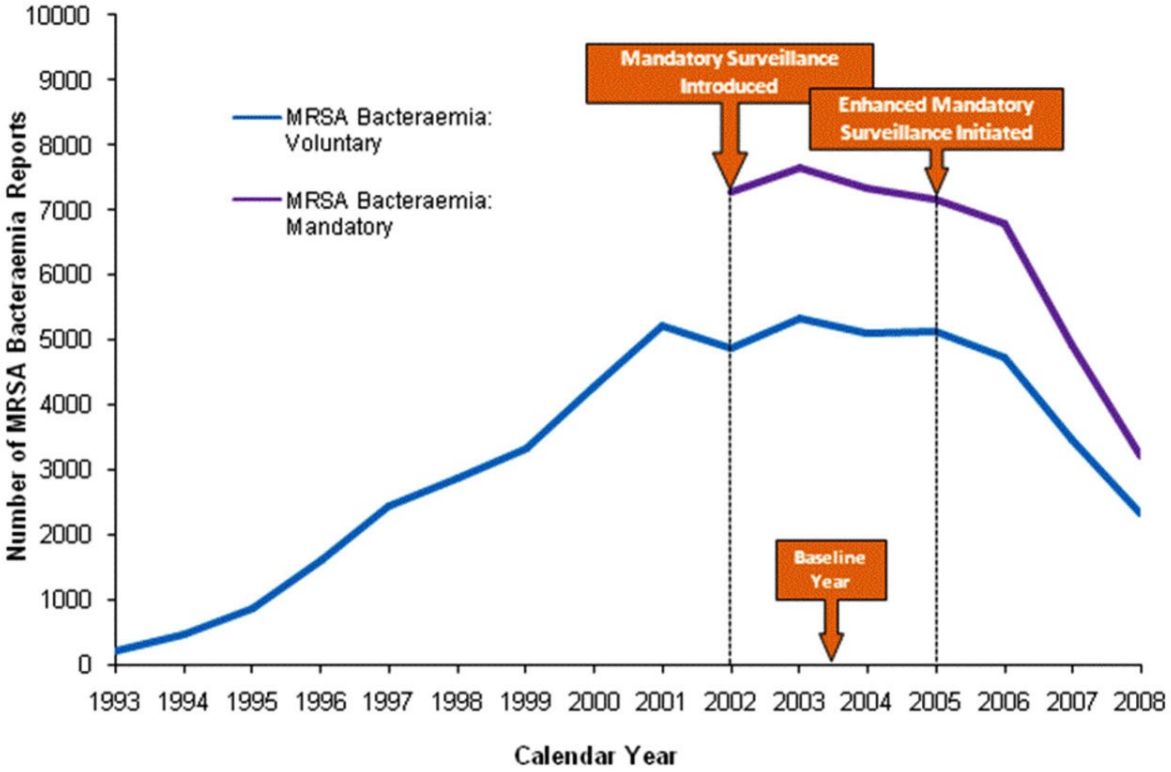
5.4.1.1 National infection strategy

The infection health reform programme was initiated in 2004 to stem the significant increase in a specific group of infections; Meticillin-resistant *Staphylococcus aureus* bacteraemias (hereafter referred to as MRSA) that had occurred over the previous ten years- see Figure 5.1.

The political scrutiny of the retrospective MRSA data and the expansion of negative popular media coverage(280) resulted in the Department of Health (DH) developing the infection reform programme and a departmental action plan which was implemented across both

semi-autonomous regulated hospitals (Foundation Trusts) and directly controlled hospitals (Trusts) with little regard to the DHs new policy direction of devolution and with a greater level of intervention and implementation that had occurred in the history of the DH. These NPM approaches were complemented and subsequently eroded by novel and indirect control modes, employed by the DH to maintain its stated policy direction, in response to significant political and media pressure to improve the MRSA bacteraemia rates.(231)

Figure 5.1 Voluntary and Mandatory MRSA Bacteraemia Reporting 1993-2008



UK Health Protection Agency. Pearson et al. (2009) Impact of mandatory surveillance on the measurement of meticillin-resistant *Staphylococcus aureus* bacteraemia in the English NHS: comparison of mandatory and voluntary surveillance reporting systems. http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317132089460 (Accessed 27 May 2012)

These infections are resistant to certain antibiotics, resulting in significant illness, potentially death in susceptible hospitalised patients. The UK laboratory-based voluntary system showed a dramatic rise in MRSA between 1990 and 2001, with the prevalence of these infections being associated primarily with hospital-acquired infection. The mandatory web-based surveillance system was introduced in 2002 with the enhanced version of this system

being implemented in 2005 (providing real-time data entry and more detailed information on risks and incidence of infection), with a marked decrease in infections from 2006. This reporting was complemented in 2005 by surveillance for *C.difficile* infections.

Prior to the reform programme (1990-2004) at strategic level, the policy agenda for infection control was implemented through the traditional line management structures of the health system, from the Department of Health (DH) to Strategic Health Authorities to hospital units (Trusts). Changes in policy were communicated to Strategic Health Authorities and Trusts via policy directives, recommending changes in practice. The increased volume of MRSAs reported through the voluntary system led the government to recognise the inadequacy of using the traditional direct control system and overlaid this with contemporary New Public Management (NPM) style controls; the introduction of national clinical targets (2005), performance management of Chief Executives and more detailed measurement of infections through the introduction of a mandatory retrospective surveillance system for MRSA in 2002.

The DH resorted to three more novel and indirect control modes to attempt to achieve traction on the issue of rising MRSA and *C.difficile* infections: i) the design of a web-based Foucauldian surveillance mechanism to increase the field of visibility of hospital performance on infection rates which precipitated local self-surveillance activities ii) the enrolment of large numbers of hospital staff in national surveillance and governance utilising data from the web-based system iii) the increase in public visibility of infection rates through government transparency policy agendas. The next section traces these three elements of the reform programme through the national infection surveillance programme and the case study hospital Trust.

5.4.1.2 National Infection Surveillance Programme

I examine a key component of the infection health reform programme, the national infection surveillance programme and the associated enhanced surveillance database as an artefact, an indirect control mechanism to exert disciplinary accountability through surveillance by constructing a field of visibility around Trusts. I will review the operationalisation of the surveillance programme and database, assessing its operation centrally and the local enactment within Trusts and individual clinicians through the lens of a case study organisation.

The infection surveillance programme, prior to 2001, was operated as a voluntary surveillance scheme for hospitals and was subsumed by the Health Protection Agency, an

independent UK organisation established by the government in 2003. Infection numbers were published annually based on voluntary hospital returns that fed into a national controls assurance framework which encouraged a self-inspecting and regulating capability and required a level of trust in hospitals self-reporting against the standard, a concept which the government found insufficient against the rising levels of infections. As a result, the surveillance programme became colonized by the DH for the purpose of controlling hospital infection levels in 2001, in response to continual rises in MRSA bacteraemia numbers since 1990. The DH introduced mandatory surveillance of *Staphylococcus aureus* bacteraemias based on quarterly organisational-level laboratory returns in 2002, a year in which there was a further increase in reported bacteraemias of over 7,000 per annum.

As a result of minimal improvement in MRSA numbers by 2005, the DH resorted to a more coercive strategy with the introduction of the 'web-based enhanced surveillance database.' This database was notable for the level of enhanced 'real time' surveillance detail required on every case, the capacity for Trusts to enter data directly using the web-based interface and the scope for monitoring individual hospitals. The amount of detailed data was much greater than the previous retrospective data gathered through laboratory-based systems. Hospitals were mandated to enter 'real time' detailed patient-level data about individual infection cases (MRSA bacteraemias 2004 and subsequently cases of *C.difficile* 2007) which involved collecting patient details for each episode such as NHS number, hospital number, date of birth, and sex, as well as information concerning the patient's location, date of admission, consultant specialty, and care details at the time the blood sample was taken. This was commented on by a Director within an arm's length agency:

'MRSA, the reduction target has been very, very, very tightly managed from the top down. At a time where the Department of Health is moving to a devolved administration, as far as the NHS is concerned, this is one.....this is one area which is being micromanaged, to the nth degree, to the single infection, MRSA recorded infection. Which is quite an interesting behavioural experiment actually?' [72] Director of Arm's Length Agency

The increasing level of detail required on every bacteraemia was matched by the increasing regularity of surveillance activities by the DH detailed in Table 5.1. Directives from the centre to hospitals increased with reporting, data checking and publication periods becoming more frequent, as the government sought to maintain greater control over Trusts through the surveillance opportunities that the electronic database presented.

This level of surveillance of Trusts led some Trusts to adopt gaming behaviour in an attempt to reduce their numbers of MRSA. As a result of protests from Trusts that their infection numbers were artificially increased by 'community cases' those patients who already had MRSA blood stream infections when entering the hospital, the DH reclassified MRSA infections into hospital and non-hospital (community) cases. This reclassification led to a complex set of rules under an 'appeals process' that highlighted a sense of mutual visibility and associated vulnerability within Trusts. A formal 'non-trajectory' appeals process was established and managed by the Health Protection Agency on behalf of the DH to determine against a complex set of criteria, which individual cases could be accepted or declined during the process.

Table 5.1 Directives issued by the DH, detailing key changes in infection reporting, data checking and publication requirements

Date	Infection Name/Reference Number of Directive	Reporting/Data Checking Frequency	Publication
11th February 2000	Infections HSC 2000/002	Not noted	Not noted
April 2002	Mandatory MRSA bacteraemia surveillance by NHS acute Trusts, England		
9th June 2003	MRSA PL/CMO/2003/4, PL/CNO/2003/4	Monthly/Quarterly	Annual
March 2005	MRSA PL/CMO2005/4	Monthly/Quarterly	Six-monthly
April 2005	National Target to reduce MRSA bacteraemias by 50% in March 2008		
October 2005	Introduction of web-based enhanced surveillance database for MRSA		
21st December 2005	*C.difficile* PL CMO/2005/6 PLCNO2005/5	Not noted	Annually (2004)
30th March 2006	MRSA PL/CMO/2006/2 PL/CNO/2006/2	Monthly/Monthly	Six-monthly
7th November 2006	*C.difficile* Gateway ref: 7318	Six monthly/six-monthly	Annually (2005)
7th December 2006	HCAI, *C.difficile* Gateway ref: 7490	Six monthly/six monthly	Jan 2007 Quarterly
December 2006	National target to reduce *C.difficile* by 30% in 2010/11		
April 2007	Introduction of web-based enhanced surveillance database for *C.difficile*		
11th April 2007	*C.difficile* PL CMO (2007)4 PL CNO (2007)2	Monthly/Quarterly	Quarterly
27th November 2008	*C.difficile* Gateway ref: 10936	Monthly/Monthly	Quarterly
April 2010	National MRSA objective for 2010-11		

7th June 2010	MRSA and *C.difficile* Gateway ref: 14373	Weekly/Weekly	Weekly
6th January 2011	MSSA Gateway ref: 15353	Monthly/Monthly	TBA
20th April 2011	*E.coli* Gateway ref: 15980	Monthly/Monthly	Monthly

5.4.1.3 Hospital staff enrolment in infection surveillance

In the creation of a field of visibility, the government used physical control initially, in the form of 'improvement teams' colloquially described in the media as 'hit squads':

'In parallel with that [performance management] we set up the improvement teams which were not performance management, although we worked closely, but they were advisory and supportive, and they were to go out into Trusts that were having problems, which ended up being most of the Trusts in the country, over the years. [73/4] DH Director

These teams comprised clinical staff, technical experts and managers recruited on a temporary or secondment basis from hospital Trusts across the UK and who were tasked with visiting hospitals to elucidate their performance and offer advice and support:

'The big change was the creation of a programme that actually went into active mode, the setting of the target and then going out in that period to actually do things and to draw people in from the NHS to help us to create the team, that we did, and that we have.'[73/4] DH Director

This level of peer scrutiny and surveillance, which extended the field of visibility for the centre and encouraged a culture of surveillance by clinician managers who were in a position to peer-review each other's data, was run in parallel with technical control, in the form of the web-based surveillance tool. This tool extended the efficiency and effectiveness of the centre to undertake surveillance and reduced the resources required for surveillance, freeing up resources for more focused surveillance and intervention in hospitals that were identified as poor performers.

A further cadre of hospital staff, an elite group of clinical managerial hybrids who were partially self-selecting through their enthusiastic commitment to the programme and their ability to have reduced infection rates in their own organisations were recruited by the DH to provide strategic leadership and direction on a range of initiatives. These included the design of multiple clinical guidelines (known as 'High Impact Interventions') under a

programme called ‘Saving Lives’, developing guidance for hospital Trust Boards, contributing to the improvement teams, assisting in policy formulation and ensuring knowledge transfer through conferences and learning events.

5.4.1.4 Web-based transparency agenda

The surveillance opportunities of the database were extended beyond the original scope of the reform programme when in January 2010, the government began publication of the weekly reporting for MRSA and *C.difficile* on-line(232) within the policy initiative, ‘Opening up Government.’ This initiative is explained on the government’s website as promoting the government’s policy agenda of transparency as a transformative force to ‘encourage greater public participation in decision making.’(233) Public sector data is published on a website using a user-centric web format that enables the general public to access raw data from a range of government departments and other agencies. Infection data is available through links with the Health Protection Agency (hpa.org.uk) website, a government arm’s length agency. The HPA, with a primarily scientific and technical staff, were cautionary in their advice to the public:

‘It is important to note, however, that these data are not classified as Official Statistics and hence the data should be interpreted with caution. Please refer to the guidance for further information.’ (234)

The guidance referred to in this advice details a series of caveats and limitations to the data that appear to reflect tensions between the government policy agenda to create democratic transparency and the professional concerns of the scientific and technical community that the data might be misunderstood or misused.

In summary, my preliminary analysis suggests that a Foucauldian perspective can be applied to the national case; with i) the active use of novel indirect control modes by the government to complement existing line management/NPM style approaches ii) the creation of a field of visibility using electronic panoptical surveillance systems in health care iii) the enrolment of staff in surveillance activities and iv) the engagement in self surveillance and subjectification of clinical managerial hybrids.

5.4.2 Case study hospital Trust

The hospital Trust is based in a large city with a diverse population and provides secondary health services to its local population and tertiary health services to a broader patient

population from across the UK. Following a merger with another large acute teaching hospital Trust in 2007, the Trust was officially recognised as an academic health science centre in 2009, which cemented a partnership between the Trust and its partner academic institution with a mission to demonstrate excellence in research, patient care and education. Juxtaposed against this transition, the Trust failed in several attempts (2005, 2009) to become a Foundation Trust, (a hospital overseen by an independent regulator), owing to its poor financial position.

5.4.2.1 Local infection prevention and control

In infection terms, prior to 2004, the Trust maintained a small infection control team that comprised infection control nurses and infectious diseases doctors who were responsible for dealing with infection outbreaks, developing infection policy and educating staff in infection control practice. Infection rates were high. An infectious diseases doctor [63] recalled that the Trust had very high levels of bacteraemia-related blood stream infections in 1999. By 2004, the Annual Risk report to the Board in July 2004 highlighted a 'significant incidence of infections' suggesting that efforts to address the infection problems had not gained traction within the hospital. The publication of 'Winning Ways'(36) by the government in December 2003, a report that set out a clear direction for hospitals on the action required to reduce healthcare associated infection, mandated that hospital Trusts introduce a new Director role on Boards, the Director of Infection Prevention and Control (DIPC). The Trust recruited to this role in 2004, with a female, relatively junior, infectious diseases doctor who recognised her appointment as 'a brave decision' by the Chief Executive who could have recruited more senior, male establishment microbiologists based in the laboratory. The DIPC role was ward-based, acting as an advisor to clinical teams on infectious disease issues and managing infection problems relating to equipment, the environment, medication, outbreaks and incidents. In addition, the role required managerial focus: to provide direction on infection prevention and control issues at the Trust Board; to address infection problems with medical and nursing colleagues; to determine policy and strategy for infection and to manage infection performance across the Trust. The DIPC was originally a career clinician, but progressively developed into a clinical managerial hybrid role through the adoption and influencing of the national agenda. The DIPC was seen as effective and innovative, having developed good relationships with the hospital Board, having clinical credibility with a wide network of clinicians in the hospital and being driven by the value of improving patient outcomes. Despite this, the DIPC continued to experience resistance from certain clinical

specialties or individual clinicians who challenged infection control policies and resisted change.

Table 5.2 Empirical evidence of Foucauldian themes

Foucauldian themes	Evidence of themes in case study hospital	Local actor's interpretations
Self surveillance	Statistician recruited to develop detailed epidemiological data at unit and division level	*'And when I started we also had a statistician start at around the same time, so it's hard to compare prior to that, but it, I got the impression that people were asking for data and we just didn't have it. So that's changed rapidly, we have more data that you know what to do with now, people are constantly asking for it, so I think that's been a major change' [75].*
	Infection surveillance built into hospital balanced scorecard and clinical incident reporting system	*'shortly after I was made director and we introduced the system of integrating the monitoring of infection prevention and control into directorate scorecards and making clear lines of accountability which sat with directorates aligned with financial accountability and all other areas of corporate accountability, and that actually just changed everything. And also gave a framework for feedback.'[63]*
	Implemented new localised infection control surveillance system within the hospital (ICNet)	*'I actually think as numbers have, in fact in a way it's, we're creating these sticks to be beaten with because actually it was interesting at the, I can speak from the [hospital] site, they were so used to getting data all the time that when they had to do a month without it whilst we standardised how we do everything cross site,[Trust merger in 2007] and in fact we had to take a big hit to stop, standardise everything, so that we could reintroduce it in a way that would involve all the trust. But the people that were used to getting data all the time, all the time, were getting angry, upset, and yet this was something we had introduced.' [63]*
Self governing	Influential clinical managerial hybrids in the structure (clinical directors) recruited to increase self-governing capability within their own clinical areas	*'So as Clinical Programme Director I'm accountable for all of the outcomes essentially in the clinical programme group....so essentially I'm accountable for hospital acquired infection and infection control practices that happen in my clinical services, so the delivery of infection control. The difference in terms of what it changed, the scope is bigger because there are now more clinical areas since three sites.' [133]*
	Clinical infection champions appointed in each unit to observe, influence and feedback on infection control	*'I think infection prevention and control has become more, in my words, there are still policies and procedures however I do believe it's become more focused and more tangible in what you do. It's more measurable, I think, if that's the right word.'[143]*

5.4.2.2 Design of infection surveillance systems

A major change introduced by the DIPC was to set up a tranche of ICT based self-surveillance and self-governing infection mechanisms within the hospital, in response to the national scrutiny of hospital infection rates and to influence other clinician's behaviour using epidemiologically robust infection data. These mechanisms are outlined in Table 5.2, detailing local actors' interpretations of these mechanisms in action.

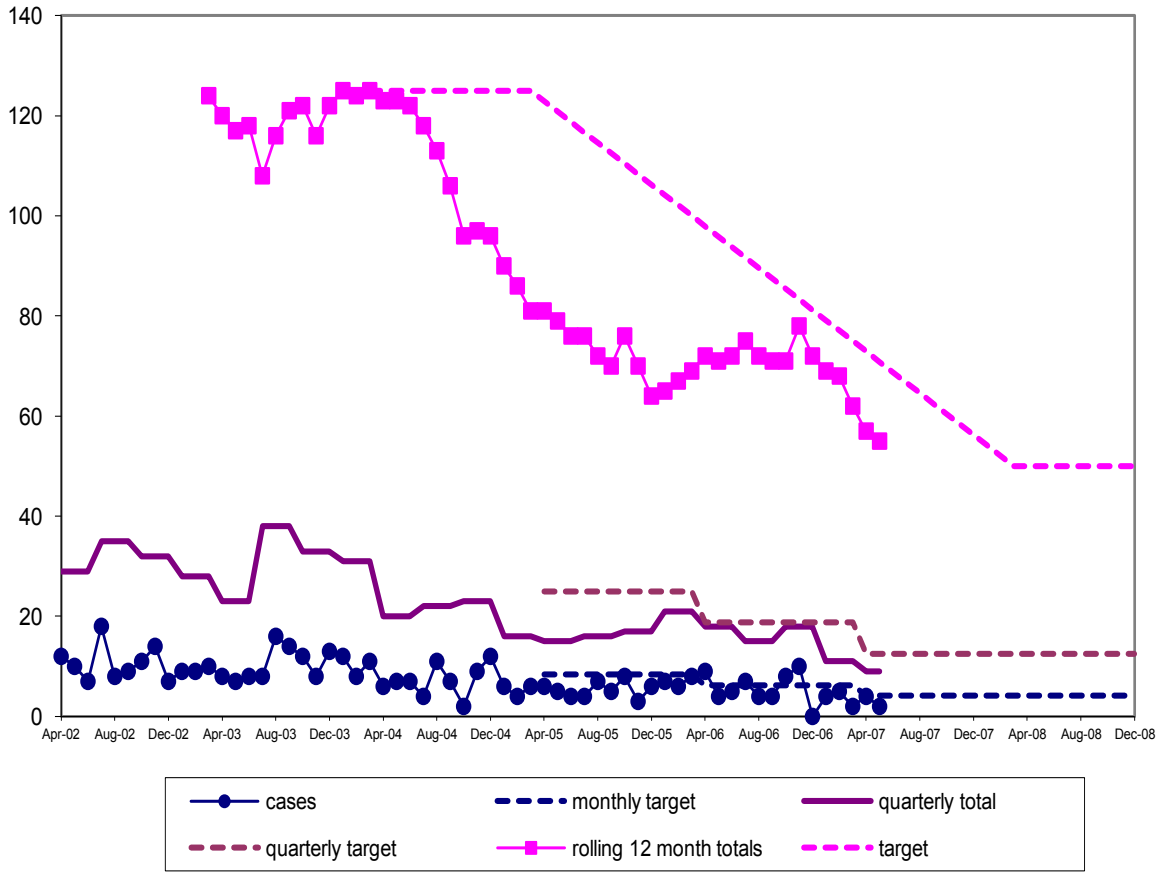
Three ICT mechanisms; the creation of electronic epidemiological data, the colonisation of a managerial balanced scorecard with infection data and the implementation of a localised infection control surveillance system served to increase the field of visibility for infection in the hospital. The apparatus for surveillance was intensified, in that specialist clinical areas, such as the intensive care unit (ICU) and renal unit which had operated semi-autonomously prior to these changes became the focus of attention: *[High levels of ICU Bloodstream Infections] 'But a huge amount is around attitude, data feedback and really, really making it an area of focus.'[63]* The level of scrutiny was extended to clinical as well as throughput indicators which had previously been the primary focus. A fundamental change in individual clinician behaviour as a result of these surveillance mechanisms was noted by the DIPC. Individual clinicians, who may have previously resisted the surveillance, were actively enrolling in enthusiastic self-surveillance, to the extent that when infection data was temporarily unavailable, the clinicians became angry and upset.

5.4.2.3 Clinical Self-surveillance

A linked change was evident, through the performance management apparatus, of senior clinical managerial hybrids, such as Clinical Directors, taking accountability for infection rates in their own clinical areas and becoming self-governing in relation to their group's infection performance. The DIPC was able to successfully devolve accountability for infection to these self-governing hybrids who responded competitively to deliver improved infection rates compared with their colleagues. The establishment of a network of clinical infection champions at a consultant/nurse leader level assisted in enroling more people in governing and self-governing and enabled sustainable self-surveillance networks across the organisation, supported by the intensification and extension of infection control surveillance mechanisms and data. Clinical directors and clinical champions gained kudos internally from supporting the overarching infection initiative, evident from an increase in applications to the pay award committee in the Trust that justified a 'merit award' on the grounds of their work in infection prevention and control.

In describing her development, the DIPC outlined an iterative process of development in the clinical managerial hybrid role across national and local boundaries over time. Initially, as a member of a national advisory expert group: the Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection (ARHAI), a DH Advisor and a member of improvement teams, the DIPC became recognised for her value in her national hybrid role. This was consolidated locally through the credibility achieved by significant improvements in local infection rates (see Figure 5.2) as a result of the changes implemented in Table 5.2. A further iteration occurred when the DIPC undertook retrospective sensemaking around the improvements and created the Hammersmith Organisational Model of Infection Prevention (HOMIP) locally.(235) This model provided a platform for a further iterative stage, to speak about the model at conferences and other knowledge transfer events. Through this iterative process, her career and status developed nationally as a hybrid and led to enhanced multidisciplinary research interests which facilitated success with research grants and developed credibility through research publications.

Figure 5.2 Trust MRSA Blood Stream Infection Cases and rolling 12 month totals against DH Target, by month to May 2007



5.5 Discussion

5.5.1 Direct to indirect control modes

This case represents a transition from direct to indirect technologies of steering, which I argue represents a positive 'adjustment' by the government from a resilience perspective. Three novel indirect technologies were in evidence: the design of a web-based Foucauldian surveillance mechanism to increase visibility of hospital performance on infection rates; the enrolment of large numbers of hospital staff in national surveillance; and local self-surveillance activities and the increase in public visibility of infection rates through government transparency policy agendas. I argue that initially (2002-4) the first two indirect control modes complemented direct NPM style management modes of target setting, performance management and measurement. However, the implementation of the enhanced 'real time' surveillance tool in 2005 and the enrolment of more hospital staff in self-governing activities caused a shift in the extent of visibility. This shift, combined with the increased frequency of the reporting and publishing of infection rates, resulted in the gradual erosion of direct control modes. For example, after 2010, national targets were minimised and the focus moved to locally derived and specific targets. These indirect modes operated through drawing committed clinical managerial hybrids into self-governing roles enabled the DH to operate 'loose/tight' governance regimes and enabled targeted intervention and supportive improvement for poorer performers. From a macro perspective these positive adjustments to rising infection rates increased visibility at meso-level. Organisational resilience increased as hospitals with low resilience to infections were the focus of 'tight' governance regimes, receiving targeted resources and support whereas hospitals with high resilience to infections benefitted from 'loose' governance regimes and were able to capitalize on the involvement of a cadre of self-surveilling leaders who took accountability for delivering lower infection rates.

5.5.2 The electronic panopticon

Empirically, I have applied the electronic panopticon concept to analyse a novel and indirect control mode, a 'real time' mandatory web-based surveillance mechanism in the health care sector. I argue that the success of this panoptic device as a control mechanism to create disciplinary accountability and to increase hospital resilience to infections was evidenced by the significant reduction in MRSA and *C.difficile* rates by 2008 within three years of the new systems implementation. The new surveillance system, as an novel and indirect control mode, exhibited control features that exemplified the panopticon gaze(73): the reporting was mandatory for every hospital in England; both regulated (Foundation Trust) hospitals and

directly controlled (Trust) hospitals were required to enter data, in effect overriding the regulatory devolvement of power to Foundation hospitals; data was requested at individual patient-level and the intensification of gaze was reflected in changing information requirements from annual calls for data to become continuous data requirements with weekly publication (see Table 5.1) and provided a field of visibility on the stringent performance targets against which hospitals were monitored. The 'constraints of power' (73)p202 were conferred electronically on hospital Chief Executives who were responsible personally for 'locking down' their organisation's data using a personal password once they had assured its accuracy, eventually on a monthly basis.

In contrast, McGivern & Dopson suggest that DH standardised quarterly performance reviews failed to control the jurisdictional space in a biomedical network.(215) In accounting for the differences, the panoptic device: was embedded in an organisational hierarchy, rather than across a more loosely defined network which created a clear hierarchy of disciplinary accountability; created a field of visibility around the organisation's performance and by default the Chief Executive's performance against the targets; ensured the function of inspection and surveillance was ceaseless and unverifiable, as continuous data was scrutinised by unknown observers within the DH which increased apprehension amongst Trusts; and caused adaptations in Trusts' behaviour in response to the perpetual surveillance which normalised intensive infection reporting so that additional requirements to add further infections, MSSA and *E.coli* were not met with any resistance. The combined effect of these changes was to cause a system adjustment which reduced MRSA and *C.difficile* rates significantly. Although superficially, this adjustment appears to have increased organisational resilience to infections, in reality the close scrutiny paid to these two organisms, distracted attention and resources away from hospitals developing a more holistic approach to infection prevention and control and addressing the potential threat of other hospital-acquired infective organisms.

At local level, I see the electronic Panopticon being developed by career-oriented clinical managerial hybrids to engage in self-surveillance which had the effect of creating a sense of mutual visibility and collective responsibility and diminishing the oppression of surveillance(74)p346. In the case study Trust, influential clinical managerial hybrids benefited from being able to use the surveillance devices to assert control with their peers within their own spheres of influence. I view these adjustments as positive, as resilient capability in the hospital was increased due to the creation of self-surveillance systems,

which had the active enrolment of influential clinical leaders and participation from their clinical peers.

5.5.3 The surveying centre with a capacity to intervene

The successful functioning of the electronic Panopticon, altered the relationship of the DH with hospital Trusts and the general public. Prior to the introduction of the enhanced surveillance system the DH operated reactively to the rising rate of infections, under scrutiny from the general public through the media and the Public Accounts Committee. It employed a physical means of surveillance to check on the performance of Trusts, the establishment of improvement teams, or 'hit squads' as they were colloquially known in the media. These teams could only react to retrospectively published data on the mandatory surveillance system and visit Trusts directly to intervene in their infection control practice. In addition, the hit squad methodology was hampered by its epistemic dependence which required a degree of negotiation and interaction with hospital Trusts to arrive at its conclusions. The benefit of the enhanced web-based surveillance database with increasingly regular and detailed 'real time' information requirements was the epistemic independence that this provided, i.e. the knowledge base was independent of the inspected party(222) and therefore could transmit 'the presence of the omniscient observer and so induce compliance without the messy conflict-prone exertions of reciprocal relations.'(74)p323. The system in effect facilitated Foucault's 'automatic functioning of power.' (73)p201 This reduced the need for the DH to intervene in such a widespread way, as detailed intelligence was available to the centre which enabled targeted interventions in poorly performing Trusts, thus increasing resilient capacity at macro-level through a flexible approach to developing resilience to infections at meso-level.

The relationship of the DH with the general public altered through the availability of 'real time' data and was used for the new 'transparency' policy agenda that was introduced by the new coalition government. The conceptualisation of Bentham's architectural Panopticon structure(219) as a design to achieve 'universal transparency' by means of glass walls fitted onto a skeletal iron structure(74)p320 is reflected in a discourse of transparency and patient empowerment, evident in later communications between the DH and hospitals to justify the mandated operation of the web-based tool. The democratising potential of the panopticon device was used as a justification for the extension and intensification of its use in infection surveillance 'so that information for patients continues to improve' in a letter from the Secretary of State for Health in June 2010 (Gateway ref: 14373). However, earlier letters justified the use of surveillance in relation to minimising the risk of infections for patients and

staff (PL/CMO/2003/4, PL/CNO/2003/4). The disjuncture between earlier and later discourses, leads us to question whether this constitutes rhetoric or genuine articulation of DH policy intention and the extent to which it improves accountability to the public and increases visibility of hospital performance on infections. More recently (2011-12) weekly infection data has been published on a new government transparency website (data.gov.uk) entitled, 'Opening up government' and is described as one feature of the new policy agenda for transparency to make healthcare better. However, the arms length and largely professionally staffed body which analyses the infection data, issued guidance on the use of the weekly statistics which reflects the professional unease with which the new transparency agenda is being viewed. The guidance notes that weekly data is not defined as 'Official Statistics' according to the Code of Practice and therefore should be used with caution. This suggests that while the government has latterly utilised the transparency agenda as a mechanism to increase resilience to infections by extending the panoptic gaze, the benefit to patients and the public is less from the accessibility and transparency of data at this stage and more from the reduction in MRSA and *C.difficile* rates that the surveillance mechanism has achieved.

5.5.4 Self surveillance and self governing by clinical managerial hybrids

In contrast to studies that apply early Foucauldian conceptions of panoptical power as a means of self subjection of an individual(225), the empirical evidence from this study is that individual clinicians, particularly those who assumed clinical managerial hybrid roles, were able to internalise external surveillance, the process of subjectification, through the development of a self-disciplined framework developed with other like-minded hybrids in the hospital.

I observe that the psychology of horizontal and vertical visibility(74) created by peer and national availability of infection data respectively, motivated clinical managerial hybrids to operate strategically by creating further internal surveillance mechanisms that not only responded to the new centralised requirements for mandatory MRSA and *C.difficile* reporting, but in addition, introduced local surveillance tools that enabled self-surveillance. Clinical managerial hybrids were observed to develop their internal networks to encourage other influential clinical managerial hybrids within the organisation to participate in the self-surveillance processes to create their own modes of thinking and behaviour(76) and to use them to enhance their scope of self-governance within the organisation. A further development of technologies of self was the iterative process engaged in by the DIPC to develop her role, status and career as a clinical managerial hybrid through participation with

other clinical managerial hybrids in national committees, development of guidelines and the creation of new models of infection organisation. I consider the creation of a cadre of self-surveilling leaders who proactively developed new identities through the development of technologies of self created the most positive adjustment in comparison with other indirect control modes. The adjustment was positive from a resilience perspective as it generated long-term resilient capability within the organisation through enrolment in self-organisation under surveillance, which led to the construction of novel meso-level surveillance systems and facilitated the construction of new routines and a new governance order.

5.6 Conclusion

My primary contribution to the organisational resilience literature is to identify, within the spectrum of existing Foucauldian theorising about ICTs in the health sector, a highly effective ICT-enabled strategy involving the successful government transition towards novel and indirect control modes. These indirect control modes had a positive impact overall on hospitals' resilience in reducing infection MRSA and *C.difficile* rates nationally. However, I found that the indirect control modes did have unintended consequences, such as preventing a holistic approach to infection prevention and control in hospitals. I considered that the most effective indirect mode from a resilience perspective was the active and creative enrolment in self-governing and self-surveillance by clinical managerial hybrids who experienced strong identity shifts. This positive change which involved clinical hybrids in the construction of new routines and a new governance order was found to create a long-term resilient capability to reduce infection rates in hospitals. This strategy is not representative of the findings of previous studies of ICTs in health where most empirical cases find that ICTs fail to deliver the predicted outcomes and tacit clinical resistance is observed.

I contribute further by applying a social science approach, Foucauldian governmentality theory to a novel arena. Whilst the work of Foucault(68) has been applied to healthcare,(208;216), the application of Foucauldian theory to the study of organizational resilience and to the specific case of infection prevention and control is novel. I used a Foucauldian framework to explore the system adjustments that resulted from rising infection rates and found it useful to explain the government transition from direct to indirect control modes, in particular to provide a rationale for clinical involvement in the surveillance programme and to explain the significant reduction in MRSA and *C.difficile* rates after 2006.

A further contribution is that I use an in-depth qualitative study with an embedded case study to study organisational resilience. I developed this qualitative design to analyse resilience

from a system perspective, in order to assess the effect of each macro-level intervention at meso and micro-level in hospital organisations. I used in-depth interviews at macro, meso and micro-level to explore the interactions and influences on hospital organisations that might encourage or discourage resilient practice.

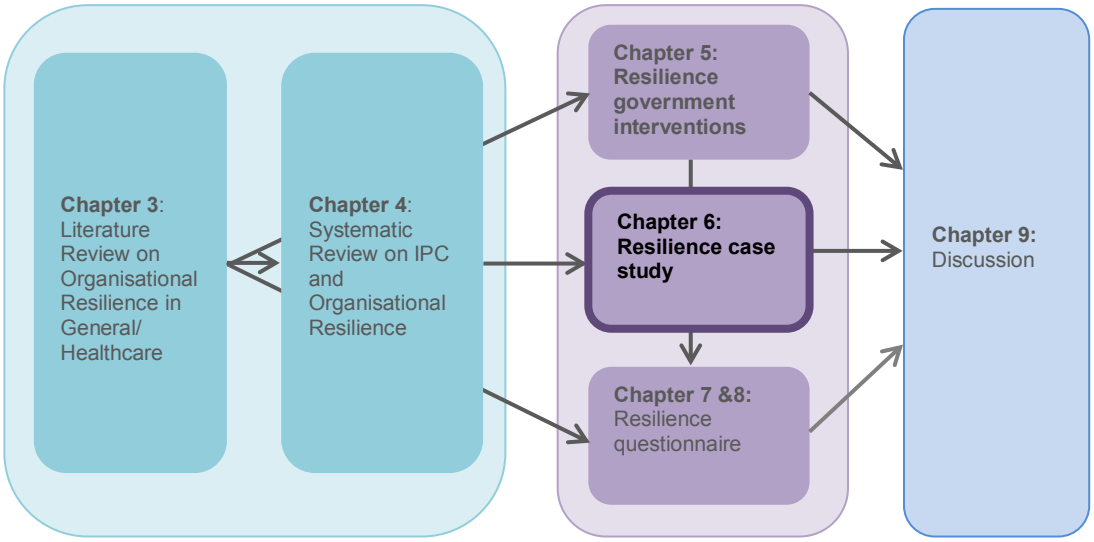
This study has several limitations. The case study Trust was purposefully selected for analysis as a case which represented a transition towards positive and innovative infection control practice. As a single embedded case study, whilst providing rich qualitative data from which to draw evidence, it is limited in terms of broader generalisability. The DIPC in the case study was recognised for participation in infection improvements. It would be useful in future studies to enroll additional clinical hybrids to understand the extent to which the DIPC's approach was comparable to clinical hybrids in other hospital organisations.

I propose that further work would be valuable to explore the Foucauldian perspective in relation to the application of novel indirect modes of governing across health sector organisations, to understand better the operation of organisational resilience from a systems context.

6 Chapter 6. A Sensemaking Perspective: Organisational Resilience during an Unexpected Event

6.1 Introduction

The second of the theoretical/empirical chapters, in this chapter I develop an organisational resilience framework, using comparative studies from the literature and underpinning sensemaking theory, to assess levels of resilient and resistant practice. An in-depth case study analysis of an organisation-wide unexpected event, a Norovirus outbreak is used to inform the development of this framework.



This research study adopts a sensemaking lens to understand the often contradictory and complex events that occurred during an unexpected infection outbreak in a large healthcare organisation. Few studies have taken a multi-faceted approach to sensemaking throughout the course of an event or issue, to explore the interaction between different types of sensemaking at different points during an unexpected event. This study addresses this gap by examining the chronological stages of an infection outbreak from a range of sensemaking perspectives to improve our understanding of organisational resilience in practice.

This chapter contains two sections. In the first section, I use two comparator studies from the literature to inform the development of an organisational resilience framework; the first is a seminal sensemaking case study focused in healthcare(18), Weick and Sutcliffe's re-analysis of the Bristol Royal Infirmary paediatric cardiac cases, as the nearest healthcare

comparator to this study and the second is a seminal study focused in aviation, that assesses sensemaking on aircraft carriers. (192). To inform this comparison, I assess the key literature on sensemaking during unexpected events and outline the interrelationship with organisational resilience.

In the second section, the organisational resilience framework provides a basis for analysis of an unexpected and unprecedented organisation-wide infection crisis to assess how the study contributes to existing knowledge on levels of resilient and resistant practices within organisations.

6.2 Section 1. A Sensemaking Perspective on Organisational Resilience: A Conceptual Background

6.2.1 An Organisational Resilience Framework

I will draw on the work of a key contributor to the sensemaking literature over the last two decades, Karl Weick, to develop an organisational resilience framework for assessing the levels of resilient practice that an organisation exhibits. Karl Weick has explored sensemaking theoretically and in a number of empirical contexts, often at the extreme ends of organisational functioning during expected and unexpected events (64;109;153;236) which makes his works particularly relevant as a comparator for this study. He has examined cultural failure and collapse in firefighting(19) and healthcare(18) at one end of the spectrum and at the other end, assessed cultural high reliability on flight decks of aircraft carriers.(192) The links between sensemaking and organisational resilience in his work are implicit and there is inadequate conceptualisation of how sensemaking contributes to the study of organisational resilience. To address this issue, I will reference two of these polarised, yet seminal studies, one focused on healthcare, the other on flight decks, to develop an organisational resilience framework with explicit links to the sensemaking literature. I will use this framework as a basis for understanding the case study examined in this chapter, an unexpected infection outbreak in a hospital Trust.

The first study which explores resilience (implicitly) and sensemaking in healthcare from the perspective of cultural failure is Weick and Sutcliffe's case study of the Bristol Royal Infirmary (BRI). At BRI, a very high mortality rate for paediatric cardiac switch operations was 'explained away' by senior clinicians and managers as unusual case complexity. In reality, there was clear evidence that Bristol had divergent performance from other UK centres, yet paediatric cardiac surgery continued with poor results for almost fourteen years

until it was stopped in 1995, leading to Public Inquiry which reported in 2001. Key characteristics of sensemaking in relation to resilience from this study are outlined in Table 6.1. The cultural mindset that enabled what Weick and Sutcliffe call a 'culture of entrapment' to develop involved: optimistic cognition (misplaced optimism that improvement might occur despite continued poor results) and strong behavioural commitment (social rationalisation and legitimisation of poor results at micro and macro level in the organisation). Ultimately, I consider the organisation was characterised by low resilience, as many examples of resistant behaviours are evident, including failure to learn and distrust.

The second study, which considers effective sensemaking during flight operations on an aircraft carrier, is Weick and Robert's case study of flight deck scenarios that they argue represent the 'collective mind.' This cultural mindset describes the heedfulness with which social cognition, interrelations and actions occur within a system. Weick and Robert outline the characteristics of this high reliability, high resilience culture in which cognition is precautionary (reflecting attentiveness to potential problems) and conation is weak (reflecting a willingness to consider and enact alternative behaviours). This culture is characterised as high resilience, with numerous examples of resilient behaviours, such as accelerated learning and swift trust being demonstrated.

Table 6.1 A preliminary organisational resilience framework from a sensemaking perspective

Level of organisational resilience	**Cultural Mindset**	**Cognition**	**Conation (Behavioural commitment)**	**Displayed behaviours**	**Organisation performance**
Low	Entrapment: Blind spots Justifications Rationalisation	Optimistic	Strong	Concealment Distrust Failure to learn Dogmatic	Organisational Collapse/Failure
High	Collective mind: Heedful interrelating Mindful attention Social interactions	Precautionary	Weak	Openness Swift Trust Accelerated Learning Sceptical	Organisational Reliability/ Failure-free

In Table 6.1 I have developed a preliminary organisational resilience framework that explicitly references key aspects of Weick's sensemaking theory based on the two studies outlined above. I have defined two polarised resilience positions, based on the literature.

The first is a scenario of low organisational resilience. In this scenario, a cultural mindset exists either in part of or the whole organisation, which encourages staff to: develop blind spots to areas of unsafe practice; justify the status quo even when it is unsafe; and, socially rationalize and legitimise poor practice as acceptable practice. The failure to acknowledge unsafe practice leads to optimistic cognition, as the cultural mindset encourages an expectation that the situation will improve. Conation is strong, because staff develops a strong behavioural commitment to the course of action that has socially acceptability. Deviation from this mindset would require significant disruption to the established thinking and acknowledgement of failure and would probably necessitate external intervention or whistle-blowing, given the strength of commitment that is likely to be exhibited internally. In this context, the displayed behaviours, as they would appear to someone outside the organisation, are those of concealment, distrust, dogmatism and failure to learn. The likely outcome of this scenario is that organisational performance will deteriorate and ultimately lead to the collapse or failure of the organisation. In the healthcare context, this might involve regulatory failings and the subsequent merger of the hospital with a higher performing organisation.

The second scenario is of high organisational resilience. In this scenario, a cultural mindset exists of collective accountability which is characterised by relationships based on heedful interrelating, mindful attention and social interactions. Heedful interrelating refers to a form of interaction between individuals or groups that is attentive, careful and conscientious. Mindful attention describes a level of awareness in attending to situations that is thoughtful and focused on the impact on others. Both these terms contribute towards the third term, social interactions. Reliable and effective social interactions between individuals and groups rely on heedful interrelating and mindful attention. When this occurs, the group is operating as a 'collective mind.' Cognition is precautionary in this situation, because staff considers the potential ramifications on other individuals and for the system. Behavioural commitment is weak, as individuals are open to other courses of action rather than being fully committed to one, potentially faulty course of action. The displayed behaviours are those of openness to new approaches, the rapid development of trust, accelerated learning and a skeptical outlook that challenges established ways of thinking. From an organisational performance perspective, this mentality encourages reliability and progress towards a failure-free environment, where every effort is made to minimise errors. I will use this conceptual framework as a basis for assessing the sensemaking interactions in the case study unexpected event.

6.2.2 Organisational resilience and sensemaking during an unexpected event

6.2.2.1 The role of unexpected events

Having developed an organisational resilience framework based on the sensemaking literature, I will examine the interaction between sensemaking and organisational resilience in the context of an unexpected event, which is the focus of this study. I will review in more detail the features of sensemaking and sensegiving that either contribute to or detract from organisational resilience, when an unexpected event or series of disruptions to the organisation occurs.

When an unexpected event occurs, a dynamic process is triggered for organisational members who attempt to make sense of the changing and unfolding situation. Described as an intensification of sensemaking, individuals try to make meaning, justify what is happening based on this meaning and then reconstruct the past to ensure it is consistent with the present.(18)p80 There are three conditions where explicit efforts at sensemaking might be found; i) in the event of a crisis when a dramatic loss of sense would be experienced ; ii) when the loss of sense is more mundane but still problematic; and iii) in unfamiliar contexts where sense is elusive.(153)p414 In the event of these conditions or when an expected event fails to happen, a routine is interrupted.

I suggest that the way an organisation handles an unexpected event is key to its level of resilience. A resilient organisation would identify and act rapidly upon the event whereas a less resilient organisation may attempt to normalise or compartmentalise the event.(237) Practical examples of these conditions might include the sudden introduction of new organisational forms, such as merged, restructured or disintegrating organisations.(238-241) This can lead to a breakdown in a shared organisational sensemaking, i.e. a sense of common purpose and lead to de-identification with the organisation. Balogun and Johnson suggest that this process can create sensemaking fault lines between organisational groups which requires resolution through negotiation.(238) p543

6.2.2.1.1 The individual contribution

In the situations described above, how the individual behaves is critical. Sensemaking theories help to explain the cognitive and behavioural responses of individuals and teams to these situations. Self-interest is more likely to be exhibited when an unexpected event occurs and sensemaking intensifies. If self-interest predominates over a commitment to organisational goals, then role systems break down, sensemaking fails and an organisation

will be less resilient. If individuals are able to maintain resilient practices; bringing and valuing diverse analytical perspectives on a problem(118), demonstrating a willingness to question what is happening,(19) and engaging in greater respectful interaction to enrich the information exchange (148), then there will be increased 'conceptual slack'(148) which is likely to increase an organisation's competence.(118) Sutcliffe and Vogus include ad-hoc problem solving networks, fluid decision structures and using rich media (e.g. meetings) to communicate as constituting important elements of the 'conceptual slack' that contributes to increased resilience.(118)

6.2.2.1.2 Role systems

Role systems are a key factor in crisis-based sensemaking. Organisations will have a role system; a structure of roles that are interrelated by associated rules and expectations. During normal everyday events, it is unlikely that this role system will alter significantly but in the event of a crisis or disaster, there can be a tendency for the role system to collapse and routines to disintegrate. Sensemaking is critical in the type of cognitive reorientations (239-241) that are implicit in revised role systems. If an unexpected event causes some roles not to be filled, unfamiliar roles to be allocated or failures in leadership roles, then individuals' sensemaking can become confused and disoriented as they are no longer able to make sense of their context according to their past experience. There are several resilient solutions to this scenario.(19) One solution is the use of improvisation, or what has been termed 'bricolage'.(19) Weick argues that when under pressure, bricoleurs have the creativity to improvise with whatever resources are available and develop an improvised role system. An alternative is the use of virtual role systems, where individuals conceive of the organisation in their imagination and mentally take on other roles, to address shortfalls in the real role system. One-to-one interaction in place of the role system helps to generate ideas, interpret situations and provide social support. (19) An inverse relationship has been identified between roles systems and the degree of meaning. Resilience is maintained through a direct and inverse relationship between the two, so where there is less meaning, for example in the event of a disaster, then more role structure is required. Weick notes that where role systems do not keep pace with fast-moving environments, then reliance on individual wisdom and respectful interaction between team members maintains resilient practice.(19)

6.2.2.2 Applying sensemaking theory to unexpected events

Several gaps exist in the sensemaking literature which this study aims to address. A key issue in the sensemaking literature is that the majority of papers focus on one element of sensemaking, e.g. embedded, distributed, ecological and analyse the entire chronology of the event against this one element, rather than exploring the range of sensemaking elements that emerge at different stages of an unexpected event. This is illustrated in more detail in a taxonomy of sensemaking and sensegiving in Appendix B, which demonstrates the number of studies that are interpreted using one element of sensemaking. The true complexity of organisations may be underestimated by applying simplified sensemaking models to empirical studies. A second, related issue is the number of static, rather than interactive sensemaking studies are in the literature, which fail to explore the dynamics of interactions between individuals and groups. Again, this is discussed and illustrated in more detail in Appendix B. In this thesis, I aim to address both these issues in my study of organisational resilience, by remaining cognisant of the full range of sensemaking approaches in my case study and by exploring the complexity of individual and team dynamics during an unexpected event using interactive sensemaking approaches.

A further issue that is more evident in the structural resilience literature, is that sensemaking is usually described as antecedent to the main response to an unexpected event in resilience frameworks.(20;22;138) The contribution of sensemaking in this literature is to explain the micro-level local behavioural processes at the start of an unexpected event. These processes use the strong cognitive focus of sensemaking theory to explain individual's responses and interactions when first encountering an unexpected event. There is less focus on how sensemaking may unfold during an event, as the emphasis in the literature is usually on the structural and technical response to the crisis. In contrast, I will use the sensemaking perspective to assist in understanding individuals' and teams' sensemaking *throughout* the often contradictory and complex unexpected events of an infection outbreak to contribute to an understanding of organisational resilience.

6.2.3 Conclusion

In conclusion, I propose that adopting a sensemaking lens to study an unexpected event or crisis will assist in determining the extent to which an organisation operates resiliently or not. I have developed a preliminary organisational resilience framework that references sensemaking studies from the literature to analyse my in-depth case study. However, there are a number of criticisms of the sensemaking perspective. Sensemaking is used in the

literature to define polarised scenarios; either complete organisational failure (low resilience with resistant behaviours) or significant organisational reliability (high resilience with resilient behaviours). There are few studies that consider a 'middle-of-the-road' organisation affected by an unexpected event through a sensemaking lens. As the majority of organisations constitute the middle ground, there is a large gap in organisational learning about resilient practice which this research aims to address.

Gaps in the sensemaking literature that this research will address include a focus on one element of sensemaking rather than exploring the types of sensemaking that emerge at different stages of an unexpected event and an emphasis on static sensemaking studies, rather than more complex interactive sensemaking studies. A further issue in the structural literature is the lack of awareness of sensemaking approaches *throughout* an unexpected event.

This research will use the sensemaking perspective to study sensemaking *throughout* the often contradictory and complex unexpected events of an infection outbreak, in a healthcare organisation that is neither in collapse, nor a state of high reliability, but demonstrates reliable and less reliable elements of practice.

6.3 Section 2. Applying a Sensemaking Perspective to understand Organisational Resilience in practice: a Case Study

6.3.1 Introduction

In this section I apply the analysis of sensemaking in the context of organisational resilience, examined in Section 1 to a case study of an acute hospital Trust. The Trust in question experienced a significant unexpected infection event in 2007, in the form of an organisation-wide Norovirus outbreak.

6.3.1.1 Research Context

Fieldwork was conducted at the acute teaching hospital Trust in 2009. The name of the Trust has been anonymised as part of the agreement for it undertaking this study and will hereafter be referred to as 'City Trust.' The Trust has a translational research reputation developed through links with an academic institution. It provides a full range of clinical services, undertaking over 500,000 inpatient, day case and outpatient consultations a year, for patients from diverse ethnic and cultural backgrounds with general and specialist clinical needs. Prior to a merger in October 2007, services were provided across two main hospital sites, hereafter referred to as site A and site B. During the autumn 2006 and spring 2007, the period of focus of this study, the Trust was planning for a merger with another city hospital Trust in October 2007, involving the preparation of plans for new organisational structures and systems.

City Trust was an ideal site to study from an organisational resilience and infection perspective as the Trust had been identified nationally as demonstrating resilient practice in relation to infection prevention and control owing to reductions in two high profile infections that were monitored by the government: a significant reduction in MRSA and more gradual reduction in *C.difficile* was reported by the Trust between 2004 and 2009. The history of this improvement was that the Trust had initially reported higher than average levels of MRSA BSIs and *C.difficile* when mandatory reporting was introduced in 2001 and January 2004 respectively. Owing to the high infection rates, in 2003-4, a newly appointed Director of Infection Prevention and Control sought to embed infection prevention in the systems, structure and behaviour of the organisation and increase the visibility of infections to all staff. The impact of this work was observed by the Department of Health, who incorporated many of the ideas and suggestions for change in their national implementation tools for MRSA.(242;243)

6.3.1.2 January 2007 Norovirus Outbreak Crisis

Every winter at the Trust, Norovirus, or the colloquially named 'winter vomiting bug' would affect the capacity of the hospitals to operate effectively to some degree, usually causing the full or partial closure of one or two wards. Norovirus is a community-acquired highly transmissible virus which affects between 600,000 to 1 million people in the UK every year. The virus is easily spread through contact with an infected person or contaminated surfaces as the virus can survive for several days on surfaces or objects touched by an infected person.(244) When Norovirus affected the hospital, it could cause case-to-case spread and staff spread. On 24th January 2007, a Norovirus outbreak commenced with four index cases (the first cases that indicated the existence of an outbreak) on two wards in site A, presenting with diarrhoea without the usual symptoms of vomiting. Within four days, six wards were completely closed on site A as a result of the outbreak. By the peak of the outbreak, twenty-one wards were closed across the two main hospital sites and one hundred and twenty-six patients were identified with diarrhoea in the timeframe. One hundred and seventeen staff reported symptoms to occupational health. Figure 6.1 shows the daily number of new cases (incidence) of Norovirus from the first recognised case on 24th January by site and Figure 6.2 shows the daily number of continuing cases (prevalence) of Norovirus.

The Trust's initial response was confused by two factors: firstly the uncharacteristic clinical presentation of the virus, as vomiting was uncommon and diarrhoea was the primary symptom, also a symptom of many other clinical conditions or treatments; and secondly, the multiple points of entry of the virus to the hospital, initially through site A and four days later, through site B. Within five days of the first recognised case, and following a one-off meeting which established the outbreak as an extraordinary event, a daily coordinating meeting was established on site A, involving over 25 managers and clinicians from across the Trust and chaired by the interim Director of Clinical Services. One week later, the new Chief Operations Officer started in post and by the end of that week had changed the format of the meeting to a smaller, clinician-led group and changed the approach to managing the incident to focus on clinical safety over bed capacity. The virus affected the hospital site A until 12th February and then less markedly from 16th February to 24th February. It affected hospital site B from 28th January to 12th February. Learning from the outbreak informed future unexpected events, including continuing operations during the heavy snowfalls and strikes that occurred in later years.

Figure 6.1 Daily incidence of Norovirus cases from the first recognised case on 24th January to 12th February 2007

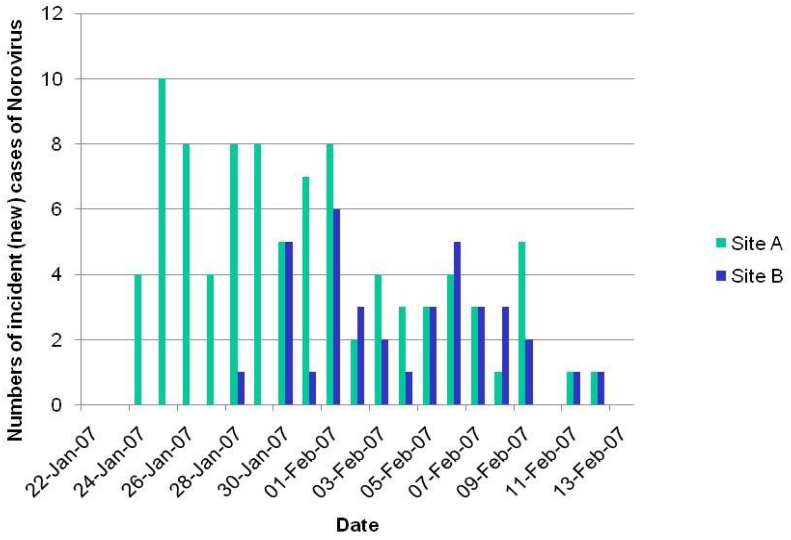
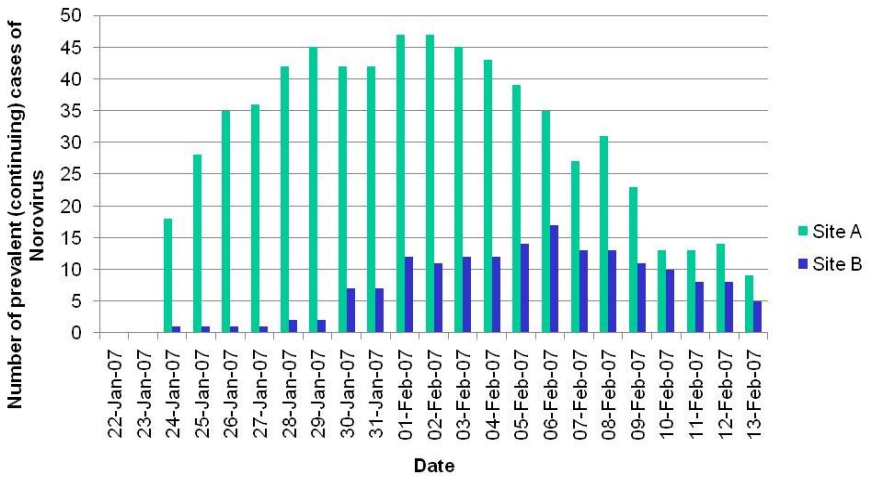


Figure 6.2 Daily prevalence of Norovirus cases from the first recognised case on 28th January to 12th February 2007



6.3.2 Methods

6.3.2.1 Case Study Approach

A case study approach was chosen in order that the preliminary organisational resilience framework could be examined in detail in one organisation. Yin defines the scope of a case study as an empirical inquiry that 'investigates a contemporary phenomenon in depth and

within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.'(226) p18 The case study provides insight into the context of the phenomena being studied, in this case an infection outbreak. An outbreak, or disruption to the organisation's state provides an opportunity to understand the contexts when staff may choose to improvise, be creative, utilise bricolage, in addition to changing rules, policies and procedures when new behaviour may be needed.(62) The case study method allows multiple sources of evidence to be triangulated and the prior development of theoretical propositions to guide data collection and analysis.(226) As multiple sources of data from the hospital, e.g. interviews, documentation were required for triangulation of the evidence and theoretical propositions had already been developed from the resilience literature, the case study approach was considered most relevant.

The research design, including semi-structured interview schedules (see Appendix C & D) and consent forms (see Appendix E) were developed and approved by Barnet, Enfield & Haringey Local Research Ethics Committee on 25th November 2008, reference number: 08/H0723/8. The data was collected from three overlapping sources: i) semi-structured interviews ii) documents iii) participant observation. The data from these sources was combined and triangulated to maintain the integrity of the analysis(245) and compared to official reports on the outbreak and no significant differences were found.

6.3.2.2 Semi-structured interviews

A semi-structured interview schedule was developed (see Appendix C) using open-ended questions that reflected all the organisational resilience topics of interest, relating to a critical incident technique method(246) to identify an appropriate infection incident. The aim was to recruit participants from pre-defined inclusion criteria, where participants: were involved in the management of infection incidents, reflected a cross-section of professional groups and were from different levels within the organisation. Twenty-three participants were recruited in total to provide a sufficient sampling frame to cover the criteria. Participants were identified initially by the review of archival documents from the Trust Infection Prevention Committee report on the outbreak. The output from these initial participants was analysed to identify a suitable incident (described in more detail in a later section). Further participants were recruited using a snowball sampling design where participants provide referrals to further interviewees, but only were selected if they fulfilled the criteria above. Participants were approached by sending them an introductory letter, information sheet and consent form, approved by the Ethics Committee, requesting their participation in a one-hour semi-

structured interview. All the participants that were approached consented to participate in the research and a mutually convenient interview date and venue was arranged and the interview was recorded, with the participant's consent. Interviews lasted between 45 minutes to 90 minutes, depending on the number of critical infection incidents recalled. Interviews were recorded and transcribed verbatim following pre-defined rules. The interviews were transcribed by a transcribing company that had signed confidentiality agreements and the resulting transcripts were checked against the original interview tapes for accuracy. The interviews were anonymised at this stage by substituting the participant's name for a unique case number on each transcript.

6.3.2.3 Data Collection

The literature on organisational resilience in relation to unexpected events (55;99;247) was used to structure the data collection. The study was designed to examine one critical infection incident in depth, including routine practices, prior to and post the incident, to assess the degree to which participants' responses demonstrated organisational resilience. To achieve this, the chosen approach used Critical Incident Technique (CIT), a research method that uses informants' recollections of a critical incident. In this study, participants were asked to recollect critical infection incidents.(246) Semi-structured interview questions were derived from four key areas: i) descriptions of routine practice and behaviour prior to the incident ii) the cause, description and outcome of the critical incident, ii) participants' feelings and perceptions of the situation iii) actions taken during the incident and iv) changes (if any) in their future practice and behaviour after the incident (Appendix C). The first eight participants in the study were asked to recall critical infection incidents from the previous five years. An analysis of these incidents against Westrum's typology of resilience situations,(248) identified one critical infection incident that fulfilled all the criteria for the study, an organisation-wide Norovirus outbreak that commenced in January 2007. The process by which this was achieved is documented in the following section.

6.3.2.4 Identification of critical infection incident

The three criteria used to determine which infection incident to select are set out in Table 6.2. Firstly, as this study is testing *organisational* resilience, it was important that the whole organisation was impacted by the infection incident. Secondly, the critical mass of interviewees (sources) who recalled critical infection incidents and the number of references to infection incidents made by interviewees that could be coded to the resilience factors (coded references) was determined. The third criteria used the Westrum resilience

framework(248) that grades resilient situations, according to either i) a regular threat with a standard response and low potential to disrupt the system ii) an irregular threat which constitutes a one-off event, is of low probability but has the potential for a serious outcome and iii) unexampled events which are extremely unexpected but have a devastating outcome. Each infection incident recalled by the first eight interviewees was graded according to Westrum's typology(248) to identify all those incidents which were irregular threats. Based on the criteria referred to in Table 6.2, the Norovirus incident that occurred in January 2007 met all the criteria, as shown in Table 6.3. No other infection incident fitted all the criteria. The highest number of references pertained to this incident (n=39), compared to the next most frequently occurring references which were to *C.difficile* outbreaks that occurred across the organisation on a seasonal basis (n=16). Having selected the Norovirus incident from 2007 as the focus for the case study, 15 further sources were identified for invitation to an interview based on their involvement in this critical incident, which including the first 8 interviewees, comprised 23 sources in total. Of these 23, 19 sources referred specifically to the Norovirus outbreak in their interview in sufficient detail to include their account. The interviews were closed when no new issues were emerging and data saturation was reached.

Table 6.2 Criteria to determine which critical incident to select for analysis

Criteria	Explanation
Organisation-wide	To test an organisational resilience framework, the infection incident needed to impact on the whole organisation. This was contrasted with infection incidents occurring in specific teams, which may have team-specific cultures, issues and environments
Critical mass	Interviewees refer most often to factors relating to that incident
Level of threat (Westrum)	Resilience tested with irregular threat rather than regular threat as described by interviewees in study

Table 6.3 Critical Infection Incidents by study criteria for inclusion

Infections	Organisation or team based	Irregular or regular threat (Westrum typology of resilience)	No of interviewees' references to incident factors (Weick & Sutcliffe)
Acinetobacter 1998-9	Team	Regular (Clusters)	6
BSIs ITU - 2003-9	Team	Regular (Clusters)	3
C.difficile 2003-9	Organisation	Regular (Clusters)	16
C.difficile Care of Elderly 2008	Team	Regular (2 Clusters)	10
MRSA Orthopaedics 2004-5	Team	Regular (Cluster)	3
MRSA 2003-9	Team	Regular (Clusters)	7
MRSA Cardiothoracic 2003-9	Team	Regular (Clusters)	6
MRSA Neonates 2007-8	Team	Irregular	19
Norovirus 2003-9	Organisation	Regular (Seasonal)	10
Norovirus 2007	Organisation	Irregular	39
Norovirus Cardiothoracic 2008	Team	Regular (Cluster)	2
Klebsiella Renal 2009	Team	Irregular	1

6.3.2.5 Documents reviewed

Retrospective data totaling over 15,000 pages was collected including Trust Board papers, the Trust Infection Prevention Committee papers, local Trust infection data from 2001 to 2008, annual reports and business plans, Annual General Meeting papers, national Infection Prevention and Control reports, including the National Audit Office Reports of 2000,(34) 2004(92) and 2009(93) and Department of Health Reports from 1998 to 2009. These documents assisted with providing a context for the outbreak, both nationally and locally and informed engagement with participants in discussions about specific issues and events.

6.3.2.6 Participant Validation

As the critical incident was retrospectively recalled, participant validation of the initial findings took the form of attending Centre for Infection Prevention and Management annual reviews, which included teams from microbiology, infection prevention and control, managers and

clinicians. At an annual review in 2011, initial analyses of the data were presented to participants and feedback received in group discussions afterwards. Participation in these reviews enabled informal interaction with a large multidisciplinary group and served as a means to check the consistency and validity of interview data. Participant feedback was used to check back themes informally with participants on an individual basis.

6.3.2.7 Data Analysis

Data analysis involved two phases, firstly an initial data analysis using retrospective qualitative content analysis based on Weick and Sutcliffe's mindful infrastructure as a behavioural framework(55). This framework describes positive resilient behaviours, known as 'mindful behaviours' and negative resistant behaviours, known as 'mindless behaviours' which contribute to high and low performance respectively in the context of an unexpected event. Secondly, the analysis was developed with in-depth qualitative thematic analysis arising from the detailed descriptions of sensemaking processes that were contained in each of the content categories.

6.3.2.8 Qualitative Content Analysis

Content analysis was chosen as the initial method in order to assess the existing theoretical frameworks.(249;250) Content analysis provides a mechanism of coding data from multiple sources to an *a priori* framework in a manner that facilitates counting of the data. Qualitative content analysis was chosen as it is a mixed method that has developed from the traditional content analysis approach of frequency and classification analysis combined with the more recent approach of interpretive analysis of text to incorporate understanding of meanings, attitudes and behaviours. This method was relevant as in addition to testing resilience frameworks against the empirical data, the aim was to understand the process of sensemaking in a healthcare infection context. The choice of a deductive approach enabled theory testing and triangulation which was relevant to test the resilience frameworks in a complex healthcare setting. The use of frequency counts enabled ordering and comparison of the various factors within each framework, but as a qualitative approach was taken, a statistical analysis would not have been appropriate.

Interview data was analysed according to a pre-determined coding scheme which was developed from the Weick and Sutcliffe framework into a categorisation matrix. The sampling unit of analysis was each interview transcript. The recording/coding unit of analysis was individual sentences within each transcript. These hold the information that is

processed during coding and forms the basis of frequency analysis.(249) During the interviews, participants spoke regularly in long sentences with multiple phrases concluding in a key point, which made the use of sentences a viable option. NVivo, a software package designed for the analysis and categorisation of text was used to facilitate the process of content analysis. Sentences of text from each transcript were coded manually to the coding categories within the theoretical framework. The content from the categories of resilient practice within the framework were then sub-categorised using interpretive coding techniques derived from an inductive evaluation of the data. The resulting sub-categories were reviewed to identify the specific clinical or managerial practice that denoted resilience. This data was presented in tabular form to demonstrate the range of interventions used by staff within the organisation to manage resiliently.

6.3.2.9 Inductive thematic analysis

As a second phase of data analysis, an inductive thematic analysis of data was undertaken, by making use of the extensive interview narrative and the documentary evidence to construct a 'thick' description(251) of the chronology of the Norovirus outbreak. This second phase of data analysis had two elements; first and second order analyses. First order analysis was undertaken to capture the organisational responses to the outbreak and the informants' interpretations of these events. Second order analyses were conducted to discover themes and patterns in the rich narrative descriptions of the chronology of the outbreak. The data was examined for schemata that concerned how the organisation and individuals responded, prior to, during and after the outbreak.(238) The stages of this second order analysis were similar to those outlined by Gioia and Chittipeddi(239) as follows: the initial qualitative content analysis was used to identify explanations for individuals' and groups' behaviours and actions as the event unfolded, interview accounts were analysed to determine if they retained consistency or altered during the event, cross-account analysis of interviews was undertaken to identify patterns of divergence or convergence and emerging thematic dimensions were extracted from the data. Continual iterative comparison between data sources and theory occurred through these stages until the patterns became evident and 'theoretical saturation' was reached in that no new themes emerged.(252) The schemata that emerged from this analysis related to: different schemata for different time periods, schemata for the process of managing the outbreak and schemata for the different sensemaking processes as the outbreak unfolded. The schemata for different time periods are outlined in Table 6.4.

Table 6.4 Schemata for different time periods within the Norovirus Outbreak (January – February 2007)

Phase 1 Routine	2006 - Jan 2007	Routine Practice Regular, low-level clusters of infection Preparation for merger
Phase 2 Discovery	Wed 24 January – Sunday 28 January	Unidentified infection Multiple points of entry Rapid spread of virus Pressure on hospital beds
Phase 3 Imposed Control	Monday 29 January - Thursday 8 February	One-off meeting Control meeting Medical Director Referee Restructured teams
Phase 4 Collective Responsibility	Friday 9 February – Friday 16 February	New leader Smaller meeting Clinicians as experts Streamlined decisions
Phase 5 Rapid Recovery	Saturday 17 February – Saturday 24 February	Rapid recovery Systematic policies Surgical engagement Outbreak management
Phase 6 New Routine	Sunday 25 Feb – 2008	Learning into practice Revised routines

6.3.3 Results

This section reports on the findings from the analysis of the Norovirus outbreak in 2007. I examine the results from the analysis of the outbreak against Weick and Sutcliffe's mindful infrastructure framework(55) as a contextual background to the main results. The main results use the initial schemata based on phases of the outbreak which cover a period of approximately five weeks. Each temporal schema expounds a descriptive first order analysis and thematic second order analyses as a format to explore cognition, behaviours and actions from a sensemaking perspective during the outbreak.

Table 6.5 Resilient and resistant practices during the management of an organisation-wide Norovirus outbreak 2007

Framework from Weick, K and Sutcliffe, K. Managing the unexpected: resilient performance in an age of uncertainty. Jossey-Bass; 2007	Resilient Practices						Resistant Practices					
	Capacity to anticipate unexpected events			Capacity to contain unexpected events			Failure to anticipate unexpected events			Failure to contain unexpected events		
Characteristics of resilient and resistant practices / Interviewees	Tracks small failures	Resists oversimplification	Remains sensitive to operations	Maintains capabilities for resilience	Monitors and or takes advantage of shifting locations of expertise	Total Resilient Practices	Small failures denied	Simple diagnoses accepted	Frontline operations taken for granted	Recovery is treated as routine	Experts defer to authority	Total Resistant Practices
Director	3	1	11	34	14	**63**	0	0	0	4	0	**4**
Director - Clinical	2	5	2	16	6	**31**	2	6	1	0	3	**12**
Clinical Director	4	5	25	45	11	**90**	1	3	5	10	0	**19**
Consultant Medicine	2	1	8	25	15	**51**	9	3	11	12	4	**39**
Consultant A&E	9	3	10	21	6	**49**	2	1	2	7	1	**13**
Nurse Manager	2	0	11	20	4	**37**	0	1	2	1	0	**4**
Nurse Manager	1	5	12	28	0	**46**	4	3	3	10	4	**24**
Nurse Manager	4	1	11	22	6	**44**	4	4	9	1	2	**20**
Senior IPC Nurse	21	6	8	15	4	**54**	0	3	5	13	11	**32**
Senior IPC Nurse	23	0	25	22	4	**74**	3	3	4	7	5	**22**
Clinical Manager	11	0	19	18	5	**53**	9	0	3	1	3	**16**
Manager	1	3	16	26	7	**53**	2	1	2	4	5	**14**
Nurse Manager	3	1	11	30	3	**48**	2	0	0	4	3	**9**
Nurse Manager	4	3	14	17	4	**42**	0	0	2	0	3	**5**
Manager - Beds	7	4	35	19	11	**76**	2	2	19	15	0	**38**
Manager - Facilities	6	1	10	8	4	**29**	1	0	2	6	0	**9**
Manager	6	3	19	30	10	**68**	0	4	13	19	7	**43**
Manager	6	1	11	22	8	**48**	1	0	1	0	0	**2**
Manager	0	3	8	10	0	**21**	2	0	3	3	0	**8**
Total of each characteristic	**115**	**46**	**266**	**428**	**122**	**977**	**44**	**34**	**87**	**117**	**51**	**333**

Resilient practices: red/amber=low resilience (0-5), yellow=moderate resilience (6-15), green =high resilience (≥16). Resistant practices: green/yellow= low resistance (0-5), amber=moderate resistance (6-15), red = high resistance (≥16).

6.3.3.1 Frequency of resilient and resistant practices

The initial results from the study were based on qualitative content analysis of interviews against the mindful organising framework taken from Weick and Sutcliffe's work(55). These results provide an interesting contextual backdrop to the richer qualitative first and second order analyses. In general, the Trust's modus operandi seemed to focus on its operational sensitivities (sensitive to operations and taking operations for granted) (n= 353) and its ability to operate resiliently (capability for resilience and treating recovery as routine) (n=545) out of a total number of references to resilient and resistant practices (n=1,310). This suggests that it may have less developed practice and routines in relation to its capability to track small failures (n=159) with the notable exception of the Infection Prevention and Control senior nurses whose attentiveness to small failures constitutes 38% of the instances in this category, although this reflects the requirements of their job role. The practice of denying small failures is only 28% of the total category, suggesting reasonably resilient practice, despite the lower number of instances. Interestingly, although there were few instances of resisting oversimplification (n=46), equally simple diagnoses being accepted (n=34) was the lowest scoring category in resistant practices. This may reflect the hospital Trust's tendency to operate in silos, with relatively little interaction between each silo, resulting in simplified and routinised practices or suggest that individuals operate to an existing set of assumptions and rarely question them. The instances of expertise being used effectively (n=122) is over double the instances of experts deferring to authority (n=51), reflecting mainly resilient practice around the use of clinical expertise and leadership.

City Trust demonstrated a relatively low organisational capacity to anticipate unexpected events, but demonstrated a stronger capability to contain unexpected events, in particular, maintaining capabilities for resilience. Conversely, low levels of failure to anticipate an unexpected event were reported, although there was a more mixed picture around three resistant practices: frontline operations were taken for granted, recovery is treated as routine and experts defer to authority. These findings suggest that the Trust had fewer strategies in place to anticipate irregular, unexpected events, except by remaining sensitive to operations, the highest scoring category (n= 266) out of the anticipatory categories (n=427). The reliance on maintaining capabilities for resilience (n=428) as a means of managing unexpected events is clear, receiving over three times as many references as 'monitoring or taking advantage of shifting locations of expertise.' Of particular note on an individual basis, is the high score (n=45) for the Clinical Director's maintaining capability for resilience. This

person took on a significant leadership role in relation to the outbreak and this is reflected in the instances of resilient strategies that were used to manage the outbreak effectively.

To summarise, the premise is that whilst every complex organisation might be expected to demonstrate resilient and resistant practices, resilient practices need to outweigh resistant practices for an organisation to demonstrate organisational resilience and the contrary is true if an organisation demonstrates organisational resistance which is characterised by defensive routines.

Table 6.6 Outbreak Schema Development

Schema	Subschema	Examples	Sensemaking
Phase 1 Routine practice (2006 - January 2007)	Tacit systems Ad hoc organising Operational focus Improvisation Data-driven performance	Mini-republics Pockets of resistant practice	Habitual routines and practices
Phase 2 Discovery (24 Jan- 28 Jan)	Confusion Scanning Allocating attention Communication	Multiple point of entry Anomaly identified Anomaly discussed with multiple stakeholders Emails, discussions at ward level	Embedded sensemaking Rapid sensegiving
Phase 3 Imposed control (29 Jan – 8 Feb)	Extraordinary event Imposed control Individual self-interest Novel action Multiplicity of expertise Changed roles	One-off high level meeting Control group – chaired by interim Director of Clinical Services Vascular, orthopaedic surgeons and ICU consultants Spatial reorganisation Hybrid roles, new roles	Distributed sensemaking Distrust Role systems
Phase 4 Collective accountability (9 Feb – 16 Feb)	Deference to expertise Flexibility	New Director of Clinical Services – hands chair of control group to Medical Director Two sessions of group to agree single plan All hands to the pump Dunkirk spirit	Collective efficacy Collective mind Conceptual slack Trust
Phase 5 Rapid Recovery (17 Feb – 24 Feb)	Maintenance of activity targets Learning	Post-outbreak report and management response Briefing	Organisational Learning and Enactment
Phase 6 New routine (25 Feb – 2008)	Explicit knowledge Systematic (reliable) process Structured organising Experience of unexpected	Stool charting Co-ordinated central response for future incidents Experience for dealing with snow and flu	Restructuring of habitual routines and practices

6.3.4 Findings from Thematic Analysis

6.3.4.1 Inductive Analysis

In the next section, for each of the phases (1-6) of the infection outbreak listed in Table 6.6, I describe the first-order findings and elaborate on the second-order thematic findings. The first-order analysis explains the story of the outbreak from the interviewees' perspective and provides examples of the subschema through representative quotes. It shows how cognition and behaviours of those involved with the outbreak changed over time, represented by the phased schema. The second-order analysis explores the theoretical implications of schema changes that are outlined in the first-order analysis and supports the development of an explanatory framework.(238)

6.3.5 Phase 1

6.3.5.1 First-Order Findings

6.3.5.2 Organisational Schema prior to Outbreak

Prior to the outbreak occurring in January 2007, the Trust was preparing for a merger with another city Trust that was due to take place in October 2007. Preparations included planning for new structures, systems, roles and responsibilities. Operationally, there was a strong focus on meeting national performance targets, for example, a maximum four hour wait target for patients in Accident and Emergency and on achieving local targets, built into the Trust balanced scorecard. The Trust response to external pressures, such as the Department of Health was perceived as reactive and time consuming:

71 – Large number of requirements from the Department of Health or visits from the Healthcare Commission or we have a potential Department of Health visit that seems to exercise haphazardly the minds of those that we sometimes get direction from and that suddenly becomes the priority and the panic of the time.

From an infection control perspective, practice was mixed. The integration of infection control targets into the balanced scorecard, use of statistical data and strong leadership from the Director of Infection Prevention and Control had initiated a process of local accountability for infection practice. Effective clinical management of small clusters of infections, such as MRSA or *C.difficile* prevented a wider impact on the hospital and there was acceptance that some Norovirus would be seen every year.

78 – There were the odd isolated outbreak of generally the C.difficile or Norovirus, but it was pretty much part and parcel of day-to-day management...when you had a small, localised outbreak you took the appropriate precautions in that area and carried on as normal. I don't recall having to cohort more than six patients in one area and close off a ward or it spreading any further than that, so not remembering probably means that there wasn't any major significant issue.

However, Trust infection policies had been updated but were inconsistently enforced as certain directorates in the hospitals were perceived to operate as mini-republics, being selective about which policies they would choose to implement. These issues caused tensions between central teams, such as infection control and local directorate teams who acted on the basis of local and individual accountability and did not appreciate challenge to their operating values and principles. The Director of Infection Prevention and Control explained this dilemma in relation to performance data:

63 - You're not stepping on toes in terms of their hierarchies. You're providing their data.....they knew that also when they did well that that was also reported upwards and included in my reports to governance and boards and things. So that's another ripple effect, knowing that their data not only is being held up to them as a mirror for their, but also that it's going upwards and outwards.

On a day-to-day basis, the infection control team responded reactively to issues as they arose. The team was perceived to be disjointed, to members of their own team and more broadly to clinical areas throughout the Trust. Infection practice in the Trust was audited by the infection team, but was somewhat haphazard and systematic use of standardised tools, for example stool charting was not in place.

75 - Yeah we have loose definitions with what is diarrhoea, what classifies an outbreak, and also what's the sort of descriptors of diarrhoea, at the time we didn't have a standard terminology for what diarrhoea is, one nurse would say diarrhoea's different to somebody else.... we had different documentation on each of the wards, there's no standard

From an outbreak management perspective, there was no pre-existing, documented structure for crisis management and the flu outbreak plan was in embryonic form. The Trust policies were not geared up for the impact of a large magnitude outbreak on the service.

6.3.5.3 Second-Order Findings

6.3.5.4 Habitual Routines and Extended Accountability

Prior to the outbreak occurring, the directorates (clinical groupings) within the Trust were semi-autonomous, only being held to account centrally on their finances and aspects of clinical governance. A well developed sense of individual accountability existed at clinician level to their patients, immediate colleagues and teams. Habitual routines and practices had developed over time and discussion or challenge to these practices, particularly well-embedded clinical routines was met with resistance. For example, the involvement of a central team, such as the infection control team to try and resolve infection clusters within boundaried units, such as the intensive care unit, could be received very personally by the clinical leader as described by one of the infection control nurses:

75 - But it was very, very hard work, not physically, but it was emotionally hard work trying to use all your persuasion skills and negotiation skills, and still maintain the relationship, and in the end the relationships just broke down, we, which was quite upsetting

Central team involvement was perceived to be interfering and representing an exaggerated response to issues that could be resolved locally. From a sensemaking perspective, there was resistance to tracking or admitting to failures owing to the potential for impact on the unit's reputation and leadership. There were many unspoken, existing routines based on a set of traditions and tacit systems which relied on the experience of those involved and were passed on through word-of-mouth training and improvisation.

135 - We actually had forgotten to do an awful lot of things and if you think about all the people moving around with the different mergers and traditions you see at a bed based management [level], but we just forgot about how to do it and then that's because that's what was based on tacit systems actually without operational policies.

Contextual factors had altered some existing routines, with the focus of the Trust on the forthcoming merger; habitual patterns of behaviour had been broken and haphazardly replaced, if at all. The majority of minor infection outbreaks were managed successfully at a ward or unit level as part of day-to-day clinical management and were viewed as minor 'punctuations' in habituated routines.

Challenges to individual accountability had begun to occur with the introduction of central systems to hold directorates to account, including performance systems, such as the

balanced scorecard, central monitoring of infections and clinical governance mortality reviews. There were many clinicians, teams and units within the Trust that participated actively in the extended accountability arrangements, but pockets of practice existed where these new routines were resisted fiercely.

6.3.6 Phase 2

6.3.6.1 First-Order Findings

6.3.6.2 Discovery of Outbreak

The first (index) cases associated with the Norovirus outbreak occurred on Wednesday 24th January 2007 at a time of 'winter pressures' where additional seasonal patients put pressure on bed capacity. Norovirus is a community-acquired virus, but once in the hospital, can be hospital-acquired. Norovirus patients usually present with vomiting. The discovery process for Norovirus occurred at multiple points in the hospital as patients with community-acquired Norovirus arrived at different entry points. There were several routes of entry identified by: unexpected enormous pressure in Accident & Emergency (A&E) (the duty management team identified pressure and escalated the problem to the Service Manager, Emergency Medicine), bed and ward closures (the Inpatient Capacity Manager identified problem, liaised with the Infection Prevention and Control team and escalated to the interim Director of Clinical Services) and increased cases of diarrhoea on Medical Wards (the Clinical Director of Medicine and Lead Nurse for Medicine met to discuss what the problem was). At each point, clinicians' or clinical managers' attention was allocated to the anomaly (253) as a result of proactive scanning of the environment. However, at this stage, there was a lack of clarity about the underlying infection as the patients' presentation fitted with a *C.difficile* prognosis from a clinician perspective as the patients were long stay patients on Medical/Care of the Elderly wards, with no vomiting and were presenting with infective diarrhoea of unknown cause. The actual cause could not be confirmed until results were returned from the laboratories as described by an infection control nurse:

75 - This was Norovirus but it didn't present with vomiting, so we were kind of lulled into a false sense of security at the beginning by thinking, this can't possibly be Norovirus because it's not vomiting. But then we were getting positives, and viral spread is very quick and rapid, and so it was typical in that sense, but we were confused by it because it, we weren't having the vomiting as well.

133 - It just didn't seem right. We were saying, are we sure this isn't Noro, but because there's no vomiting because it was an atypical outbreak it was no, no, no it's C.diff but of course it became apparent over the course of, over the first weekend, I think, that it was Noro and not C.diff.

An early meeting took place on Thursday 25th January in the third floor offices of Site between the Clinical Director for Medicine and their colleagues to discuss the early cases. Agreement was reached to treat the problem as an outbreak and during the first four days of the outbreak, the consultants in the directorate of Medicine took action to isolate infected patients in bays of wards or on whole wards. Communication with the multidisciplinary teams in the directorate to explain the situation occurred within 24 to 36 hours of the initial cases being identified. Despite these efforts, the virus spread rapidly resulting in the closure of six wards by the 28th January at which point early indications from the laboratories over the weekend period suggested that the infective agent was Norovirus instead of *C.difficile*.

6.3.6.3 Second-Order Findings

6.3.6.4 Embedded Sensemaking and Rapid Sensegiving

Clinically embedded sensemaking was evident in the early stages of the outbreak, triggered by the extraordinary circumstances and unexpected nature of the Norovirus outbreak. Clinicians and clinical managers identified that there was a problem at an early stage, utilising their embeddedness in clinical areas to notice anomalies in their local environments, bracket the anomalies based on their prior knowledge and experiences, engage in sensemaking conversations with colleagues to elicit additional cognitive and environmental perspectives and escalate the problem within the organisation. More problematically, initial sensemaking was confused by two simultaneous and contradictory cognitive cues; patients exhibiting no vomiting and diarrhoea. This caused the sense makers to be overwhelmed by the scope of possible meanings that resulted from vague, equivocal cues, causing problems of confusion and ambiguity.(64)

The infective agent was incorrectly labelled as *C.difficile* as this seemed the more likely infection, given the presenting symptoms. However, this caused a period of confusion as the resulting rapid spread and community contagion did not fit with *C.difficile*, as described by the admitting medical consultant and the inpatient capacity manager who took active roles in managing the outbreak:

128 - it became very rapidly apparent that we had a group of patients in whom we thought actually had C.diff and it very rapidly transpired that they were C.diff negative, but that there was another infective agent going on here and we started seeing that coming in from the community....I think that was the first realisation that we had an issue, when we were in a situation where we were looking at having to close parts of the Acute Admissions Unit, because of what was clearly an infectious diarrhoea but of unknown aetiology.

78 - this particular outbreak started with people having diarrhoea, so we didn't pick it up as Norovirus very early on and we thought initially that we had an outbreak of C. diff and so we were sending off lots of specimens and not getting C. diff toxin positive, so we didn't know what it was.

Weick comments that only occasionally are salient, novel, unusual and unexpected cues pursued(64)p86 but in this situation, a small group of clinician leaders including the Infection Control consultant, the Clinical Director of Medicine and the admitting Medical Consultant persisted in trying to understand and make sense of what they noticed. By the end of the weekend period (27-28th January) they had determined that Norovirus was the likely cause of the diarrhoea, by which time, six wards were affected. The alertness of this group of senior clinicians reflects Schon's emphasis on the role and interactions of experienced and senior practitioners. He argues that such practitioners use expert sensemaking when encountering an unexpected event by engaging in 'a reflective conversation with the situation' (254)(1983:77). The 'conversation' involves framing the situation using a repertoire of past meanings and tacit knowledge, whilst remaining open to unique elements. This process makes that tacit knowledge more explicit and the basis of future action.(254)

Embedded sensemaking was evident in the Clinical Director of Medicine's approach to the outbreak as, in the space of four days, the Clinical Director drew on their identity and personal experience of being a front-line clinician and leader to construct a plausible story of what was happening in sufficient detail to start to brief others, to;(255) notice and bracket cues through their ability to recognise discriminatory detail, make sense of confusing cues, impose labels on interdependent events and act rapidly on that information. Communication occurred through clinically embedded local sensegiving rather than through the central communication team.

Rapid sensegiving was evident early in the outbreak, but focused in particular areas of the Trust where leaders were engaged fully in sensemaking. For example, in the Medicine directorate, an observable change from automatic thinking to active thinking and action was

evident in the rapidity with which meaning making was converted to action as described by the admitting Medical Consultant:

128 - I think it varied between individual groups, so for the clinical medicine teams it actually happened pretty quickly. I think [the Clinical Director]l was getting emails and updates out probably within the first 24 to 36 hours saying, there's a problem, we need to start creating some beds

In these areas at ward and unit level, there was active and rapid sensegiving in the form of debate, clarification and enactment which involved detailed communications with other teams, co-ordination of operational plans and rapid education of staff which is described in one account from a ward manager:

130 - So there was a lot of coordination between the two of us as managers, a lot of talking to the nurses, a lot of educating the nurses, because I find that the sort of chaos and mayhem of something like this is often resolved when people understand what's going on.

In this time period, a rapid degree of sensegiving was less evident in other areas within the Trust, particularly in areas where clinical leaders had not been involved in the sensemaking activities, for example in certain surgical areas, as described by a senior nurse:

137- I remember going to talk to the orthopaedic surgeons, who were utterly clueless, this was about five days into it and they had Noro on one of their wards and were utterly clueless about why they shouldn't be going onto one ward and then tracking onto another, a stream of about 20 of them.

In the surgical areas, surgeons continued with their habitual routines and practices, attempting to admit their patients to theatre, until the point at which they were prevented from doing so by physical obstacles such as closed wards and reassigned theatres, which created tensions between the surgeons and the physicians and infection control team whose focus was on trying to control the outbreak. This became a major issue in the next stage of the outbreak, where more formal structures and systems were introduced to contain the outbreak.

6.3.7 Phase 3

6.3.7.1 First-Order Findings

6.3.7.2 Imposed Control

This phase of the outbreak commenced on Monday 29th January and lasted until Thursday 8th February. Following a one-off meeting led by the interim Director of Clinical Services (IDC) with key participants from infection control, medicine and inpatient capacity, agreement was reached that the outbreak 'needed to be managed in an extraordinary way.' (66) Control was imposed through the introduction of twice-daily command and control style disaster recovery meeting which constituted a large group (over 25 people) of internal multidisciplinary stakeholders. This approach was borne out of the IDC's previous responsibilities for emergency planning and 'embryonic' flu planning. The meeting took several hours each morning, involving a detailed census of as near to real-time ward activity as possible. To achieve this, all the clinical areas within the Trust reported back available beds, infected cases and theatre capacity to enable the attendees to monitor the number of infected cases and agree how to proceed with managing the outbreak. The focus on bed capacity and operational management was felt by some clinicians to detract from the clinical focus of infection control management, creating a managerial clinical divide as described by an infection control nurse based on Site B:

71 -because it is complex deciding, it's not just as easy as saying a patient does have diarrhoea or doesn't have diarrhoea and this is infectious and this is not, it's actually a far more complex clinical decision making than that sort of model allows.

A fundamental tension that arose between clinical teams during this period was the competing priorities of those clinicians wanting to retain 'elective capacity' (the capacity to bring in planned patients) and those wanting to focus on ending the outbreak. The clinicians attempting to retain their elective capacity were perceived by the outbreak team as individually self-interested, parochial and operating against the interests of the Trust. As the organisational capacity for throughput of patients was rapidly compromised, some clinical teams, e.g. the intensive care team were accused by other clinical teams of following inappropriate clinical pathways and others, e.g. vascular surgeons were criticised for trying to circumvent outbreak policies to maintain their patient throughput and bed capacity. Other surgeons, e.g. the Ear, Nose & Throat team worked with the outbreak team by operating flexibly to maintain their elective capacity through weekend working. The Medical Director took on the role of 'referee' to resolve tensions between the clinical teams by making sense

of the priorities of different groups and persuading them to adopt an alternative clinical strategy, which involved them assessing potentially infected patients to free up the Infection Control team's capacity.

Within this timeframe, an innovative, spatial re-conceptualisation of the entire hospital was constructed with specific infected and non-infected areas, teams, processes and admitting arrangements. These separate areas, colloquially known to the majority of respondents as 'clean' and 'dirty' areas were delineated throughout the patient's pathway, to enable two flows of patients to follow one pathway or the other through A&E, the admitting wards, medical wards, surgical wards, intensive care areas and theatres. This system required cognitive reorientation for all the teams working within it, as they were required to adopt an improvised role system, becoming members of either an infected or non-infected team. This process was coordinated with the Occupational Health department who identified individuals that had recovered from Norovirus to join infected teams and vice versa. This innovative spatial re-design was based on the prior experiences of the small group of front-line clinicians who took leadership responsibility for the outbreak. These clinical leaders drew from key elements of their prior experiences to conceive the hospital re-orientation which included; corralling patients, opening and closing services, maintaining separate admissions streams, ensuring staff worked in one admission stream or the other and day-to-day education of staff on how to manage infection and prevent transmission. A key feature was that the re-design was dynamic, so if a non-infected area became infected, then that would be closed off and a new non-infective area would be identified, as described by the Clinical Director:

133 - So it started off with the limited number of wards, isolating the patients, but got to the position where we weren't on top of the outbreak so we started to cohort infected, non infected patients, cohort staff for those groups, and on a several times a day basis it became necessary to lock off one bit of the pathway and divert patients somewhere else. So if an area that you were treating as a venue for new, non infected admissions started to have patients or staff with diarrhoea then you closed that one off to acute admissions and diverted the acute admissions somewhere else.

In addition, the re-designed hospital balanced central ward closure with local patient cohorting decisions, ensuring that local accountability could be retained alongside central control. The re-design resulted in an improvement in overall capability within the hospital and assisted in containing Norovirus in identified areas so that full infection control

precautions could be implemented and the area could be deep cleaned when the Norovirus was eradicated.

These changes in the hospital required rapid alterations in roles and a high degree of flexibility which was exhibited by staff at all levels within the organisation. Wildavsky(256) p70 suggests that a capacity 'to investigate, to learn, and to act without knowing in advance what one will be called to act upon' is crucial in achieving resilient practice in unknown situations. Respondents described a range of adaptations to their roles including new roles, different jobs, alternative areas, changed or additional shifts, out of hours, working nights and undertaking extra hours for no extra pay, as described by the inpatient capacity manager:

78 - it became very, very complex to manage it effectively, and actually everybody changed their roles for a period of three or four weeks in order to focus on managing the outbreak rather than their normal daily business.

In addition, some respondents described hybrid roles, where they continued in their existing role but took on specific additional roles for the outbreak, which may have been much more junior in function but ensured that processes continued effectively. The Clinical Director described continuing in their existing role whilst taking on a medical staffing type of role to ensure that there were adequate numbers of additional junior medical staff to fulfil the demands of the re-designed hospital:

133 - And what this meant in practice was over the course of the three weeks or so I ended up basically sourcing residents for about two weeks in the director of services' office at [Site A, City Hospital]

6.3.7.3 Second-Order Findings

6.3.7.4 Distributed Sensemaking

Patterns of distributed sensemaking were evident in this phase. The transition from discovery to imposed control resulted in a pluralistic picture with evidence of resilient and resistant practices. One element of the distributed sensemaking was the use of a command and control group meeting which became the structure through which identities and strategies materialised.(257) By bringing multiple stakeholders to one consensual meeting, the opportunity to access varied cues to make sense of what was happening was possible. Weick suggests that the use of meetings and direct contact to create rich personal data from

which sensemaking can emerge is more important than impersonal data such as emails, or electronic reports.(64) Despite the attempts to impose control through the command and control structure, the semi-autonomous clinical directorate groupings reflected a loosely connected organisation where clinical teams had a partial image of the priorities and issues in the hospitals. Although certain areas; Medicine and Cancer Services participated in the continued process of sensemaking through the central command and control meetings, in other clinical and corporate teams within the organisation attended the meeting but had not realised the significance of the outbreak and continued to follow existing routines. One critical role, the bed manager, had continued to follow existing bed management routines for managing an infection:

126 – 'There were a number of areas that I think had diarrhoea, and we'd gone through our usual closing bays, trying to isolate patients in side rooms in order to manage a slightly higher number of diarrhoea cases than we usually saw. And then we got some results back saying that we'd got Norovirus, and then got lots more results back saying we've got Norovirus, and realised quite, and realised at that point that we had a significant problem, and it was spreading across the trust'

As this example illustrates, rather than adopting extraordinary strategies for dealing with the outbreak, in certain areas, habitual routines continued as a result of individuals reacting to, rather than anticipating cues. The reactive nature of these responses suggests inadequate participation in the collective sensemaking processes and an absence of sensegiving to this team. Tillement et al suggest that professional rivalries and asymmetric relations between occupational groups can be heightened during unexpected events and reduce organisational resilience.(135) This was evident with certain surgical teams who had formed their own perspectives on the event by choosing to follow existing habitual routines and not alter their behaviour to take account of the outbreak. The individuals in these teams were perceived by the physicians to be focused on getting their patients into surgery regardless of the consequences for the whole organisation, although the surgeons' frustration with the constrained capacity for their patients was recognised, as described by members of the outbreak team:

128 – the other big headache was a lot of the specialist teams, especially the surgical specialist teams, they got very frustrated that they could not bring in tertiary referrals, they couldn't bring in elective procedures and there was quite a lot of grief about that.

126 - that's not to say that some people still didn't try the eagle gamesmanship of getting their own patients in. It still happens, and it's really irritating, especially when you've got that sort of crisis going at the time.

137- And in terms of surgeons, it was so variable. I have to say, they were the most difficult kind of group to deal with really I think, in terms of understanding the impact.

133 - There were some tensions because periodically a surgical team would take a case to theatre without having been given the all clear for an intensive care bed, which then created a problem managing.

These surgeons appeared to have a narrower perception of their role with a focus on individual patient care and were less embedded in the broader sensemaking and sensegiving processes across the Trust. As a result, sensemaking was distributed throughout the organisation, with groups reaching equivalent, rather than shared meanings from the situation.

An associated issue was one of trust. The outbreak had resulted in temporary groups forming to manage the outbreak, requiring the rapid formation of new relationships with individuals and teams who, prior to the outbreak, had little day-to-day contact. In this phase of the outbreak, there was evidence of distrust between clinical groups who expressed suspicion about the intentions behind the actions of other groups, as described by one of the medical consultants:

128 - one was the high dependency and critical care axis, who were very keen to get patients off ITU to create beds and there were certainly occasions where I looked at people who'd come off ITU and said, well hold on a minute, this person has been sent down either inappropriately or the fact that they've got diarrhoea has been masked in order to achieve a discharge and we certainly, ended up having a second HDU closure because of a step down on a patient who'd been started on, I think Vancomycin, quote just in case they got some diarrhoea, unquote. Now, they certainly had diarrhoea when they came down to us.....so one is suspicious that, that there were some clinical pathways being followed that were not ideal for anybody.

A further issue that accentuated distributed sensemaking was that an elicited cognitive taxonomy(257) was operating in which the physicians regarded the surgeons as self-interested and parochial, and the surgeons regarded the physicians as overreacting to the

infection problems. The basis of this is that Norovirus is a medical rather than a surgical condition and the surgeons dealt with surgery and their junior doctors attempted to manage patient co-morbidities. The surgeons felt that they were focused on their surgical priorities and the physicians considered themselves to be managing the infection issues to improve patient safety and public health. These taxonomies exacerbated the sense of different core identities between groups. Some groups justified these positions during interviews, for example, a physician described why the physicians would exhibit greater embeddedness in infection management, citing more regular contact with and management of patients who may be sicker, more vulnerable and at greater risk of infections that are easily transmitted and a member of the surgical team justified their cognitive taxonomy whilst recognising the futility of it at the same time:

128 - The other side of it is that within gastroenterology *we provide a significant service for the sick end of patients with, usually with C-dif, colitis, so we're involved with management of that group of patients. And in a slightly broader sense from the endoscopy point of view, we do a lot of endoscopic procedures on patients with high risk infection transmission issues and there's a lot of infection control and cross contamination awareness that has to be driven by that patient group.*

137 - [Norovirus 2006-7] But I think because it's surgery, we'd never assume that any kind of infection outbreak would affect us, which is crazy really, when you consider all the planning we had done previously for bird flu but it did, and it is crazy.

These taxonomies prevented heedful interrelating and created sensemaking fault lines(238) within the organisation that prevented the development of shared cognition and behaviours to respond effectively to the outbreak.

The innovative and novel spatial re-design of the hospital and staff involved recombining cognitive and behavioural repertoires that already existed, for example, experience of corralling patients, opening and closing services and maintaining separate admissions streams. The improvisation or 'bricolage' required to bring together these existing response repertoires (109) to form a new hospital system and extending the range of the action repertoires, for example, making changes to patient flows, staff work areas and bed capacity served to overcome the challenges presented by the virus, leading to heightened feelings of efficacy which in turn encouraged sensemaking.(109) From an individual and group perspective, this capability for reconfiguring resources using existing routines(118) and the use of bricolage to develop an improvised role system under pressure, defines resilient

practice. Weick suggests that in a crisis situation, resilience is maintained when more role structure is created to compensate for less meaning in a situation.(19)

6.3.8 Phase 4

6.3.8.1 First-Order Findings

6.3.8.2 Collective Accountability

A new leader, the Director of Clinical Services (DCS) started work on 5th February to take over from the interim Director of Clinical Services. The Chief Executive introduced the DCS to the Control group in the first few days in post, as described by the IDC:

66 - And I was left to carry on managing it [the Control group] because clearly I'd already started. I think it was the second week of February, and the chief executive came in with [the DCS), and they made some comments about the way the meeting was being run. And looking back, I didn't find that very helpful at the time, because it felt quite undermining.

The implied criticism in this quote was reflected by other informants who felt that the meeting had become too big and chaotic and was at the wrong time of day (too early) to have gathered accurate information to inform timely decision making. The Director of Infection Prevention and Control explained the concern that the focus was on bed capacity rather than individual clinical assessments:

63 - I think the headless chicken type of approach and everything must be ready for the bed management meeting, no because actually they'll have to wait, because assessments need to be made appropriately instead of multiple moves being made for the wrong reasons.

The new DCS describes implementing rapid change that increased the collective accountability for the outbreak:

127 - You move away from colleagues thinking that you all have respective accountabilities to play out and the scales will tip one way or the other and we'll get it right or we won't, to people recognising very quickly we're all here for the same reason, we all have a common understanding of the big issue facing us and we all quite simply just want to get through it and work it out. And get a sustainable solution as quickly as possible.

The DCS rapidly identified the key priorities to resolve the outbreak within the first week of starting in post.

127 - And if I did anything when I arrived it was one, to get the, be clear about who was leading what we were trying to do and secondly to keep asking the question where have we come from? Where are we now? And how are we going to stop it? I kept asking it until a plan emerged....I think that took about two sessions, so after the first session it was oh yes these are all of the things we've talked about before, I know you've asked the question these are things we should be doing in priority order rather than a montage of things that people could pick and choose from and by the second meeting people were really clear.

One priority was to identify two critical clinicians, Director of Infection Prevention and Control and the Medical Director, who were essential to co-ordinate the outbreak by creating 'the space for the right leaders to come together.' A significant symbolic action was to hand the chair of the Control Group to the Medical Director which reflected the willingness to defer to specialist expertise. A linked priority was to ensure that the key decision makers were involved which resulted in the large Control Group meeting being pared down to a small decision making group, which met on a daily basis and was nicknamed COBRA (in recognition of the government COBRA which stands for Cabinet Office briefing room A and describes the meeting location of a cross-department government emergency committee that meets about high priority issues). The critical feature of COBRA was that it drew on flexible networks of clinician expertise and was driven by clinical decision making, with membership including the Director of Infection Prevention and Control, the Medical Director, the Director of Surgery, the Director of Medicine and the Lead Pathologist with other clinical specialists as required. The larger meeting format was retained on a bi-weekly basis as the DCS explained, 'it stopped everyone talking about everybody else to be quite honest and 'oh well we would do this but they said that we can't.' We just had it out in the room.' (127)

A second priority was to create a clear plan of action, focusing on patient safety which meant isolating patients. The DCS describes the process of sensemaking he engendered by tapping into an organisational cognitive reservoir of 'simple' thinking that was embedded in the academically-focused nature of the Trust:

127 - And I think there is a lot about the way that the predecessor Trust [prior to the merger in October 2007] worked with just that way of thinking amongst the leadership and the professors and the lead clinicians who actually keep it simple. When did it happen? Where has it happened? How many cases? What's the gestation? How long does it take to clear the whole thing out? What's effective? What's the evidence base? And let's just get on and do it then and make it happen.

The issue of certain surgical groups operating disparately was addressed by the DCS who described using the 'simplistic' argument of promoting safety over performance to persuade the surgeons to participate in the collective effort:

127 - in a humble way you may have other people that if they don't understand that simplicity [safety first] they may just keep piling in the elective work. And it was almost a moment of revelation when new in to role I said, as Director of Clinical Services at the … of [City Trust] I said, well haven't we got to stop adding to the problem, haven't we at some stage got to stop admitting patients in to this group of hospitals? And it was almost everyone went, my God, it's the right thing to do by my God. So that was important.

Friday 16th February signalled a turning point where the outbreak affected the Trust less markedly on site A and had largely resolved on site B.

6.3.8.3 Second-Order Findings

6.3.8.4 Collective Mind

There is evidence of the three elements of the conceptualisation of the collective mind at this stage of the outbreak: contributions; representation; and subordination. Contributions are evident from key individuals in the system; the new leader, the critical clinician coordinators and specialist clinical contributors. In particular, the early contributions of the new leader were perceived by participants as a defining point in the outbreak. The DCS was perceived to have contributed by shifting the mindset, from one of managers focusing on hospital capacity and experts deferring to authority to one where managers took advantage of shifting locations of expertise and experts focused on patient safety. This was achieved by delegating leadership and engaging the clinical experts, one of the five features of mindful organising.(55) It may be that decision making had become more tangible at this stage, as a result of previous discussions and that participants ascribed to the leader the greater simplification and clarity of decision making as a retrospective reframing process, to form a new identify as a collective team managing the outbreak together.

The role of representation, or greater interconnectedness within the system was recognised by participants in this phase. The leader's role was critical in creating a shared value set, 'safety first, keep it simple, stop the rot and then get going' and drawing on a shared cognitive reservoir (simple, evidence-based thinking) to create temporal interconnectedness with which to frame the proposed actions to engender organisation-wide support. This evidence of heedful interrelating created greater capacity to make sense of the outbreak as it

unfolded. The successful engagement of the disparate surgical groups through these approaches led to the surgeons appreciating the interrelatedness of their actions on others in the system (subordination). The role of a key clinician coordinator as self-designated chairperson was critical in engaging different groups of surgeons, as he describes:

134 - for example, the decision is unpopular to stop orthopaedic admissions or do something different, you then have to go and talk to the orthopaedic surgeons and tell them this is what it is and tough tits.

As a result of these series of conversations, the surgeons halted all but the critically urgent elective work and focused on the outbreak which was an important element in the rapid resolution of the outbreak, as the DCS explained:

127 - By comparison other hospitals around us were stuck in it. And then we became the hospital group that supported the others because they kept piling the work in. They kept adding to the problem.....And they just didn't stop and clean out, clear out.

The greater interrelation between these previously disparate groups in the system, contributed to a more comprehensive collective mind, which served to create greater shared understanding of the complexities of the outbreak and support a swifter conclusion to the outbreak.

Collective efficacy was a contributing feature of the enhanced collective mind in this phase. The new shared understanding of the outbreak led to increasing shared confidence that all the teams involved would be able to organise and action the changes that were required to resolve the outbreak. All the available emotional and behavioural resources were utilised in addressing the outbreak as described by two participants:

143 - I remember sitting here but I remember thinking, we've got a team here that can manage this, do you know what I mean?

136 - I do remember thinking that it was, when we're tested it's, people really step up, and they did communicate and they did thank staff and there wasn't a sense of panic and, oh, God we've got to do this and we must reach the target, I didn't feel that pressure, for a change, it was certainly, it was very much about, this is what, this is our focus, let's not lose sight of that, but just tell us what you need and we'll give it to you.

This efficacy supports the loosening of control to move decision making and problem solving to those who have the greatest expertise. Additional factors that contributed to collective efficacy in this phase included having positive leadership with a clear vision, shared strategies based on a shared value set, expertise-driven decision making, multidisciplinary co-ordination (with disparate groups included) and a highly skilled, senior, competent group of clinicians and managers supporting the process. (258;259) These factors encouraged positive adjustment from individuals to become more confident of their problem solving capabilities, encouraging a positive cyclical process that enabled the group to overcome the challenges they faced to conclude the outbreak.(118)

A further element that contributed to organisation's competence and increased the 'conceptual slack'(148) in the Trust was the conceptual openness that was exhibited at this stage. There was a willingness to ask questions to bring focus to the problem, bring diverse analytical perspectives to the table in the form of clinical experts and specialists and encourage respectful interaction between previously disparate clinical groups. This openness contributed to the creation of conceptual slack and relational redundancy(131) that enabled more attention to be paid to organising the outbreak response and activated relational networks, in place of addressing relational problems that had existed previously.

6.3.9 Phase 5

6.3.9.1 First Order Findings

6.3.9.2 Rapid Recovery

The outbreak concluded on 24th February on site A, which was hit the hardest with Norovirus and on 12th February on site B. Despite the outbreak, the Trust managed to meet all its performance targets at the end of the financial year in March 2007 although there was tension between the emergency and elective sides of the organisation about achieving recovery, as described by a Clinical Director:

133 - In the recovery phase there was clearly the tension of the emergency axis of the hospital saying, 'oh let's just slow down on the elective stuff, we're not comfortable with this yet', and the elective side of the organisation saying, 'look we're losing hundreds and hundreds of cases a day, this does seem to be dying down, we've got to bite the bullet'. And interestingly there were some similar discussions happened last year with the snow, so this kicking back into action is quite a delicate decision because different people have different agendas and it does need somebody probably to arbitrate at executive level, I think.

This reflection demonstrates a key issue, the tradeoff between safety and performance within the organisation which is a contributory factor to organisational resilience. The social sensemaking process that underpinned the decision making around this trade off involved different individuals with different agendas attempting to communicate their interpretation of prior events to influence future action.

With the aim of concluding the outbreak formally, a report was produced dated 20 March 2012 which was reviewed by the Trust Infection Prevention and Control Committee. The report contained a summary of learning points and recommendations which included an action plan to be activated if a transmissible infectious agent were to threaten the Trust in the future. Recommendations included the formation of a high level, small lead team and reinforcement of the clinician's role in patient assessment. A formal management response to the recommendations dated 16 April 2007, in the form of an action plan, was presented at the Trust Executive meeting for consideration and approval and was considered by interviewees to have informed more formalised future planning.

However, to achieve a rapid recovery, some of the discussion and learning around the incident appeared to be lost to front-line operational staff:

71 - I remember that we were going to be told that they were going to write up a quick paper that they'll send to us and we would have the chance to formally respond to that, but I don't think that ever happened actually, I don't remember it happening.....unfortunately I got the feeling, because they kept on saying they would share it with us, but that communication seemed to fall down as well, so it seemed to be about very few people being involved in lessons learnt and it seemed to be an incredibly, almost quite an abstract exercise.

75 - I think there was from a corporate level a document that was meant to, because I think afterwards you did do your lessons learnt, and what could we have done differently? And I think something was drafted, but I'm not sure where it ever got.

More positively, relational networks that were created as a result of the outbreak for a functional purpose were maintained after the outbreak. This suggests that these relationships were built on solid foundations of trust, as described by one nurse:

75 - Again I think the whole Trust really did pull together, I found someone the other day in estates, and the reason that he is such a good colleague is because of this outbreak, at the time, it was only a minor point but estates had an A3 colour copier and an A3 laminator, and

we needed signs producing, and we just, they did it all for us, they helped us, they went round, the built boards to go outside each of the wards, and they were here till ten at night as well. And I think everybody just seemed to pull together, and those relationships you built up then are obviously still there, and that's really good.

6.3.9.3 Second-Order Findings

6.3.9.4 Organisational Learning and Enactment

Organisational resilience is affected by an effective trade-off between safety and performance, as occurred at the end of the outbreak. The sensemaking process that resulted in the 'delicate decision' (133) involved the development of alternative cognitive mindsets between different actors with different agendas, which were reflected in the different options presented by the Clinical Director. The balance of these options rested in part on the articulation of the two main occupational groups; physicians and surgeons which were characterised by symbolic and identity issues.(135) The surgical perspective was the loss of hundreds of cases per day which affected their commitment to individual patient care and reduced organisational performance and the physician perspective which was the discomfort from increasing elective work before the outbreak had been resolved fully. The need for an executive arbitrator between these occupational groups reflected the strength of identity issues resulting from these trade-offs.

Organisational learning can be understood as 'the revision of response repertoires in ways that improve organisational performance.' (26)p846 From an organisational learning perspective, this phase of the outbreak was characterised by two distinct types of organisational learning as described by Christianson et al; learning *from* an unexpected event (similar to the concept of deliberate learning(46)and learning *through* an unexpected event.(26)

Learning *from* this outbreak occurred at a high level in the organisation with few front-line staff involved and poor communication of the lessons learnt. The process was formulaic, involving a written report and a management written response in the form of an action plan. This type of deliberate learning attempts to codify the tacit knowledge that was learnt from the outbreak. The risks implicit in this process are over-simplification of learning and over-emphasis on processes that were relevant to success. The codification occurred through formal reports and action plans which were perceived by front-line staff to be an abstract exercise as it failed to capture the learning *through* the outbreak which they felt to be more

important. In contrast, front-line staff described their multiple areas of learning from the outbreak as experiential; they had learnt *through* the event as it unfolded and the lessons that they identified were lessons that they would put into practice after the event. Examples of learning 'through' the outbreak were lessons that had been learnt from risks, problems and challenges that occurred throughout the outbreak. These lessons were exhibited in the organisation in a practical way, as described in the following example which relates to clinicians reviewing and changing their ward layout to minimise the infection risk:

127 - I think the other bit that lots of colleagues did, coming back to me now, is look at ward layout, look at space between beds and the fantastic thing was you didn't have to say anything to people, just through the learning, people started to come through and say themselves, we're taking a bed out there.

From a sensemaking perspective, the collective efficacy that was evidenced at the later stages of the outbreak appeared to support quicker and more skilful organising that facilitated rapid recovery at the end of the outbreak. A clinician describes this effect on the rapid routinisation of outbreak-related activities:

128 - I think a lot of the sort of very rapidly put together policies at the time basically became written in stone. There was, with relatively little review, I think it's fair to say. So they possibly are not the most ideal way of doing things, but that's what happened.

There was evidence of 'enacted salience' during this outbreak, a process which focuses on the specific and unique features of a rare event and provides opportunities for unique sensemaking and sensegiving. In this case the scale, impact and organisational attention allocated to this outbreak made it unique and led to subsequent unexpected events appearing more routinised as reflected on in relation to subsequent events:

133 - And we haven't had anything quite so intensive subsequently. For all the pandemic flu planning or last year's norovirus or the snow, no there's nothing that subsequently is, seems quite so much on the same scale.

A linked issue is that described by Christianson et al, who explain that 'when learning occurs *through* rare events, the nature and magnitude of the learning may not be apparent until subsequent rare events.'(26)p857 This was true of the Norovirus outbreak, where all the learning related to organising and managing an unexpected event, was subsequently codified into emergency planning documentation, including command and control guidance.

Participants noted that this contributed to the improved management of future incidents, such as heavy snowfall, pandemic flu planning and subsequent Norovirus outbreaks.

Organisational learning continued into the next phase of the outbreak, but transitioned from the immediate learning that contributed to a rapid recovery, such as balancing safety and performance or minimising infection risks on wards to longer term and more reliable integration of learning into new organisational routines.

6.3.10 Phase 6

6.3.10.1 First Order Findings

6.3.10.2 New Routines

After the outbreak, learning from the outbreak influenced people's cognition, behaviour and practice in ways that served to strengthen and improve existing organisational routines. These three types of learning will be described in more detail in this section. Cognitive learning included the revision of cognitive cues to improve individuals' ability to identify, assimilate and act on problems. Behavioural learning resulted from crisis-induced pressure on individuals to try out new behavioural approaches and then incorporate these new behaviours into future practice. Practice learning involved individuals or groups adapting or renewing existing practices in the light of learning from the outbreak.

From a cognitive perspective, participants noted that paying increased attention to infection control as a result of the outbreak encouraged broader attention to all aspects of patient safety. Increased organisational awareness was evident to potential patient safety risks, such as patient pathways through the hospital, consistency in clinical processes and areas of potential harm. A further cognitive change was the use of lower trigger points for the creation of mini taskforces to deal with a particular incident or event. These trigger points were cognitive markers of improved sensemaking and reflected more effective noticing, bracketing and acting on clinical or organisational anomalies. This cognitive change was supported by improved information, as reported by one participant:

137 - Our daily SITREP [situation report] now reflects where we've got areas that are closed or potential D&V.

Greater cognitive awareness was evident in the recognition of needing to build slack into the system, to ensure adequate redundancy for rapid response to an unexpected event:

127 - Well that it's knowing that you have to have surplus capacity to make sure that things aren't queuing and stacking and probably to make sure that the place isn't over heating so much that you're starting to spread infection.

In addition to cognitive learning, behavioural learning opportunities were identified from the outbreak. A Director reflected that:

134 - It was a very good learning point for me actually, how the hospital works or didn't work and how you can get control of something relatively quickly if you involve a few crucial people and make some simple, clear decisions, that you only go and meet once a day and then only a few people are going to be there and they've got specific tasks and they're given enough support.

Similarly, several leaders reported on behavioural changes based on prior experience from the outbreak. A key behavioural change was the use of segregation of infected and non-infected patients and staff into the infected and non-infected areas, which had continued after the outbreak in one area of the hospital. Participants were confident that this behavioural approach could be reinstated rapidly, should circumstances warrant this:

66 – They [A&E] did a lot of clinical, they had interesting approaches in trying to segregate patients known to be uninfected, from those who might be. So that was really good. And I don't know whether they do that on a daily basis, but I think they'd be able to do that at the drop of a hat now, because they did it back then.

Practice changes also resulted from learning lessons from the outbreak. A significant change was making previously vague routines much more rigorous and disciplined. One example was bringing consistency to the Infection Prevention and Control approach which had been perceived as reactive prior to the outbreak. This meant ensuring all the team, including any infection control nurse would take the same approach, based on a new formality about work routines. (75) One frequently quoted practice change was the introduction of clear policies that provided organisational assurance. The introduction of Bristol stool chart, as an objective measure of stool sample consistency across the hospital was a key example:

71 - Now it's standard practice that patients who are showing signs will be put on a Bristol stool chart, so you've got a far more objective tool, for example, to help make that decision.

A further example was ensuring much more rigorous practice on bed closures and isolation rooms:

71 - it's gained a much higher priority and we are, as I said before, far more rigorous about making sure that where we can patients go into isolation rooms, close the beds at a very early stage for a predetermined time

Innovative developments were introduced to support these practice changes, for example, visual templates of ward layouts that had been created at the time of the outbreak continued to be used for individual ward outbreaks. (75)

6.3.10.3 Second Order Findings

6.3.10.4 Restructuring of habitual routines and practice

An unexpected event is a 'brutal audit'(55) of resilience as it disrupts organisational routines and exposes the strengths and weaknesses of the organisation.(26) From a cognitive perspective, those affected can 'see more clearly what was already underway, what they had been learning and the limits of their previous comprehension.'(26) p857 Issues of organisational identity, culture and capabilities are exposed and questioned. The benefit of this process is that it can raise awareness of problems and potential, leading to insights and learning across the organisation about how routines might be improved. If these insights are acted upon, then existing routines can be made more reliable and expertise that existed informally can be converted into routines to reduce misunderstandings. This process has been described as 'restructuring' where old routines that were perceived to be inadequate are reorganised or updated, taking into account learning from the unexpected event.(26) Participants in the Norovirus outbreak described many examples of 'restructuring.' One set of improvements related to formalising many informal routines, such as the introduction of the Bristol stool chart, designation of infected and non-infected areas in certain units and greater rigour in ensuring bed closures and use of isolation rooms. A further set of improvements related to how an unexpected event would be managed and organised, taking learning from this event into planning for future events. Participants described the documentation of a command and control structure for future unexpected events, an emergency response committee formed with appropriate people, the development of an emergency planning team, improved centralised and real-time communication mechanisms, including use of the intranet and central emails, the introduction of policies for standardised

and structured responses to events and the development of redundancy through building slack into the system:

71 - I think terms of communication are better, because now when we have diarrhoea we have these policies in place, where we're more likely to be informed straightaway and we have more of a structured response, using things like Bristol stool charts to help inform that decision.

Participants reflected that these approaches had assisted with more recent audits of resilience, such as coping with severe snowfall and pandemic flu planning.

Underpinning these explicit actions was the experiential learning that had been gained and provided an organisational memory for how to manage such an event again. One element of the experiential learning was based on improved organisational networks, the development of trust and relationships strengthened through a crisis situation. Another element was based on increased alertness to patient safety risks and recognition of the need for prompt action should an anomaly arise. These implicit functions reflected increased sensemaking (increased awareness and bracketing of anomalies) and improved sensegiving (more effective, coordinated responses and information provision) to prevent distributed sensemaking and were described by one participant as a 'sleeping network', a set of powerful informal structures and relationships that lay dormant until they were required for another unexpected event. However, the network was potentially threatened by pivotal participants leaving the organisation for other jobs, creating a gap in the network and organisational memory that was irreplaceable.

To summarise, a series of restructuring activities were identified by participants, some relating to explicit activities, such as the introduction of new policies, guidance and teams and others relating to implicit improvements, to sensemaking and sensegiving capabilities, such as improved relational networks and greater awareness of anomalies and how to act on them, based on experiential learning through events.

6.3.11 Discussion

In this research study, I adopted a sensemaking lens to understand the often contradictory and complex events that occurred during an unexpected infection outbreak in a large healthcare organisation. I will assess this case study against the preliminary organisational resilience framework based on a sensemaking perspective (Table 6.1) that I originally proposed which reflected the polarised perspectives on sensemaking in the literature. I will

reference the gaps in the sensemaking literature that I described to understand the different types of sensemaking throughout the unexpected event and to explore the dynamic interactions at micro and meso-level and conclude by reflecting on the implications for organisational resilience in practice.

This research examined the sensemaking strategies adopted by the 'middle of the road' case study organisation reacting to an unexpected and high impact event. Many organisations may fall into this category(260), yet there is little literature that describes the effect of an unexpected event on their performance. This study attempts to fill this gap, providing a perspective on the multi-faceted and complex sensemaking and sensegiving strategies that are enacted throughout the event.

6.3.11.1 Intermediate Resilience

My main theoretical contribution is to identify a concept of 'intermediate' resilience which is positioned between the low and high levels of organisational resilience set out in Table 6.7.

In Table 6.7, I define the sensemaking characteristics associated with the concept of intermediate resilience.

Table 6.7 Organisational resilience framework from a sensemaking perspective

Level of organisational resilience	**Cultural Mindset**	**Cognition**	**Conation (Behavioural commitment)**	**Displayed behaviours**	**Organisation performance**
Low (resistant behaviours)	Entrapment: Blind spots Justifications Rationalisation	Optimistic	Strong	Concealment Distrust Failure to learn Dogmatic	Collapse/ Failure
Intermediate (resilient and resistant practices)	Sub-cultures: Warring factions Temporary cultural cohesion Common purpose	Pragmatic	Varied	Caution/Confidence Initial Distrust/ Developing Trust Experiential Learning Stoicism	Improvement or Decline
High (resilient behaviours)	Collective mind: Heedful interrelating Mindful attention Social interaction	Precautionary	Weak	Openness Swift Trust Accelerated Learning Skeptical	Reliable/ Failure-free

Depending on how an unexpected event unfolds, intermediate resilience will operate in one of two ways. Either organisational resilience will prevail to resolve the event satisfactorily and organisational performance will improve or resistant practices will predominate and organisational performance will deteriorate, leading to organisational decline. The cultural mindset that is evident in the intermediate resilience scenario is one of sub-cultures, where in the context of routine practice, the predominant attitudes, behaviours and beliefs would favour the sub-grouping over the whole organisation. In the context of an unexpected event, the disruption to routines might either create further defensiveness within the sub-culture, with more entrenched resistant behaviours or a willingness to put aside territorial and professional divisions and create temporary cultural cohesion for the common good. At organisational level, cognition is pragmatic, as the sub-cultures favour the approach that supports their interests and leads to the most effective resolution of the problem. Conation is varied, as there is weak behavioural commitment demonstrated by those individuals or teams willing to adapt and flex to new approaches and practices required in response to the event, or strong behavioural commitment demonstrated by individuals who are unwilling to depart from existing routines and justifications, which support high autonomy and choice.(18) Conation is varied as displayed behaviours can alternate between caution and confidence and from initial distrust to developing trust. Learning is often experiential, as poorly developed routines are tested, revised and restructured and cognition develops towards an improved state of alertness. Ultimately the response tends to be stoic, based on recognition of the need to deal with an unexpected event with fortitude and resolutely address problems as they occur, until the event is resolved.

More recent resilience literature proposes that commitment to resilience is a principle of high reliability organising.(55) Through this framework, I suggest a more nuanced argument on the basis that resilient practices are common to all organisations, including those demonstrating intermediate levels of performance. Even in failing organisations, there may be individuals, teams or departments that are engaged in resilient practice, despite a prevailing resistant organisational culture. This commitment to resilience, through the adoption of workarounds and reduction of errors, may be all the greater in a lower reliability organisation because organisational systems are unreliable and teams are blasé about errors. However, there is usually a finite level of coping resources, even with the most adaptable teams and flexible individuals, if the underlying organisational support mechanisms are not in place to maintain overall resilient practice.(128;261) In the context of an unexpected event, there may be sufficient commitment to resilience at individual or team level, even in an organisation that demonstrates lower meso-level resilience, to encourage

overall micro-level commitment to resilience for the duration of the event. An unexpected event can act as a catalyst for a reassessment of the appropriateness of existing behaviours and practices, with the potential for a rapid, if temporary cultural shift towards more resilient, collective behaviours.

This framework contributes to organisational resilience and sensemaking literatures by providing a mechanism for assessing the spectrum of organisational resilience function. The majority of the literature focuses on high reliability, high resilience or failing, low resilience organisations. Although healthcare organisations exist that are judged to be systemic failures, the most recent example being Mid Staffordshire NHS Foundation Trust, reviewed through a Public Inquiry(262), the majority of healthcare organisations fall between the polarised ends of the spectrum that the sensemaking and resilience literature focuses on. By developing a framework that reflects these polarised ends of the spectrum, I am able to define the nature of sensemaking and resilience in this middle ground.

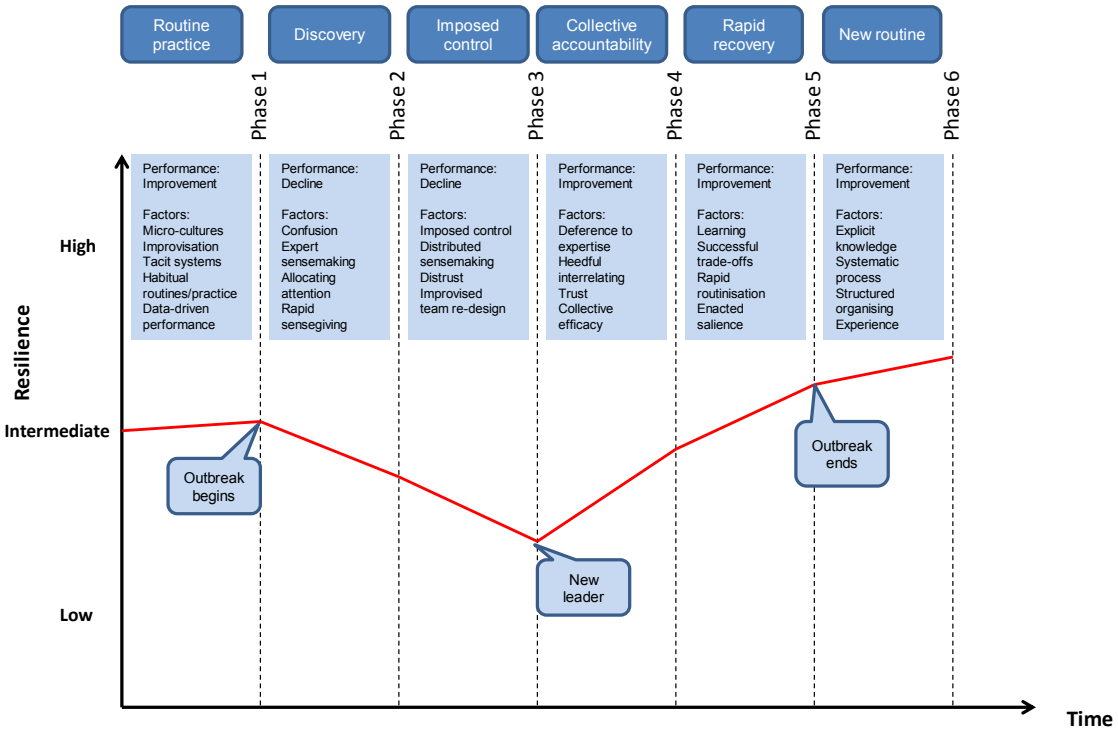
6.3.11.2 Evidence for intermediate resilience in the case study

In my case study, I found that intermediate resilience described a scenario of resilient and resistant practices co-existing during an unexpected event which is described in Figure 6.3. Organisational performance in this scenario was understood to be the throughput of patients in the hospital (linked to various national targets such as time in the Accident and Emergency department) in a safe environment.

In Figure 6.3, I present a visual representation of intermediate resilience enacted through the case study organisation, highlighting the links with organisational performance. I propose that intermediate resilience is a dynamic concept, as levels of resilience fluctuate throughout the organisation's response to the unexpected event, as is evident on this diagram.

In Phase 1, the pre-outbreak phase of routine practice, there is a mixed picture of resilience. I noted slight performance improvement against national and local targets, but micro-cultures predominating, with a reliance on habitual routines and tacit systems. In Phase 2, although embedded sensemaking and rapid sensegiving was evident amongst a small group of physicians in the early stages of the outbreak, the majority of staff continued in habitual routines which may have caused viral spread and exacerbated the outbreak.

Figure 6.3 Diagram showing intermediate resilience enacted in case study hospital



This performance deterioration continued into Phase 3, where distributed sensemaking (with resistant behaviours) was evident. The introduction of a new leader who deferred to expertise resulting in the altered behaviours of some surgical groups (Phase 4) was required to shift the cultural mindset towards a common purpose. This resulted in resilient behaviours predominating over resistant behaviours and whilst organisational performance, as defined by throughput of patients, had not recovered at this stage, strenuous efforts were made to free wards of Norovirus so that during Phase 5, the recovery phase, elective patients could be admitted again. The outcome for organisational performance (Phase 6), in addition to managing to meet organisational targets for elective work by the end of the financial year, was performance improvement in across the organisation, leading to improved practice, behaviours and cognition resulting from organisational learning from the outbreak.

6.3.11.3 Sensemaking and Sensegiving: Dynamic Progression

From a sensemaking perspective, a key finding from this research is that sensemaking and sensegiving strategies have a dynamic progression through an unexpected event which

impacts on the level of organisational resilience exhibited. Sensemaking and sensegiving are dynamic processes within and between individuals and these contribute to a range of adaptive responses at organisational level. Within the case study organisation, the following dynamic progression was noted prior to, during and post the outbreak: habitual routines, embedded sensemaking and rapid sensegiving, distributed sensemaking, collective sensemaking, organisational learning and enactment and restructured routines. The sensemaking literature has focused on static sensemaking, see Appendix B, but this research suggests that sensemaking is interactive and progressive, in response to unexpected events. Another feature of sensemaking was the crucial turning point during this progression, which signalled a change from distributed sensemaking to collective sensemaking and ensured the rapid resolution of the outbreak. This occurred as a result of the commencement of a new leader who deferred to clinical expertise and persuaded certain surgical groups to stop all but critical elective surgery and focus on the outbreak, in contrast to the approach of other local hospitals who continued elective admissions, resulting in longer duration outbreaks. Reaching this tipping point was a critical element in achieving positive adaptive responses over negative adaptive responses. This was in contrast to the BRI study where despite whistle blowing and concerns raised by staff, the questionable clinical work continued, endangering patient safety.(18) The turning point was driven by surgical constituencies deciding that the focus on their own patients had to be subsumed to the collective responsibility for patient safety across the whole organisation. The emergent crisis leadership, development of swift trust and the ability to overcome silo mentality that characterised this tipping point were critical to reaching a resilient outcome, rather than a tragic outcome as in the BRI study. This research suggests that during unexpected events, there needs to be awareness of the interrelationships between key constituencies in complex healthcare organisations and the influences on the delicate balance between resilient and resistant behaviours, in order to achieve a resilient outcome.

6.3.12 Conclusion. My contribution to the study of organisational resilience: the case of infection prevention and control

In conclusion, my primary contribution is to have developed the literature in a modest way by adding an intermediate resilience category. This category addresses a gap in the resilience and sensemaking literature which focuses on polarised positions of high resilience, high reliability organisations and low resilience, failing organisations. I found in my case study analysis that intermediate resilience comprised a range of resilient and resistant behaviours and practices that could have led to an improvement or decline in performance. I drew on my empirical study to develop the category using sensemaking characteristics to define the

elements of culture, cognition, conation and pragmatic and experiential displayed behaviours. To develop this category further and to understand more about the turning points that encourage a transition towards a resilient approach from a resistant approach, further research in other healthcare settings would be valuable.

A further contribution is my use of an in-depth qualitative case study which enabled an intensive study of a specific case. Whilst in-depth case studies exist in this field(18;19;26;192;263), the majority use secondary data sources which limit the exploration of cognition and behaviour which is essential for the development of sensemaking theory. I used primary data sources, in the form of in-depth interviews and utilised two different qualitative techniques; qualitative content analysis and thematic analysis to ensure a robust and thorough micro-analysis of cognition and behaviour that was essential to inform the meso-level theoretical development of the study.

A further contribution is the application of a social science approach to the novel arena of infection prevention and control. I used sensemaking theory to develop my understanding of organisational resilience and found it helpful in explaining what I saw. I found that using the sensemaking approaches (Appendix B) to study resilience throughout an unexpected event, facilitated the identification of resilient and resistant practices in the organisation and the micro-level behaviours that constituted these practices. I was able to identify a dynamic progression of sensemaking which involved different types of sensemaking occurring at different points in the course of an unexpected event. These dynamic changes reflected shifts towards resistant or resilient behaviours. This contribution responds to a gap in the literature for complex, interactive sensemaking, as the focus to date has either been on static sensemaking or the adoption of one type of sensemaking to understand a particular event as described in Appendix B.

If someone was commissioning research, a sensemaking theory, case-based approach should be included. Using sensemaking theory to understand organisational resilience provided a much greater degree of insight at micro and meso-level than is evident in many of the empirical studies of resilience that use alternative techniques.(56;57)

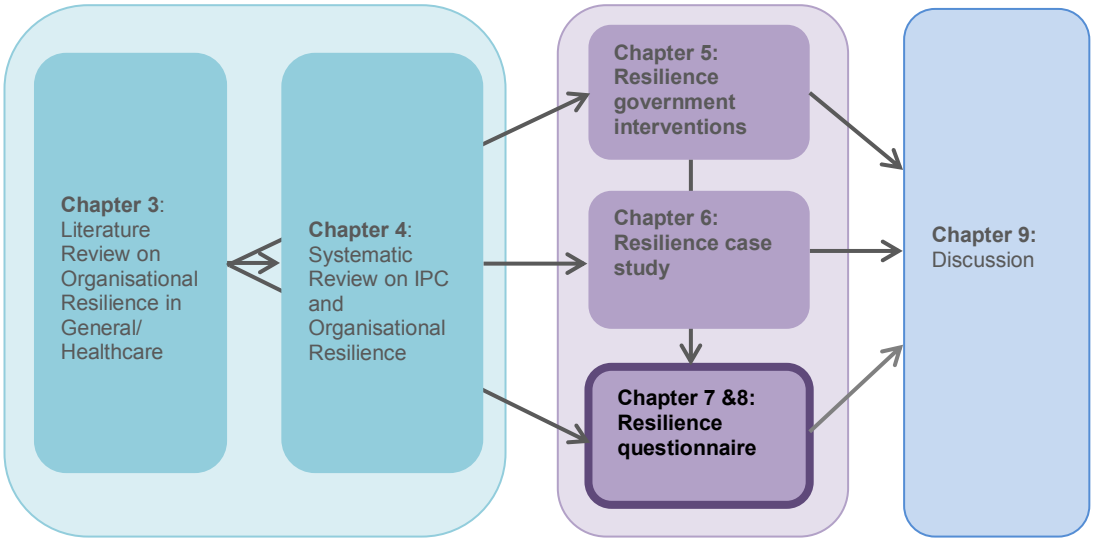
Finally, from a practitioner perspective, I have mapped the stages of an unexpected event and identified practical strategies that were used to manage an unexpected infection event that enabled a transition from resistant to resilient behaviours. In particular, I have highlighted the need for awareness of the interrelationships between key constituencies in

complex healthcare organisations during unexpected events and an appreciation of the factors that influence the delicate balance between resilient and resistant behaviours.

7 Chapter 7. Design and Development of Organisational Resilience Questionnaire

7.1 Introduction

The final two theoretical and empirical chapters, Chapters 7 & 8 are linked chapters. Chapter 7 describes the design and development of an organisational resilience questionnaire and Chapter 8 derives a revised organisational resilience questionnaire from the survey analysis based on the use of the measure.



The previous chapters have examined the importance of organisational resilience and the need to study organisational resilience factors in acute healthcare. The resilience case study in Chapter 6 shed light on the stages of an unexpected event and examined in detail, the organisational resilience dimensions that were associated with each of these stages of an unexpected event. In addition, it laid the foundation for the development of a measure of organisational resilience. As discussed in Chapter 3, many organisational resilience dimensions are cited in the literature and reflect a variety of cognitive, behavioural and systemic approaches. However, simply exploring these dimensions in qualitative empirical studies may not provide generalisability of findings to all healthcare institutions or adequate assessment of each dimension in that context.

The reason for developing the questionnaire was that there were very few tools in the literature to measure organisational resilience. Resilience tools that do exist(55;147) focus

on the impact of continuous stressors rather than unexpected events. The nature of this research is exploratory as no measures of organisational resilience in the context of an unexpected event exist, so prior hypotheses have not been developed or tested. This chapter addresses these shortfalls through the design and development of an organisational resilience questionnaire. The following chapter, Chapter 8, examines the conduct of the survey, presents the analysis of data and applies the findings to a revised organisational resilience questionnaire. The stages of work for the design and development of the questionnaire to test organisational resilience in the management of an unexpected hospital infection event are described in the table below:

Table 7.1 Stages of Design and Development for questionnaire

Stage 1	Amalgamating two resilience frameworks from qualitative case study
Stage 2	Inductive identification of chronological themes from the frameworks
Stage 3	Questionnaire design using chronological themes and resilient frameworks
Stage 4	Pilot testing questionnaire

7.2 Stage 1: Amalgamating two resilience frameworks

I analysed the interviews from the case study review of a Norovirus outbreak outlined in Chapter 6 using in-depth qualitative content analysis against two separate frameworks. The first framework is Weick and Sutcliffe's framework for resilient performance (reported in Chapter 6), which has a cognitive/behavioural focus which emphasises sensemaking – see Table 7.2. This framework contains two sets of criteria; the factors that support resilient practice and those factors that reflect resistant practices. The second framework was developed from the resilient engineering literature, specifically identifying socio-technical factors associated with the erosion of resilience(99) and factors associated with the development of resilience(247) – see Table 7.3. This framework places greater emphasis on organisational differentials, such as leadership and communication and trade-offs, such as that between performance and safety.

Both frameworks contain overlapping elements, but reflect the different foci of organisational theory (Weick and Sutcliffe) and resilient engineering (Woods, Hale and Heijer). For example, flexibility is used in both frameworks, but for Weick and Sutcliffe, flexibility relates to local actors willingness to assume virtual roles and engage in bricolage whereas for Hale and Heijer, flexibility relates to the adaptive capacity of systems and the propensity for human work to adopt workarounds or shortcuts. The second framework will be discussed in more detail as it is not the subject of preceding chapters.

The second framework (Woods, Hale and Heijer) derives from two lists of factors from the resilient engineering literature which were chosen as they outlined opposing approaches that either eroded or promoted resilient functioning. The first set of factors (Woods) relate to an erosion of resilience and were derived from an analysis of the NASA investigation report that identified the organisational factors that led to a series of space mission mishaps;

- changing environment
- increasing performance demands
- reduced resources
- new organisational structures
- heightened public and political awareness
- breakdowns in inter-group communications
- cutting costs.

Woods' factors underpinned a fundamental sacrificing decision between performance and safety considerations as NASA was under pressure from stakeholders to reduce costs and schedules and improve production outputs. (99) The report found that these factors resulted in a brittle system that demonstrated increased vulnerabilities and safety conflicts. These factors created an organisation that was less resilient and more likely to fail.

Table 7.2 Resilient and resistant practices during the management of an organisation-wide Norovirus outbreak 2007

Framework from Weick, K and Sutcliffe, K. Managing the unexpected: resilient performance in an age of uncertainty. Jossey-Bass; 2007	Resilient Practices						Resistant Practices					
	Capacity to anticipate unexpected events			Capacity to contain unexpected events		Total Resilient Practices	Capacity to anticipate unexpected events			Capacity to contain unexpected events		Total Resistant Practices
Characteristics of resilient and resistant practices / Interviewees	Tracks small failures	Resists oversimplification	Remains sensitive to operations	Maintains capabilities for resilience	Monitors and or takes advantage of shifting locations of expertise		Small failures denied	Simple diagnoses accepted	Frontline operations taken for granted	Recovery is treated as routine	Experts defer to authority	
Director	3	1	11	34	14	**63**	0	0	0	4	0	**4**
Director - Clinical	2	5	2	16	6	**31**	2	6	1	0	3	**12**
Clinical Director	4	5	25	45	11	**90**	1	3	5	10	0	**19**
Consultant Medicine	2	1	8	25	15	**51**	9	3	11	12	4	**39**
Consultant A&E	9	3	10	21	6	**49**	2	1	2	7	1	**13**
Nurse Manager	2	0	11	20	4	**37**	0	1	2	1	0	**4**
Nurse Manager	1	5	12	28	0	**46**	4	3	3	10	4	**24**
Nurse Manager	4	1	11	22	6	**44**	4	4	9	1	2	**20**
Senior IPC Nurse	21	6	8	15	4	**54**	0	3	5	13	11	**32**
Senior IPC Nurse	23	0	25	22	4	**74**	3	3	4	7	5	**22**
Clinical Manager	11	0	19	18	5	**53**	9	0	3	1	3	**16**
Manager	1	3	16	26	7	**53**	2	1	2	4	5	**14**
Nurse Manager	3	1	11	30	3	**48**	2	0	0	4	3	**9**
Nurse Manager	4	3	14	17	4	**42**	0	0	2	0	3	**5**
Manager - Beds	7	4	35	19	11	**76**	2	2	19	15	0	**38**
Manager - Facilities	6	1	10	8	4	**29**	1	0	2	6	0	**9**
Manager	6	3	19	30	10	**68**	0	4	13	19	7	**43**
Manager	6	1	11	22	8	**48**	1	0	1	0	0	**2**
Manager	0	3	8	10	0	**21**	2	0	3	3	0	**8**
TOTAL	**115**	**46**	**266**	**428**	**122**	**977**	**44**	**34**	**87**	**117**	**51**	**333**

Resilient practices: red/amber=low resilience (0-5), yellow=moderate resilience (6-15), green =high resilience (≥16). Resistant practices: green/yellow= low resistance (0-5), amber=moderate resistance (6-15), red = high resistance (≥16).

Table 7.3 Development and Erosion of Resilience during the management of an organisation-wide Norovirus outbreak 2007

	Development of Resilience (Hale & Heijer)							Erosion of Resilience (Woods)							
Framework from (Eds) Hollnagel, E., Woods, D.D., Leveson, L. Resilience Engineering. Concepts and Precepts. Ashgate Publishing 2006.	Ability to manage severe pressures and conflicts between safety and performance goals	Mobilisation of resources to intervene at critical points	Excellent communication	Responding rapidly to events	Flexibility	Coping with unexpected and unplanned situations	Total Resilient Factors	Increasing performance demands - external	Reduced resources - external	Cutting costs - internal	Breakdowns in inter-group communications	Changing environment - external	New organisational structures	Heightened public and political awareness	Total Resistant Factors
Director	14	7	10	4	6	15	**56**	2	0	0	1	3	1	1	**8**
Director - Clinical	1	5	2	2	5	14	**29**	0	0	0	2	10	1	4	**17**
Clinical Director	6	15	13	7	7	29	**77**	4	3	0	7	6	10	0	**30**
Consultant Medicine	1	6	13	5	9	12	**46**	0	3	6	16	9	0	7	**41**
Consultant A&E	6	5	12	2	7	8	**40**	1	0	3	7	2	0	0	**13**
Nurse Manager	3	8	7	4	8	4	**34**	0	0	0	4	9	1	3	**17**
Nurse Manager	4	9	16	2	11	21	**63**	1	0	5	10	2	0	0	**18**
Nurse Manager	3	1	4	1	7	19	**35**	5	0	0	12	8	0	1	**26**
Senior IPC Nurse	6	0	3	7	1	12	**29**	6	0	0	7	1	5	3	**22**
Senior IPC Nurse	14	3	5	2	7	15	**46**	1	0	1	3	1	1	0	**7**
Clinical Manager	11	7	4	4	7	11	**44**	1	0	0	5	0	6	1	**13**
Manager	10	9	3	4	13	15	**54**	0	2	1	0	8	0	3	**14**
Nurse Manager	5	5	7	2	4	11	**34**	1	0	0	8	3	0	2	**14**
Nurse Manager	5	9	2	4	1	23	**44**	0	0	0	2	0	3	1	**6**
Manager - Beds	20	9	15	7	5	15	**71**	2	0	7	17	12	1	1	**40**
Manager - Facilities	2	4	10	1	5	4	**26**	0	0	1	3	5	0	3	**12**
Manager	0	6	8	5	4	22	**45**	0	1	5	19	16	14	3	**58**
Manager	7	13	4	2	5	8	**39**	1	0	0	0	4	0	3	**8**
Manager	4	1	3	0	4	7	**19**	6	0	0	5	3	0	0	**14**
TOTAL	**122**	**122**	**141**	**65**	**116**	**265**	**831**	**31**	**9**	**29**	**128**	**102**	**43**	**36**	**378**

(Resilient practices: red/amber=minimal development (0-5), yellow=moderate development (6-15), green =major development (≥16). Resistant practices: green/yellow = minimal erosion (0-5), amber=moderate erosion (6-15), red = major erosion (≥16).

The second set of factors (Hale and Heijer) relate to the development of resilience in an organisation. Organisational resilience is viewed as the ability to avert a disaster or major upset.(247) Hale and Heijer suggest that by anticipating threats, an organisation should be able to recognise when it is close to an unsafe boundary and by coping with events using the characteristics detailed below, an organisation can adapt quickly to prevent what Rasmussen describes as a 'drift to danger.'(264) Characteristics that promote resilient function encompass:

- Flexibility
- Coping with unexpected and unplanned situations
- Responding rapidly to events
- Excellent communication
- Mobilisation of resources to intervene at critical points
- Ability to manage severe pressures and conflicts between safety and performance goals

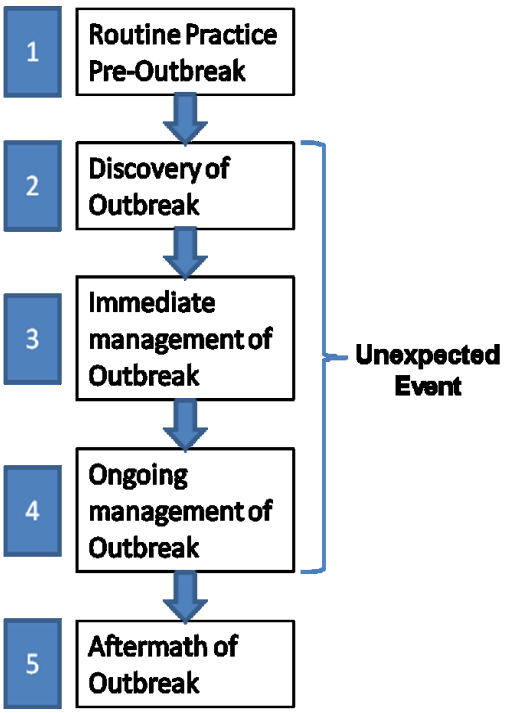
For this research, these two sets of factors were matched together to form a framework, for example, 'breakdowns in inter-group communications' was matched with 'excellent communication', 'cutting costs' and 'reduced resources' were matched to 'mobilisation of resources to intervene at critical points.' The resulting framework contained factors that eroded and developed resilience, against which the case study organisation could be assessed.

The results of the qualitative content analysis using both frameworks (Table 7.2 and Table 7.3) demonstrate that in the case study organisation there were examples of cognitive/behavioural and socio-technical characteristics in the same unexpected event. In addition, there were examples of resistant and resilient practices as well as practices that eroded and developed resilience, with approximately two-thirds of practices falling into the positive categories in each framework. To develop the resilient dimensions for the questionnaire, the most frequently occurring content categories from each framework were identified as resilience constructs to incorporate within the questionnaire.

7.3 Stage 2: Extracting chronological themes

The qualitative statements that underpinned the content categories from the Weick and Sutcliffe and the Woods, Hale and Heijer frameworks were used to inductively map out a chronological sequence of events that assisted in defining stages of the outbreak and identifying the resilient dimensions (behavioural and systemic factors) that were linked to each stage. These stages were reviewed with a psychologist to refine each stage of the infection outbreak and to confirm which dimensions constituted resilient practice within each stage. This resulted in a five-stage format for the questionnaire which is described in more detail below. The first stage (1) is routine practice pre-outbreak which can be described as the anticipatory or preparedness stage, stages 2,3 and 4 involve responding to the impact of an unexpected event and stage 5 involves recovering or readjusting to the impact of the event as illustrated in Figure 7.1.

Figure 7.1 Five stages of management of an infection outbreak



Stage 1 examined routine practice prior to the outbreak. As routine practice can reflect both the past experiences of the organisation and the existing performance of the organisation(78) it is essential to understand routine practice as a baseline for understanding the organisation's response to the unexpected event. Stages 2-4 reflect the sub-divisions

identified in the case study (Chapter 6) namely discovery, immediate management and ongoing management of the outbreak. Stage 2 'discovery' is conceived as a sensemaking stage, where rapid cognition, communication and action are critical in ensuring an effective response to the unexpected event. Stage 3 'immediate management' involves a set of system-focused actions to establish effective structures and systems to manage the response. Stage 4 'ongoing management' requires appropriate behaviours and systems to ensure sufficient organisational adaptation to the unexpected event. Stage 5 deals with the aftermath of the outbreak, focusing specifically on organisational learning and parallels the recovery stage in the literature. The use of these chronological stages in the questionnaire development was designed to assist respondents, as resilience dimensions reflected a logical sequence of likely stages within outbreak management.

7.4 Stage 3: Designing Questionnaire

The questionnaire was designed to reflect the chronological stages described in the previous section and to incorporate resilience-based statements into each stage; cognitive/behavioural statements from Weick and Sutcliffe's behavioural framework(55) and system/structural statements from Woods(99),Hale and Heijer's resilient engineering framework.(247) This process ensured measures were reliable and valid as statements were related to models of organisational resilience and had face validity as statements reflected qualitative content from the case study. The statements (items) for the survey were then designed through an iterative review process working between the literature and the full case study analysis (see Table 7.4) to ensure that the statements reflected both the practical empirical evidence of the case study and the resilience constructs within each theoretical framework. This resulted in the development of a preliminary draft of the questionnaire over a period of four months. A 5-point behavioural summary scale (Likert scale) that ranged from strongly disagree to strongly agree was employed. Four reverse-phrased items were included in three of the stages indicated as an 'R' in Table 7.4, to reduce response bias, as participants would be required to read the statements carefully when completing them.

Table 7.4 Questionnaire Design

Stage of Unexpected Event	Cognitive/ Behavioural Theory	Statements (Items)	Structural/ System Theory	Statements (Items)
Routine practice	Situational awareness Imagined vs performed work Flexibility	• Clinical teams were accountable for their infection performance • Infection policies were ignored in practice by clinical teams (R) • Ward staff were willing to implement new infection practices	Dynamic stability (regular threat) Awareness/ Opacity Monitoring production pressures	• Minor infection outbreaks were managed effectively • Monthly infection control data was provided to clinical areas • Performance targets for infection were used in clinical areas
Discovery	Sensemaking Sensegiving Operational communication Deference to expertise	• The outbreak was identified within 48 hours • Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified • The ward closure policy was clear to all staff • Clinical leaders were involved in decision making	Inter-group communication/ responding rapidly Coping with the unexpected	• The outbreak was escalated to Trust executive directors within 48 hours • The significance of the outbreak was underestimated (R)
Immediate Management	Track failures Sensitivity to Operations Expert and informal networks	• Information on cases was available daily • The isolation policy operated effectively • A clinical strategy for controlling the outbreak was implemented	Flexible decision structures Mobilisation of resources	• A clear structure was implemented to manage the outbreak • Bed capacity was created rapidly
Ongoing Management	Adaptation/ virtual roles Improvisation Leadership Rigour (case study)	• Staff groups were willing to work flexibly • Innovative solutions were developed for unplanned problems • An effective leader took control of the outbreak • Outbreak-related policies were implemented rigorously	Redundancy Trade offs (sacrificing decision) Inter-group communication Safety margins	• Additional resources were made available when needed • The balance between patient safety and performance goals was achieved • Communication to clinical teams was haphazard during the outbreak (R) • The elective pathway was severely impacted by the outbreak
Aftermath	Organisational Learning	• Learning from the outbreak informed future outbreak management	Buffering capacity Reliability	• The hospital Trust recovered rapidly • Policies resulting from the outbreak were implemented systematically

R = reverse-phrased items. Scores were inverted for the purpose of analysis.

7.5 Stage 4: Piloting testing questionnaire

Having designed a draft questionnaire, the next phase involved pilot testing the questionnaire. A 'talk through' discussion of the content and phrasing of each statement on the questionnaire was carried out with infection experts including Directors of Infection Prevention and Control, infection control managers and senior infection control nurses. Individual items were amended to ensure consistent meaning for all respondents, to clarify poorly defined terms or phrases and to avoid asking multiple questions within one statement.(265) The introductory wording at the top of the questionnaire was refined to ensure that participants recalled a major infection outbreak or incident that impacted on more than one ward or unit. Participants were directed towards a Norovirus outbreak, major *C.difficile* or influenza outbreak as these would be likely to have an organisational-wide impact which was required to assess organisational resilience. Pilot testing of the questionnaire occurred with individual doctors, nurses and managers and further refinement of the questionnaire was based on their feedback.

7.6 Conclusion

In conclusion, the questionnaire was developed through an inductive iterative process between two theoretical resilience frameworks from the organisational resilience literature and empirical evidence from a detailed case study of an unexpected event. The questionnaire design was informed by chronological stages of an unexpected infection outbreak and associated resilience dimensions, which constituted each statement (item) on the questionnaire. The draft questionnaire was refined through feedback from a psychologist and was 'talked through' and pilot tested with experienced infection control practitioners to ensure it had face validity.

8 Chapter 8. Survey, analysis and findings of organisational resilience tool

This study is the first test of the properties of the organisational resilience questionnaire (tool), the development and design of which was described in Chapter 7 and is found in Appendix F. I will examine the factor structure of the questionnaire using principal components analysis (PCA) and the internal consistency of the structure using Cronbach's Alpha and discuss the findings and their implications. Table 8.1 sets out the stages that I will follow.

Table 8.1. Stages of survey implementation, analysis and findings

Stage 1 **Survey Process**	• Survey sample • Survey implementation • Process of data analysis
Stage 2 **Characteristics of Questionnaire Responses and Participants**	• Characteristics of questionnaire responses • Characteristics of respondents, acute hospital organisations, infection outbreaks
Stage 3 **Results**	• Kendall's tau-b correlation matrix • Principal Components Analysis (PCA) • Organisational Resilience Framework • Internal consistency of questionnaire
Stage 4 **Discussion**	• Discussion of findings • Conclusion

8.1 Survey Process

I tested the organisational resilience questionnaire using a survey of infection prevention and control practitioners in the UK and Republic of Ireland who had been involved in an infection outbreak in an acute hospital organisation in the last three years. I describe the survey sample, the implementation of the survey and the process of data collation and analysis.

8.1.1 Survey Sample

The sample population for the survey was acute hospital organisations in the UK and Republic of Ireland. The total number of acute hospital organisations in England (164), Scotland (16), Northern Ireland (5), Wales (7) and the Republic of Ireland (6) was identified

from data on government websites; the Department of Health, England, NHS Health, Scotland, Department of Health, Social Services and Public Safety, Northern Ireland[3] and the Health Services Executive, Republic of Ireland.[4]

The sample frame for the survey was acute hospital organisations that sent representatives to infection-focused national conferences that attracted a range of different professional groups, primarily nurses and doctors. These conferences were the Infection Prevention Society (IPS) Conference was attended on 19th and 20th September 2011 in Bournemouth, the Federation of Infection Societies (FIS) Scientific Conference was attended on 17th November 2011 in Manchester and a Govtoday Reducing Healthcare Associated Infections (HCAI) conference on 14th March 2012. These conferences were attended by delegates from a number of different health sectors, including acute, community, mental health and independent providers.

The sample of acute hospital organisations surveyed was 94 out of 198 (the total number of acute hospital organisations in the UK). 150 respondents completed the organisational resilience questionnaire in total, as there was more than one delegate per hospital in some cases in England, Scotland and Republic of Ireland. This sample of convenience represents responses from 47% of hospital organisations in the UK and the Republic of Ireland. This level of response rate is considered satisfactory when compared to the average response rate of 48.4% reported in academic journals in 1995 in a study undertaken by Baruch.(266)

8.1.2 Survey implementation

The survey was implemented using self-administered questionnaires that were handed out to conference delegates in the main exhibition hall of each conference. Conference delegates were asked if they worked in an acute hospital environment and only respondents who confirmed acute hospital status and incorporated infection prevention and control in their job role were asked to complete a questionnaire. Respondents were offered a small incentive of a chocolate if they handed back a completed questionnaire. In total, 150 questionnaires were collected over the duration of four days at the conferences.

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[3] Northern Ireland Hospital Statistics: Inpatient and Daycase Activity Statistics 2011/12. Department of Health, Social Services and Public Safety, Northern Ireland

[4] Health Services Executive: www.hse.ie/eng/services/Find_a_Service/hospitals/regionlist.html#n

8.1.3 Survey Analysis

Data collation and analysis was undertaken using SPSS a statistical software package using standardised tests following the methodologies outlined by Field.(267) Nominal and demographic data categories were screened for missing data fields and the data was tabled using frequency tables and graphed using histograms and checked for normal distribution. Where the distribution of demographic data categories was skewed, responses were analysed and regrouped where necessary, to create a lower number of categories for inferential analysis. The data was then re-graphed to assess whether the data showed a nearer to normal distribution. Questionnaires were reviewed to identify data that could appropriately be added to missing fields, e.g. where a department could be coded using the specialty category description.

8.2 Characteristics of Questionnaire Responses and Participants

Having completed the survey, I describe the characteristics of:

a) the responses given to the items on the organisational resilience questionnaire; and

b) the respondents, the acute hospital organisations they work in and the infection outbreaks that they recall.

8.2.1 Questionnaire Responses

The responses to each of the 28 questions on the resilience questionnaire were assessed. Respondents were asked to grade their responses on a Likert scale from 1-5, where a score of 1 equated to ‘strongly disagree’ and a score of 5 equated to ‘strongly agree.’ Where questions were reverse-scored, these scores were inverted for the purpose of analysis. Appendix G shows the mean, median, mode, standard deviation, skewness, kurtosis and range for each question. All items on the questionnaire were answered, showing the relevance of the items to the respondents. There were very few missed data items, only one item with 3 missing data points, the remainder of items with two or less missing data points out of 150 respondents. The mean scores indicate a negatively skewed distribution and the kurtosis scores indicate a leptokurtic distribution in the majority of variables.

8.2.2 Respondents

Respondents were analysed from their demographic data; post title, profession, grade, department and specialty and membership of infection control team. Table 8.2 shows the respondents grouped by post title and profession.

Table 8.2 Respondents grouped by post title and profession

Role/Professional Group (n=149)	Nurse	Doctor	Other Health Professional
Infection Prevention and Control Nurse	35	0	0
Senior Infection Prevention and Control Nurse	8	0	0
Lead Infection Prevention and Control	16	0	1
Clinical Specialist Infection Prevention and Control	12	0	0
DIPC/Assistant DIPC	12	5	0
Microbiologist	0	27	0
Infectious Diseases/Medical Microbiologist	0	11	0
Allied Health Professional	0	0	3
Nurse Manager/Practitioner	10	0	0
Doctor/Senior Lecturer	1	8	0
Total	94	51	4

Of the total number of respondents reporting in this category (n=149), the greatest number of respondents (n=94) were nurses, of whom the largest number (n=35) were infection prevention and control nurses. The second largest professional group was doctors (n=51) of whom over half (n= 27) were microbiologists and 11 were infectious diseases/medical microbiologists.

From a specialty perspective, 54.7% described their specialty as infection prevention and control. 22% described their specialty as microbiology, and 8% as infectious diseases/medical microbiology. The remainder (n=9) were respondents working outside infection prevention and control in specialties such as orthopaedics, medicine and renal medicine. The majority of respondents (68.7%) stated that they were infection control team members with 14.7% of cases stating that they were not members. 16.7% did not state whether or not they were a member of the infection control team. In summary, the

predominant respondents were infection control nurses on agenda for change bands 6-9, who were members of the infection control team with differing levels of managerial and leadership responsibilities.

8.2.3 Analysis of responses between professions

The variance between means of the two largest professional groups in the sample; doctors and nurses was analysed using a non-parametric Mann-Whitney test, which compares the means of two independent groups to determine if the variance is significant. Nurses' responses (Mdn=4.05), were significantly more positive than doctors (M=3.59), U=1037.00, p<.001, r=.47.

8.2.4 Acute hospital organisations

Hospital organisations were assessed by; name of hospital organisation, country, Foundation Trust or not and total number of wards. On initial review, the 150 respondents represented 94 acute hospital organisations within the UK. Respondents had indicated hospital organisation in a free text field, therefore a review of every hospital organisation was undertaken using hospital websites to determine which country the organisation was based in and if in England, whether it had foundation trust status or not. 87% of the sample was in England which is unsurprising given that the conferences were held in England. However, although the actual numbers of acute hospital organisations was low from other countries (13%), the total number of acute hospital organisations in these countries is also low (17%), therefore the response rates were acceptable. Of the English Trusts, 60% of cases were foundation trusts and 38% of cases were non foundation trusts with 2% from the independent sector.

8.2.5 Infection Outbreaks

Outbreaks were analysed on; organism, start date, duration and number of wards affected. Respondents were asked to recall the most recent major infection outbreak or incident (n=131) that had an impact on more than one ward or site. In the guidance section on the questionnaire, respondents were asked to recall a major Norovirus outbreak in the last 3 years (n=123), but if they could not, they were encourage to recall a major *C.difficile* problem (n=5) or influenza outbreak (n=1) during periods of increased incidence. If there was no relevant example, they were asked to recall a minor outbreak as an example (n=2); MRSA and Carbapenemase were listed. There were 19 missing data items in this category which equates to 12.6% of the total number of respondents. The term 'approximate' was used for outbreak start month and outbreak duration, as respondents did not have the actual dates to

hand at the conference, but used their best estimate of when the outbreak started and how long it lasted. The range of outbreak start months occurred between April 2009 and February 2012.

8.3 Results

I describe the results of the first test of the organisational resilience questionnaire, using Kendall's tau-b correlation to examine relationships between variables and investigate effect sizes, and then undertake principal components analysis to explore any components in the data and associated variables.

8.3.1 Correlations

As the data was found to have a non-parametric distribution, it was appropriate to apply Kendall's tau-b non-parametric correlation matrix to examine any relationships between the variables and to test whether the correlation coefficients are significant. Kendall's tau-b was chosen over Spearman's correlation coefficient as the dataset was small with a large number of tied ranks.(267) A two-tailed test was selected, as the research is exploratory and a relationship was expected, but the direction of the relationship was not predicted in advance. A detailed correlation matrix (Appendix H) was prepared that examined relationships between the 28 organisational resilience variables, displaying the significance value of each correlation and the effect size on which it is based. I have adopted Cohen's behaviourally-based thresholds for effect sizes where r=.10 (small effect), r=.30 (medium effect) and r=.50 (large effect).(268;269) The correlation matrix revealed a large number of significant correlations between variables.

Positive, significant ($p < .01$) and large effects for correlations existed between variables which related to clinical management and leadership and effective organisation of the outbreak. A strong, positive relationship existed between involving clinical leaders in decision making and implementing: a clinical strategy for controlling the outbreak ($\tau = .654$), outbreak-related policies ($\tau = .501$), a clear structure ($\tau = .511$), daily information on cases ($\tau = .506$) and an effective isolation policy ($\tau = .511$). A similar positive relationship was found between an effective leader taking control of the outbreak and implementing a clinical strategy for controlling the outbreak ($\tau = .629$). Further evidence of positive relationships between clinical leadership and organisational variables was the positive, significant correlation between rigorous implementation of outbreak-related policies and both implementation of a clinical strategy for controlling the outbreak ($\tau = .587$) and systematic

implementation of policies resulting from the outbreak. There were large numbers of positive, significant and medium/small effect correlations between variables and far fewer examples of no significant relationship between variables. The majority of variables had a specific impact within certain stages of the outbreak and not on other stages. A few variables had a negligible relationship with other variables, particularly, the variable, 'the elective pathway was severely impacted by the outbreak' (inverted).

8.4 Principal Components Analysis (PCA)

In the next section the rationale for applying principal components analysis (PCA) to the data is discussed and the PCA analysis is examined. PCA is used to establish which linear components exist within the data and how any particular variable might contribute to that component.(267) As a type of exploratory factor analysis, PCA is usually applied to a list of variables to understand which variables cluster in a meaningful way. The decision to use PCA, in place of factor analysis was based on the requirement for a larger sample size in factor analysis, i.e. > 300 participants to support a technique such as confirmatory factor analysis which provides a stable factor solution.(267) PCA is also a psychometrically sound procedure.(267) In this exploratory and preliminary research with a sample size of 150, which falls just within the minimum proposed limits of 5-10 participants per variable up to a total of 300(270), PCA was more appropriate as a technique. In order to assess the efficacy of the organisational resilience questionnaire, PCA was applied to a revised list of 23 questionnaire items, having excluded 5 items as a result of a reliability analysis, see Appendix I.

As a further test of the adequacy of the sample size, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were checked. The KMO score was .864 where values between .7-.8 are considered good, values between .8-.9 are considered great and values above .9 are superb.(267;271) This positive indicator of adequate sample size was also reflected in the Bartlett's test which indicated a significance of .000. Bartlett's test was highly significant ($p<.001$) and therefore factor analysis was appropriate. As an additional check, MacCallum proposes that a sample size of 100-200 should be sufficient with communalities of .5 or above.(272) All communalities were above .5 and the mean of the 23 communalities was 0.615.

As the underlying factors or components were expected to correlate, i.e. they are all related to organisational resilience practice in an infection outbreak scenario, an oblique rotation was chosen over an orthogonal rotation, specifically direct oblimin, with a delta setting of zero which is appropriate for the sample size of this dataset. With regards to factor extraction, an initial extraction was set at five factors, to reflect the five chronological stages (subscales) used in the preliminary questionnaire. Kaiser's criterion is to retain eigenvalues greater than one as components and as the resulting analysis indicated five components with eigenvalues greater than one, this also complied with Kaiser's recommendation.(273) Kaiser's criterion has been found to be accurate when the number of variables is less than 30 (23 in this dataset so this criterion is met) and when the resulting communalities, after extraction are more than .7. In this research, communalities varied from .5 to .8, and the mean communality was .615 so the components should be treated as exploratory. The scree plot was not used to determine the number of factors as this relies on a sample size of 200 or more to provide a reliable criterion for factor selection.(274) As the significance of a factor loading depends on sample size(267), Stevens recommends that for a sample size of 100, the loading should be greater than .512 and for a sample size of 200, should be greater than .367.(274) For the purposes of this research, with a sample size of 150, we have assumed that the mean of these two values, .438 would be an acceptable minimum loading to assume significance. In this dataset, based on the pattern matrix (see Table 8.3 below) all of the variable loadings were over .445 and can be considered acceptable significant values.

8.4.1 PCA Findings

For direct oblimin analysis, Field recommends reviewing both the pattern and structure matrices as the pattern matrix shows the unique contribution (loading) of a variable to a factor whereas the structure matrix shows the common variance and the relationship between factors.(267) The pattern matrix (Table 8.3) was reviewed, to determine which variables constituted each component. I examine each of the five components with their associated variables, in the context of the organisational resilience literature and with reference to the five subscales (chronological stages) within the organisational resilience questionnaire; routine practice, discovery of outbreak, immediate management, ongoing management and aftermath of outbreak. I found that component three reflected routine practice and component two reflected discovery of outbreak, with minor variations. Component one, four and five constituted a new arrangement of variables compared with the stages of outbreak; immediate management, ongoing management and aftermath of

outbreak. As a result, I derived a new understanding of all five components using the organisational resilience literature and examining the variables that constituted each component. I explain my interpretation of each component in more detail below:

8.4.1.1 Performance Capability (component 3)

I consider that the three variables that load onto component 3 reflect the capability within the organisation to manage performance efficiently during routine practice; therefore I use the descriptor 'performance capability' to describe this component. The three variables comprise of providing regular performance information to front-line areas, implementing appropriate performance targets in front-line areas and ensuring front-line staff are accountable for their performance. These variables loaded strongly onto component three, demonstrating values of 0.7 or higher with no cross-loadings onto other components. I have listed component 3 first, as it comprises three out of the four variables in stage one (routine practice) of the questionnaire which is chronologically situated prior to an outbreak. The fourth variable from stage one (routine practice), 'minor infection outbreaks were managed effectively' was placed in component five, so was interpreted as part of that component.

8.4.1.2 Responsive Capacity (component 2)

I considered that the variables associated with component 2 reflect the capability of the organisation to respond to the outbreak in an agile and aware manner. This capability comprises a rapid response with the implementation of range of measures to manage the event effectively. The variables associated with component 2 describe this measure; ensuring front-line staff understands the measures to manage the event quickly, correctly assessing the significance of the unexpected event, effectively communicating the event to senior leaders, involving experts in decision making and ensuring critical operational policies work effectively. For this reason, the descriptor, 'responsive capability' seems appropriate.

Of the six variables associated with component 2 in the pattern matrix, three of these loaded strongly onto component 2, demonstrating values of 0.7 or higher. Based on the structure matrix (see Table 8.4), of the three variables within the component that load onto other components, two variables; 'clinical leaders were involved in decision making' and 'the isolation policy operated effectively' have a cross-loading where the minimum difference of 0.200 between variables(275) was not met.

I have listed component two second, as all the variables included in stage two (discovery) of the questionnaire were retained, with the exception of one variable, 'the ward closure policy

was clear to all staff.' Instead, the variable, 'the isolation policy operated effectively' was included, which was previously within stage three (immediate management) of the questionnaire.

8.4.1.3 Adaptive Capacity (component one)

Component one was made up of five variables (see pattern matrix -Table 8.3) which I consider represent the adaptive capacity of the organisation to respond to an unexpected event through its capacity to adapt to new situations. The elements of organisational adaptation which the variables describe are: using learning to inform future practice, developing innovative solutions, moving to daily information availability and systematic implementation of new ways of working. Based on the structure matrix (Table 8.4) three of these variables had multiple loadings, but if a minimum difference of 0.200 was imposed(275), only two of these variables, 'innovative solutions were developed for unplanned problems' and 'outbreak policies were implemented rigorously' had a cross-loading (in each case the loading onto the component was >0.438 but there was a difference of <0.200 between variables).

8.4.1.4 Redundant Capacity (component four)

Component four is made up of three variables (see Table 8.3) which I consider reflect the redundant capacity of the organisation to respond to an unexpected event. The elements of redundancy described by the variables are the willingness of staff groups to work flexibly, the availability of additional resources when required, and the rapid creation of bed capacity when required. Based on the structure matrix (see Table 8.4) two variables load onto more than one component, one of which 'bed capacity was created rapidly' has a cross-loading where the minimum difference of 0.200 between variables was not met.

Table 8.3 Pattern matrix output from direct oblimin 5 factor PCA

Pattern Matrix[a]

	Component				
	1	2	3	4	5
Policies resulting from the outbreak were implemented systematically	.739				
Learning from the outbreak informed future outbreak management	.705				
Innovative solutions were developed for unplanned problems	.598				
Information on cases was available daily	.543				
Outbreak-related policies were implemented rigorously	.490				
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified		-.790			
The outbreak was identified within 48 hours		-.786			
The significance of the outbreak was underestimated		.708			
The outbreak was escalated to Trust executive directors within 48 hours		-.473			
Clinical leaders were involved in decision making		-.457			
The isolation policy operated effectively		-.445			
Performance targets for infection were used in clinical areas			.894		
Monthly infection control data was provided to clinical areas			.797		
Clinical teams were accountable for their infection performance			.690		
Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)				-.826	
Additional resources were made available when needed				-.669	
Bed capacity was created rapidly				-.455	
Minor infection outbreaks were managed effectively					-.721
The balance between patient safety and performance goals was achieved					-.642
An effective leader took control of the outbreak					-.618
A clear structure was implemented to manage the outbreak					-.572
The ward closure policy was clear to all staff					-.482
A clinical strategy for controlling the outbreak was implemented					-.480

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization. [a.] Rotation converged in 15 iterations.

Table 8.4 Structure Matrix output from direct oblimin 5 factor PCA

Structure Matrix

	Component				
	1	2	3	4	5
Policies resulting from the outbreak were implemented systematically	.767				
Learning from the outbreak informed future outbreak management	.733				
Innovative solutions were developed for unplanned problems	.688			.533	
Outbreak-related policies were implemented rigorously	.674			.441	-.557
Information on cases was available daily	.641	.401	.419		
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified		.834	.413		
The outbreak was identified within 48 hours		.783			
The significance of the outbreak was underestimated (inverted)		.676			
The outbreak was escalated to Trust executive directors within 48 hours		.606			
Clinical leaders were involved in decision making	.497	.597			-.490
The isolation policy operated effectively		.550		.489	
Performance targets for infection were used in clinical areas			.899		
Monthly infection control data was provided to clinical areas			.830		
Clinical teams were accountable for their infection performance			.744		
Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)				.829	
Additional resources were made available when needed	.459			.752	
Bed capacity was created rapidly	.523			.581	
Minor infection outbreaks were managed effectively			.434		-.743
An effective leader took control of the outbreak	.505				-.723
A clear structure was implemented to manage the outbreak	.407	.462	.454		-.716
The balance between patient safety and performance goals was achieved	.473			.411	-.712
A clinical strategy for controlling the outbreak was implemented	.580	.450			-.687
The ward closure policy was clear to all staff		.404			-.607

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

8.4.1.5 Management Capability (component five)

Component five comprises six variables, which I consider represent management capability to handle an unexpected event. These relate to resilience variables that reflect the organisation's capability to comprehensively manage an outbreak through effective management of smaller events, strong leadership capability, clear structures, effective cultural trade-offs, strategic use of expert networks and operational communication. Based on the structure matrix (see Table 8.4), all six variables had multiple loadings, but if a minimum difference of 0.200 was imposed(275), only one of these variables, 'a clinical strategy for controlling the outbreak was implemented' had a cross-loading (the loading was >0.438 with a difference of <0.200 between variables).

A revised model of organisational resilience during an unexpected event was developed to reflect these exploratory components arising from the PCA, see Figure 8.1 below and a reliability analysis was run using Cronbach's Alpha to check that the reliability of each subscale was an internally consistent reflection of the construct – see Table **8.5.**

Figure 8.1 Organisational resilience constructs relating to an unexpected event

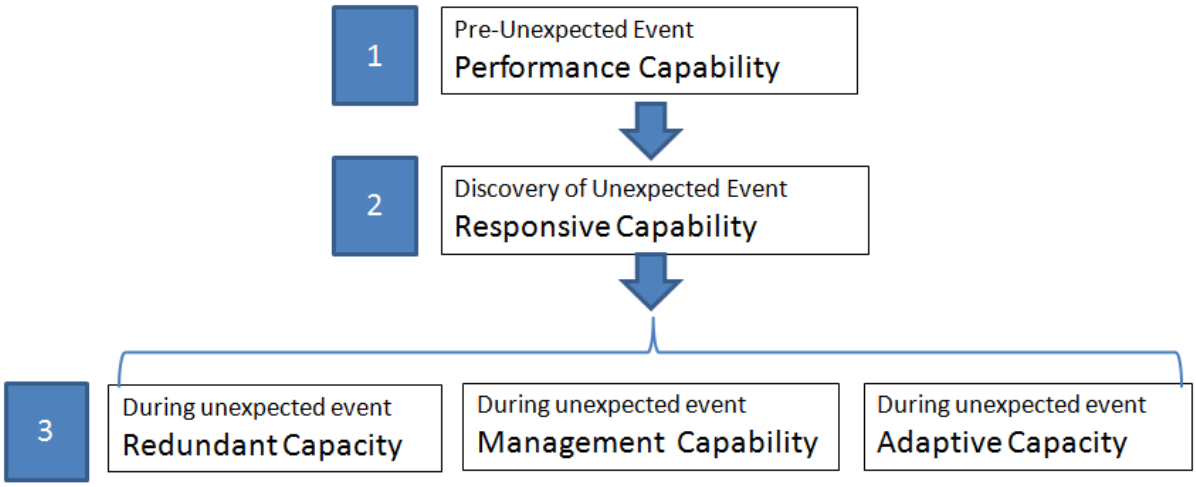


Table 8.5 Reliability Statistics for Revised Component Descriptors

Revised Descriptors for Unexpected Event Management Components	Cronbach's Alpha	Cronbach's Alpha based on standardised items	N of items
Performance Capability	.818	.817	3
Responsive Capability	.784	.799	6
Redundant Capacity	.696	.699	3
Management Capability	.823	.830	6
Adaptive Capacity	.795	.797	5

The corrected item-total correlation score identifies items that fail to correlate with the overall score from the scale. Field proposes that any item with a low correlation (less than .3) should be reviewed and potentially excluded as that item would reduce scale reliability.(267) The lowest corrected item-total correlation score was .42 so no item was found to reduce scale reliability significantly. The reliability analysis was calculated on all variables, as they loaded onto the component subscales. Cronbach's Alpha was .7 or above in each case and therefore reflected good internal consistency of each subscale.

8.4.2 Revised Organisational Resilience Questionnaire

The organisational resilience questionnaire was revised on the basis of the PCA. Five variables were removed that the reliability test prior to PCA identified as having a corrected item-total correlation score of less than .3. The variables were reorganised to reflect the new PCA component descriptions and variables were rephrased where cross-loadings between variables were less than 0.200. The revised questionnaire is shown in Table 8.6.

Table 8.6 Revised Organisational Resilience Questionnaire

MANAGEMENT OF INFECTION OUTBREAK QUESTIONNAIRE

Please read this section before completing the questionnaire:

This survey is designed to understand outbreak management in the acute hospital setting. When completing this survey, please recall the most recent major infection outbreak or incident that had an impact on more than one ward or site. The area of particular interest is the management of Norovirus but if you cannot recall a Norovirus outbreak in the last 3 years, a major *C.difficile* problem or influenza during periods of increased incidence would be suitable. If no relevant example, please tick this box ☐ and complete using a minor outbreak as an example. This survey will be anonymised and your answers are confidential.

Respondent										Outbreak Details	
Post/Title					ICT member	Yes				Organism causing outbreak	
						No				Approx. outbreak start date	
Dept/Unit										Approx. outbreak duration	
Profession	Nurse		Doctor		Pharmacist		AHP			No. of wards affected	
	Manager (non clinical)		Other		[Please state]					Total no. of wards in acute hospital organisation	
Specialty										Acute hospital organisation name:	
Grade	(AfC Band or medical level, e.g. Foundation 1, Consultant)										

These statements relate to **performance capability** pre-outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Performance targets for infection were used in clinical areas.					
Monthly infection control data was provided to clinical areas.					
Clinical teams were accountable for their infection performance.					
These statements relate to ***responsive capacity*** at the start of the outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified.					
The outbreak was identified within 48 hrs.					
The significance of the outbreak was underestimated.					
The outbreak was escalated to Trust executive directors within 48 hrs.					
Clinical leaders were available to react to the outbreak.					
The isolation policy was implemented immediately and effectively.					
These statements relate to ***redundant capacity*** during the outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)					
Additional resources were made available when needed					
Currently unused bed capacity was created rapidly					
These statements relate to ***management capability*** during the outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Minor infection outbreaks were managed effectively					
The balance between patient safety and performance goals was achieved					
An effective leader took control of the outbreak					
A clear structure was implemented to manage the outbreak					
The ward closure policy was clear to all staff					
Clinical managers directed clinical teams appropriately.					
These statements relate to **adaptive capacity** to resolve the outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Policies resulting from the outbreak were implemented systematically					
Learning from the outbreak informed future outbreak management					
Innovative solutions to problems were implemented					
Information on cases was available daily					
New ways of working from the outbreak were implemented rigorously					

8.5 Discussion

This study addresses a shortfall of measurement studies in the organisational resilience literature. The nearest comparator is a recent measurement study that used PCA to establish resilient factors relating to rail engineering planning. This study was designed using resilient concepts from the resilience engineering literature, rather than empirically based data. It aimed to assess the preparedness of the system to respond to both expected and unexpected conditions. However, the outcome of the PCA showed no direct relationship to the four main resilience factors that were originally derived from the literature.(147).

In contrast, I developed a more robust study, designing a unique empirical measurement tool for organisational resilience in the context of an unexpected event. I achieved this by designing a questionnaire based on chronological stages of an outbreak from my empirical research which fitted broadly with theoretical frameworks from the literature.(20;22) I focused my questionnaire on unexpected conditions to test specifically one contextual aspect of organisational resilience. Using PCA (Table 8.3), I identified five components (two of which reflected the chronological stages of an outbreak) with strongly loaded associated variables. I reviewed these components and described them as; performance capability, responsive capability, redundant capacity, management capability and adaptive capacity. Finally, I redesigned my organisational resilience questionnaire in line with the findings from the PCA.

The five components described above, relate closely to the organisational resilience literature. The strong positive loadings (> .7) and the unique relationship of the three performance-oriented variables onto the component 'performance capability' suggest that this is a significantly independent component and is highly relevant as a precursor to an unexpected event. This finding contributes to the literature on resilient performance, as these results confirm that having robust performance mechanisms in place in routine practice are an important facet of resilience during an unexpected event.

All the variables, bar one, loaded strongly (>.45) onto the component that I described as the 'responsive capability' of the organisation. These variables represented the organisation's ability to respond rapidly and effectively to an outbreak, using sensemaking(64;153;237;276) and sensegiving (239;277-280) strategies to: rapidly identify the outbreak, correctly estimate the significance of the outbreak, ensure that operational measures to manage the outbreak effectively were understood by staff, escalate communication to senior leaders and involve

relevant experts in decision making. Few empirical studies have attempted to measure sensemaking and sensegiving strategies as they have been viewed as sufficiently complex to make measurement difficult. In this study, I contributed to the literature by developing theoretically- derived sensemaking and sensegiving statements that reflected practical, measurable activities. As two of the variables associated with this component cross-loaded onto other components (difference between variables <0.200) I refined two statements, to more closely reflect responsive capability.

The component, redundant capacity, clearly relates to the literature on resilience and redundancy which suggests that a reasonable level of organisational redundancy is required, to ensure the organisation has the resources to respond in a rapid and flexible way to unexpected events. Too great a level of redundant resources causes the organisation to become inefficient. (20) The three elements of redundancy described in the variables were: 'staff willingness to work flexibly', which in the case study related to staff working additional hours for no extra pay, taking on additional roles and working in different environments; 'additional resources were made available when needed', which in the case study reflected the willingness of managers and directors to release additional resource into the organisation regardless of cost and 'bed capacity was created rapidly' which in the case study reflected an organisational focus on freeing up bed spaces by discharging patients and reorganising the hospital space. The contribution to the literature that this component provides, whilst requiring some fine tuning, is that it measures the ability of the organisation to free up and use redundant or unused capacity, rather than just measuring the volume of redundant capacity that exists. Many organisations may be able to identify redundant capacity, but it requires a resilient organisational culture to create the conditions that enable redundant capacity to be rapidly converted into a useful currency.

The component, management capability, relates to many of the organisational concepts identified in the literature review (Chapter 3) that relate to resilience; leadership, structures, trade-offs, tracking and managing small failures, and having clear operational strategies and policies that are clear to front-line staff. As with the previous component, redundant capacity, the contribution to the literature that this component provides, is that it is not sufficient to have management capability in place, e.g. a leader, a ward closure policy, but these have to be adequately implemented. A leader has to be effective and take control of the unexpected event and the operational policy or strategy has to be implemented and made clear to all staff. It is the active and effective use of management capability that ensures the organisation operates resiliently. A further contribution to the literature is that

these variables have been found to load onto this component. In the current literature (Chapter 3), there is a lack of clarity about the contribution of these concepts to either unexpected events or routine continuous stressors within an organisation. Many studies identify potential relationships between two or more organisational concepts, but these are often hypothesised relationships which have not been tested empirically, or the study focuses on one organisational concept in depth, ignoring interrelationships. This study identifies management-related organisational concepts that are shown to be significantly associated with a construct of management capability.

The final component, adaptive capacity, reflects the resilience literature which relates to organisational adaptation.(4;22;136) The contribution to the literature of this component is the identification and testing of measurable, adaptive practices in healthcare which can be associated with an overall construct of adaptive capacity. The variables that grouped together to form this component related to: the capacity of the organisation to learn from the outbreak to inform future outbreak management, the development of innovative solutions to unplanned problems, rigorous and systematic implementation of policies and daily accessibility of information. Each of these variables required the organisation to adapt to the unexpected event, by using strategies that went beyond those required in routine practice.

The overall contribution of this questionnaire to the organisational resilience literature is in providing a unique, if exploratory, organisational resilience measurement tool that can be used by healthcare practitioners and academics to measure levels of organisational resilience pertaining to an unexpected event. There are few examples of measurement in the literature(103;106;111;139;141) and none pertaining to organisational-level resilience during unexpected events. This study also contributes to the organisational resilience healthcare literature by providing a healthcare-specific measure of organisational resilience, relating to a topic of high importance in healthcare; infection prevention and control. The questionnaire has face validity for healthcare practitioners, as it is developed based on empirical data describing infection outbreaks. It is a useful tool for all acute hospital organisations, to enable them to benchmark their organisational resilience in relation to infection outbreaks. A further development of the questionnaire for healthcare would be to develop questions that are relevant to other healthcare sectors and to develop versions that relate to other non-infection types of unexpected events. As a first step, testing the revised questionnaire using a broader random sample of practitioners would strengthen and confirm the findings.

The limitations of this questionnaire are that it was developed from a convenience sample, rather than a random sample and this should be addressed in future research using the revised questionnaire. Although a benefit of using participants who had an organisational overview is that they were able to consider the management of an outbreak from an organisational perspective, the higher means for each statement may have resulted from infection control professionals scoring their own practice in managing the outbreak more highly than other organisational members might have done. This would be worth exploring more fully in future research by incorporating participants from a broader range of professional groups. A further issue was that the sample size of 150 was too low to undertake confirmatory factor analysis, and this could be addressed using a larger sample when testing the revised questionnaire.

8.6 Conclusion

As the previous discussion section has outlined, this study is a positive first exploration of an organisational resilience measure for unexpected events. My primary contribution, in terms of advancing organisational resilience research, is the development of an organisational resilience questionnaire that pertains to an unexpected event. The nearest comparator in the resilience literature is a measure of resilience during expected conditions, focused on rail engineering(147) as the few examples of measurement studies in the literature are either business decision support tools(106;139;141) or untested theoretically derived measurement tools.(111) I identified five constructs of capacity and capability building during an unexpected event: performance capability, responsive capability, redundant capacity, management capability and adaptive capacity. These constructs have been identified in theoretical frameworks, but without the detailed description of associated variables and have not been tested empirically. Whilst this research is exploratory, these findings provide an empirical basis for developing future studies, which will address a significant gap in research to date.(24)

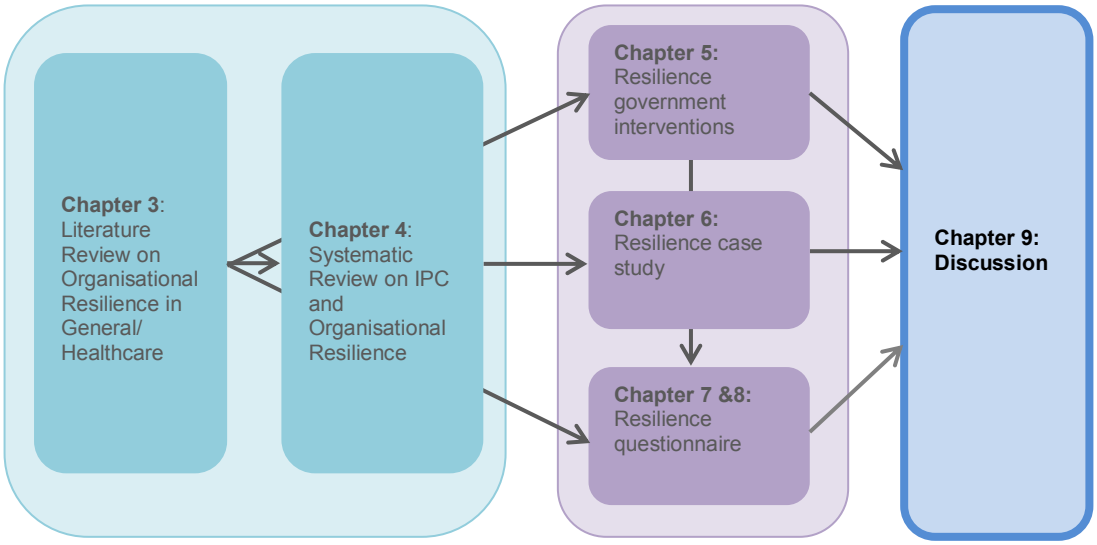
From a methodological perspective, one limitation of this study was the use of a convenience sample, although this achieved a 47% response rate across UK and Republic of Ireland hospital organisations. To ensure robustness, future sampling strategies may include the whole UK acute hospital population, rather than a sample group. A further limitation was the sample size of 150 that prevented the use of confirmatory factor analysis. Future work may include running the adjusted questionnaire with a larger (300+) sample that supports confirmatory factor analysis.

From a professional standpoint, an interesting finding is the significant difference in responses between nurses and doctors. Although this will not have a statistically impact on this study, it would be interesting to follow up this study with a qualitative approach to understand why these differences exist and whether the difference reflects a professional-level difference in attitude and outlook or issues relating specifically to an outbreak scenario.

From a healthcare practitioner perspective, the study demonstrated how useful a large outbreak event is in testing organisational resilience. Whilst acute hospital organisations are more aware of the need for preparedness and business continuity plans such as the Hospital Incident Command System in the US(281), these plans can often be mechanistic and structural in design and are silent on the cognitive and behavioural elements of managing an unexpected event resiliently. The questionnaire in this study attempts to measure both cognitive-behavioural and socio-technical aspects of resilient practice.

9 Discussion

In this chapter I begin by demonstrating how each of the objectives of the thesis have been met, before summarizing the contribution that this thesis makes to the literature, identifying the potential directions for future research, assessing the implications for clinical practice and finally, discussing the implications for policy.



9.1 Fulfilling the thesis objectives

At the start of this thesis I aimed to examine organisational resilience in UK acute hospitals, using an exploratory case study and empirical analysis, based on the following objectives:

- to investigate what is known about the concept, associated factors and application of organisational resilience to UK acute hospitals
- to explore theoretically and empirically the two contexts for organisational resilience (expected conditions and unexpected events) and;
- to design and test an organisational resilience tool to measure organisational resilience during an unexpected event.

In the next section, I explain how each of these objectives has been met.

9.1.1 To investigate what is known about the concept, associated factors and application of organisational resilience to UK acute hospitals

I undertook two reviews to investigate what is known about the concept, associated factors and application of organisational resilience to UK acute hospitals. Firstly, I conducted a literature review to understand the conceptual and empirical development of organisational resilience and how it has been applied in the healthcare context (Chapter3). The literature review addressed a gap in existing literature reviews of resilience and organisational resilience, which were either too broad(1;2), lacked methodological rigour(97) or had a practitioner focus.(98)

I found that the organisational resilience literature was diverse and disjointed as a result of ontological differentiation between disciplines. This had adversely affected the overall conceptual development of organisational resilience, although recent work had recognized the benefits of amalgamating approaches to create a multidisciplinary perspective on resilience. The literature review highlighted the conceptual breadth of organisational resilience, but the majority of studies focused on individual concepts and the few models and frameworks that had been developed were not empirically tested.

Secondly, I adopted a novel strategy of systematically reviewing infection prevention and control responses to infection outbreaks within acute hospitals to examine resilience factors (Chapter 4). I found evidence to support a reduction in the impact of outbreaks in the acute health care setting as a result of organisational resilience interventions although only six intervention studies met the selection criteria and these lacked statistical robustness for primary measures.

9.1.2 To explore theoretically and empirically the two contexts for organisational resilience (expected conditions and unexpected events)

In this thesis, I have explored theoretically and empirically the two contexts for organisational resilience. The main contribution of my first study (Chapter 5) was to apply a Foucauldian framework to a novel arena; infection prevention and control in hospitals. I identified the creation of a cadre of self-surveilling leaders with new identities who contributed to organisational resilience through the construction of new routines and a new governance order. A supporting modest theoretical contribution was, in contrast to much of the existing literature on the adoption of information communication technology (ICT) in healthcare, to exemplify a positive outcome in using ICT to construct a novel surveillance system in healthcare. Empirically, I contributed by using qualitative embedded case study to study organisational resilience in the context of routine practice. The primary contribution of my second study (Chapter 6) was to make a modest theoretical contribution by adding a

category of ‘intermediate’ resilience in contrast to the polarized categories in the literature of high and low resilience. A further supporting theoretical contribution was to identify sensemaking as a dynamic and changing process throughout the unexpected event and to identify that different types of sensemaking were evident at different stages. I contributed empirically to the literature by undertaking a detailed qualitative case study of an unexpected event analysed using social science frameworks.

9.1.3 To design and test an organisational resilience tool to measure organisational resilience in the context of an unexpected event.

My primary contribution, in terms of advancing organisational resilience research, is the production of an organisational resilience questionnaire that measures organisational resilience in relation to an unexpected event. I identified five constructs of capacity and capability building during an unexpected event: performance capability, responsive capability, redundant capacity, management capability and adaptive capacity. These constructs broadly reflect theoretically derived constructs from the literature which have not been tested empirically previously. The variables associated with each of these constructs explain how organisational resilience functions in detail.

9.2 Overall contribution to the study of organisational resilience; the case of infection prevention and control.

The overall aim of my thesis was to examine organisational resilience in UK acute hospitals, focusing on infection prevention and control. I assess my contribution to the organisational resilience literature in this section.

9.2.1 The development of a measure of organisational resilience

A significant contribution to the organisational resilience literature is the development of an organisational resilience questionnaire to measure organisational resilience in the context of an unexpected infection event. The literature on measuring organisational resilience is sparse, as identified in my organisational literature review in Chapter 3 with few examples of measurement studies in the literature. Those that exist are either business decision support tools(106;139;141) or untested theoretically derived measurement tools.(111) The development of a tool to measure organisational resilience is innovative for several reasons. Firstly it is built on the qualitative findings of a detailed empirical study of resilience therefore the questions derived from the study have face validity. This contrasts to other resilience questionnaires which are built on theoretical constructs from the literature or have not been

tested.(111;147) Secondly, the questionnaire reflects a multidisciplinary theoretical perspective, incorporating questions that build on a cognitive behavioural framework(55) and a systems/structural framework(83;247) compared to the uni-disciplinary approach evident in much of the literature. The only recent example in the literature of a measurement tool is a study that focuses on expected conditions(147), whereas this tool is unique in its focus on an unexpected event.

A further contribution is the identification of an organisational resilience framework for an unexpected event that identifies five overarching constructs; performance capability, responsive capability, redundant capacity, management capability and adaptive capacity that are related to chronological stages of an unexpected event. A key feature of this framework is that the constructs are generic and could be applied to unexpected events in other settings. Although theoretical models and frameworks describing unexpected events exist in the literature(20;22;138), the majority have not been empirically tested or derived.

9.2.2 Applied social science literature to a novel arena

The theoretical utility of two social science perspectives; Weick and Foucault to the study of organisational resilience was to provide new insights that had not previously been seen. Both perspectives were practically useful as they provided an analytical framework to assess the empirical data and enabled an in-depth understanding of the study in question. Weick's sensemaking perspective, with its focus on cognition and behaviour, enabled analysis of the dynamics of individual and team interaction in a complex hospital setting. Foucault's governmentality theory, with its focus on power, knowledge and social control enabled analysis of new indirect modes of control juxtaposed with established hierarchical modes of control.

I make a modest theoretical contribution of an 'intermediate resilience' category to the literature using sensemaking theory. The resilience literature is polarised, with research on high resilience/high reliability (26;192) or low resilience/failing (18;19) organisations. Few examples of healthcare research exist which address organisational resilience in the majority of organisations.(111) The intermediate resilience category has features of resilient practice and resistant practice and the overall outcome for the organisation is determined by the trade-off between the two, influenced by a series of factors, including the strength of leadership. I developed an organisational resilience framework that incorporated these different levels of resilience with associated sensemaking characteristics of culture, cognition and behaviour.

I found that the level of resilient practice was linked to the type of sensemaking that was exhibited, so distributed sensemaking reflected more resistant practices, whereas collective sensemaking reflected more resilient practices. This was in contrast to the literature where the majority of studies referred either to static sensemaking or assessed one type of sensemaking empirically.

I applied Foucauldian theory to study organisational resilience across a healthcare system. I identified a positive, ICT-enabled national surveillance strategy using novel and indirect control modes that significantly reduced MRSA and *C.difficile* rates nationally. This strategy is not representative of the findings of previous studies of ICTs in health where most empirical cases find that ICTs fail to deliver the predicted outcomes and tacit clinical resistance is observed.(209;212-214) In assessing the impact of these novel and indirect control modes on organisational resilience, I found that they had a largely positive impact overall on hospitals' resilience in reducing infection. However, unintended consequences were evident, resulting from the close scrutiny of specific organisms which distracted attention and resources away from hospitals developing a more holistic approach to infection prevention and control and addressing the potential threat of other hospital-acquired infective organisms. I considered that the most effective indirect mode from a resilience perspective was the active and creative enrolment in self governing and self surveillance by clinical managerial hybrids who experienced strong identity shifts. This positive adjustment which involved clinical hybrids in the construction of new routines and a new governance order was found to create a long-term resilient capability to reduce infection rates in hospitals.

9.2.3 Adopting a mixed methods approach

The mixed methods approach proved successful in spanning the ontologically diverse organisational resilience literatures and facilitated a multidisciplinary approach that incorporated social science and natural sciences methods and integrated the literature from several disciplines to develop new findings.

I used different approaches throughout the thesis:

I successfully developed and tested a quantitative measurement tool that derived from a social science approach using qualitative methods. I applied behavioural (sensemaking) and structural (resilient engineering) analytical frameworks to an in-depth qualitative case and used thematic analysis to build the evidence base for a quantitative approach. This

effective approach, involved the use of empirical studies in addition to theoretical conceptualising, which ensured that the variables reflected actual rather than hypothesised resilience practice and improved the face validity of the questionnaire.

In a further study (Chapter 4), I successfully identified resilience factors in an unexpected infection event using a multi-methods approach to conducting a systematic review. I used quantitative methods to undertake the quality assessment of papers, but applied social sciences thematic analysis to extract the resilience factors. Using these techniques, I was able to assess both the statistical veracity of the papers and explore in more depth the underlying resilience themes.

9.3 Methodological issues and limitations

From a methodological perspective, a significant issue is that the organisational resilience literature is disjointed and ontological diverse and the healthcare-focused organisational resilience literature is poorly developed. Building on existing research is problematic as few theoretical or empirical precedents exist and research themes are generally uni-disciplinary. To address these issues and achieve theoretical integration required a multidisciplinary perspective utilising a range of theoretical perspectives from different paradigms, with a mixed methods approach.

The limitations of each study are explored below:

In researching the systematic review (Chapter 4) I found a limited number of papers that were relevant to the review criteria, as the majority of papers adopted an epidemiological, clinical or microbiological focus, rather than an organisational perspective on infection outbreaks. As a result, only six papers were systematically shortlisted which reflected the need for further research in this area.

I was restrained in my questionnaire study (Chapter 7&8) from undertaking confirmatory factor analysis owing to smaller sample size than is required for this analysis. My use of a convenience sample based on conference attendees provided a larger sample than I may have achieved through a random sample, but this was less representative of the overall healthcare population.

In my empirical case study (Chapter 6) I was limited to some extent by the use of a critical incident that had occurred two years prior to the interview study. Although this was identified by participants as a significant organisation-wide outbreak and therefore remained vivid in

their memories, some participants who were named in the snowball sampling design had left the organisation and could not be traced and others had changed roles and were less willing to participate. In some circumstances the gap between interview and event affected the recall of specific events.

I designed my multi-level empirical study (Chapter 5) using one embedded case study which provided an in-depth understanding of behaviours, but the study could have been strengthened by the use of comparative empirical studies which would have assisted in generalising the findings.

9.4 Future research

As Vogus and Sutcliffe argue, there are many avenues for future research within the field of organisational resilience.(24) My research for this thesis has highlighted some key areas that would benefit from further studies. The first area is the development of measures of organisational resilience. Robust measures would contribute to a field which has few empirically derived and tested measures. Further research is required to test my revised organisational resilience questionnaire on a randomised, large sample which would support confirmatory factor analysis. The application of this measure to other unexpected events within healthcare and its broader application to other industries would be useful. Future research on measures of organisational resilience in different contexts would be valuable, for example, under routine expected conditions impacted by change, stress or disturbances.

The application of social science perspectives was found to be helpful in this thesis and provided novel insights. The use of social science frameworks to analyse organisational resilience in other contexts, particularly the in-depth study of organisational resilience during expected conditions and from a system context would be valuable.

Empirically, the field of infection prevention and control provided a rich seam of data for testing organisational resilience theories in a healthcare context. The contextual use of IPC for future research on resilience would be beneficial. Future empirically-based research is required, to either confirm or contest existing theoretical frameworks and models and to develop new empirically derived models.

Overall, there is scope to extend a multidisciplinary approach to organisational resilience research with the aim of combining different ontological and methodological approaches, to

achieve a more comprehensive understanding of organisational resilience in different contexts.

9.5 Implications for clinical practice

This research has many implications for clinical practice. I have developed an organisational resilience tool (Chapter 8) to assess the management of unexpected infection events, which will assist clinicians and managers in reviewing their approach to infection outbreaks with a view to improving practice in the future. Although there is evidence of learning from outbreaks at national and local level, this tool provides a systematic approach to assessing and potentially benchmarking practice within and between acute hospital organisations.

I have created a detailed chronological map of resilience during an outbreak (Chapter 6), which will be helpful for clinicians and managers to understand the different stages of an outbreak to assist with planning and preparedness prior to an outbreak and strategies to manage structural and behavioural issues during an outbreak.

My systematic review (Chapter 4) provides a structured basis for understanding the resilience factors across outbreaks related to different organisms. This will assist with developing more generic, organisational approaches to preparedness for outbreaks, which will contribute to developing organisational resilience.

9.6 Implications for policy

Nationally, there is an increased interest in organisational resilience particularly in the context of disaster planning. Greater governmental awareness exists of the need for organisational and system resilience, particularly in relation to issues such as pandemic flu or bad weather conditions. As there is no thorough review of the organisational resilience literature in place, my literature review will contribute to the development of policy on resilience. My systematic review has identified resilience factors relating to outbreak situations, which will contribute to the policy development on pandemic planning and preparedness. Pandemic preparedness often occurs within the context of a single infective organism based on the most recent pandemic to have occurred. The systematic review develops generic factors that cut across individual organisms and have broader usefulness for policy. I have developed a tool for measuring organisational resilience during unexpected events which could be used, with further testing, as a benchmarking tool for

resilient practice across hospital organisations and as a self-assessment measure to facilitate learning following an outbreak.

10 Conclusion

In conclusion, this thesis has contributed to the organisational resilience literature on a number of levels and to a range of audiences: academics; practitioners, managers and policy makers.

Firstly, a literature review of organisational resilience highlighted the gaps and inconsistencies in the literature arising from the ontological differentiation of the literature, the uni-disciplinary approaches and the inadequate empirical testing of theoretical models. The audience is intended to be academics interested in the study of organisational resilience. A comprehensive and robust literature review of organisational resilience is lacking in the literature. This review addresses that gap, through the critical assessment of emerging themes, gaps and areas for future research in the organisational resilience literature.

Secondly, a novel systematic review assessing the resilience of hospital's responses to infection outbreaks provided a unique contribution to the organisational resilience literature through the systematic identification of a pattern of resilient factors across the selected studies of infection outbreaks. Potential avenues for future research include the application of the systematic review methodology to developing countries. This systematic review contributes to the field of infectious diseases, informing practitioners and managers of generic resilient interventions that can be adopted in hospital practice to reduce the impact of infection outbreaks. From a policy making perspective, it informs emergency preparedness policy development, in providing an overview of commonly applied practical interventions that are effective across a range of infective organisms at organisational level. This thematic organisational level approach contrasts to much of the infectious diseases literature which has a single organism, clinical or epidemiological bias.

Thirdly, I identified the concept of 'intermediate' resilience in contrast to the polarized positions of high and low resilience and incorporated these concepts into a framework with associated sensemaking characteristics of culture, cognition and behaviour. Further research in this area might involve comparative studies to further test and refine the framework, develop the links to organisational performance and to develop our

understanding of the process of sensemaking during an unexpected event. I contributed to the literature on sensemaking and organisational resilience by identifying a process of dynamic sensemaking throughout an unexpected event and found that different types of sensemaking were related to more or less resilient practices. This study makes a modest contribution to the organisation studies field, in developing category of 'intermediate' resilience, developing the theory on sensemaking and exploring the relationship between sensemaking and organisational resilience. Within acute hospitals, it will contribute to practitioners and managers' understanding of the impact that the dynamic process of sensemaking has on organisational performance and the resilient interventions that can contribute to a positive organisational outcome.

Fourthly, my research exemplified a positive outcome in the use of ICT-enabled national infection surveillance programmes, improving the resilience of hospitals to the impact of rising MRSA and *C.difficile* rates. The adoption of self-surveillance by clinical leaders was highlighted as a successful organisational strategy for monitoring and reducing infection rates. This study contributes to the academic literature on ICTs in healthcare, both to the organisatiol studies literature on Foucauldian governmentality and to health policy literature on macro-level interventions to improve organisational outcomes. Future research in this area, might involve comparative studies that consider the use of novel indirect control modes in other sectors to assess whether they impede or encourage organisational resilience and the mechanisms by which these occur.

Finally, at an interdisciplinary level, the identification of five generic constructs of resilient practice during an expected event contributes from both a theoretical and empirical perspective. Theoretically, the quantification of organisational resilience contributes to the resilient engineering literature as previously, attempts to quantify the construct have been undertaken either abstractly or on expected events. The five resilience constructs identified in this thesis, whilst a preliminary insight, develop our theoretical understanding of the interrelationship between the chronological progression and the resilience components of an unexpected event as it unfolds. Critically, the empirical development and testing of an organisational resilience questionnaire contributes to the academic literature by: providing a more robust basis for testing an organisation's approach to an unexpected event; and addressing a significant gap in the literature for measurement studies. The strengths of this tool from an academic perspective are that it builds on a prior in-depth qualitative analysis of an unexpected event and that it incorporates multidisciplinary theoretical perspectives. From a practitioner and management perspective, this tool provides a mechanism for

hospitals to review retrospectively their resilience performance and identify areas of low and high resilience which can inform strategies for improvement. The tool can be used to compare the responses of different professional groups or specialties, highlighting variances that can be addressed. Further development of this research will involve the refinement of the tool and more extensive testing by broadening the sample frame and introducing random sampling. Whilst this tool is currently contextualised as a hospital's response to an outbreak, future research might consider the potential for creating a generic tool that builds on this preliminary version that can be tested comparatively across different health or industry sectors.

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Appendix A - Search Strategies for Systematic Review

A.1 Resilient Unexpected Infection Events Embase 03 Oct 2012

1. leadership/
2. "organization and management"/
3. communication/
4. in service training/
5. professional development/
6. hospital management/ or administration, hospital.mp.
7. practice guideline/
8. personnel management/
9. adaptive behavior/
10. patient safety/
11. error correction.mp.
12. error discovery.mp.
13. resilience.mp.
14. coping behavior/
15. error recovery.mp.
16. error prevention.mp.
17. "task performance"/
18. critical incident analysis.mp.
19. critical incident prevention.mp.
20. monitor.mp.
21. sentinel surveillance/
22. risk reduction/
23. awareness/
24. risk management/
25. defences.mp.
26. hospital planning/
27. intervention studies/
28. scenario planning.mp.
29. recover.mp.
30. mitigation.mp.
31. organizational systems.mp.
32. redundancy.mp.
33. competitive behavior/
34. hospital bed capacity/
35. capacity building/
36. organizational structures.mp.
37. decision making/
38. behavior/
39. adaptable.mp.
40. flexible.mp.
41. patient care/
42. role playing/
43. bricolage.mp.
44. organization/ or organisational culture.mp.
45. (organizational learning or organisational learning).mp.
46. policy/ or organi?ational policy.mp.

47. (organisational strategy or organizational strategy).mp.
48. organisational innovation.mp.
49. change management/ or organi?ational change.mp.
50. behavio?r change.mp.
51. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50
52. Infection Control/
53. infection prevention.mp.
54. infection management.mp.
55. Cross Infection/
56. Staphylococcus aureus/
57. Staphylococcus infection/
58. Methicillin-Resistant Staphylococcus aureus/
59. Clostridium difficile/
60. Clostridium Infection/
61. Enterococcus faecium/
62. Klebsiella pneumoniae/
63. Klebsiella infection/
64. Acinetobacter baumanni.mp.
65. Acinetobacter infection/
66. Pseudomonas aeruginosa/
67. Influenza A Virus H1N1/
68. extended spectrum Beta Lactamase/
69. New Delhi Metallo-Beta-lactamase-1.mp.
70. Norovirus/
71. surgical infection/ or surgical site infection.mp.
72. urinary tract infection/
73. hospital acquired pneumonia/
74. ventilator associated pneumonia/
75. Clostridium difficile associated disease.mp.
76. bloodstream infection/
77. Catheter infection/
78. Enterobacter/
79. 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78
80. 51 and 79
81. disaster planning/
82. emergency health service/
83. unexpected.mp.
84. emergency/
85. emergency preparedness.mp.
86. (disease outbreak* or outbreak*).mp. or epidemic/
87. superbug.mp.
88. 81 or 82 or 83 or 84 or 85 or 86 or 87
89. 80 and 88
90. limit 89 to (human and english language and yr="1999 -Current")

A.2 Resilient Unexpected Infection Events HMIC 03 Oct 2012

1. Leadership/
2. Administration/
3. Communication/
4. Inservice training/
5. Professional development/
6. Management/
7. Hospital administration/
8. guideline adherence.mp. or Clinical guidelines/
9. Human resources management/
10. Feedback/
11. Patient safety/
12. error correction.mp.
13. error discovery.mp.
14. resilience.mp.
15. error recovery.mp.
16. error prevention.mp.
17. Performance/ or Organisational analysis/
18. critical incident analysis.mp.
19. critical incident prevention.mp.
20. monitor.mp. or Monitoring/
21. Disease surveillance/
22. risk reduction behaviour.mp.
23. Awareness/
24. Risk Management/
25. defences.mp. or defence mechanisms/
26. Management Planning/
27. intervention stud*.mp.
28. scenario planning.mp.
29. recover.mp.
30. mitigation.mp.
31. organisational system.mp.
32. redundancy.mp.
33. competitive behaviour.mp. or Competition/
34. hospital bed capacity.mp. or Bed management/
35. Capacity building/
36. Organisational structure/
37. Decision making/
38. exp Power/
39. adaptable.mp.
40. Behaviour adaptation/
41. flexible.mp.
42. Health care teams/
43. Role playing/
44. bricolage.mp.
45. Organisational Culture/ or organizational culture.mp.
46. organizational learning.mp. or Organisational learning/
47. exp Policy/
48. organizational strategy.mp. or Organisational strategy/
49. organizational innovation.mp. or Innovations/
50. organizational change.mp. or Organisational change/

51. Behaviour change/
52. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51
53. Infection Control/
54. infection prevention.mp.
55. infection management.mp.
56. Health care associated infection/
57. Staphylococcus aureus.mp.
58. Staphylococcal Infections/
59. Methicillin-Resistant Staphylococcus aureus/ or meticillin resistant Staphylococcus aureus.mp.
60. Clostridium difficile/
61. Clostridium Infections/
62. Enterococcus faecium.mp.
63. Klebsiella pneumoniae.mp.
64. Klebsiella Infections/
65. Acinetobacter baumanni.mp.
66. Acinetobacter infections/
67. Pseudomonas aeruginosa.mp.
68. Influenza A Virus H1N1.mp.
69. Extended Spectrum Beta-Lactamase.mp.
70. New Delhi Metallo-Beta-lactamase-1.mp.
71. Norovirus.mp.
72. surgical site infections.mp.
73. Urinary Tract Infections/
74. hospital acquired pneumonia.mp.
75. ventilator associated pneumonia.mp.
76. Clostridium difficile associated disease.mp.
77. bloodstream infections.mp.
78. Catheter infections.mp.
79. Enterobacter.mp.
80. 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79
81. 52 and 80
82. Emergency Planning/
83. Emergency Services/
84. unexpected.mp.
85. exp Emergencies/
86. emergency preparedness.mp.
87. (disease outbreak* or outbreak*).mp.
88. superbug.mp.
89. 82 or 83 or 84 or 85 or 86 or 87 or 88
90. 81 and 89
91. limit 90 to yr="1999 -Current"

A.3 Resilient Unexpected Infection Events Medline 03 Oct 2012

1. Leadership/
2. "Organization and Administration"/
3. Communication/
4. Inservice Training/
5. Staff Development/
6. Hospital Management.mp.
7. Hospital Administration/
8. Guideline Adherence/
9. Personnel Management/
10. Feedback, Psychological/
11. Patient Safety/
12. error correction.mp.
13. error discovery.mp.
14. Resilience.mp.
15. Resilience, Psychological/
16. error recovery.mp.
17. error prevention.mp.
18. "Task Performance and Analysis"/
19. critical incident analysis.mp.
20. critical incident prevention.mp.
21. monitor.mp.
22. Sentinel Surveillance/
23. Risk Reduction Behavior/
24. Awareness/
25. Risk Management/
26. defences.mp.
27. Hospital Planning/
28. Intervention Studies/
29. scenario planning.mp.
30. recover.mp.
31. mitigation.mp.
32. organizational systems.mp.
33. redundancy.mp.
34. Competitive Behavior/
35. Hospital Bed Capacity/
36. Capacity Building/
37. organizational structures.mp.
38. "Decision making"/
39. "Power (Psychology)"/
40. adaptable.mp.
41. Adaptation, Psychological/
42. flexible.mp.
43. Patient Care Team/
44. Role/
45. bricolage.mp.
46. Organizational Culture/ or organisational culture.mp.
47. (organizational learning or organisational learning).mp.
48. Organizational Policy/ or organisational policy.mp.
49. (organizational strategy or organisational strategy).mp.
50. Organizational Innovation/ or organisational innovation.mp.

51. (organizational change or organisational change).mp.
52. behavio?r change.mp.
53. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52
54. Infection Control/
55. infection prevention.mp.
56. infection management.mp.
57. Cross Infection/
58. Staphylococcus aureus/
59. Staphylococcal Infections/
60. Methicillin-Resistant Staphylococcus aureus/
61. Clostridium difficile/
62. Clostridium Infections/
63. Enterococcus faecium/
64. Klebsiella pneumoniae/
65. Klebsiella Infections/
66. Acinetobacter baumanni.mp.
67. Acinetobacter infections/
68. Pseudomonas aeruginosa/
69. Influenza A Virus, H1N1 Subtype/
70. Extended Spectrum Beta-Lactamase.mp.
71. New Delhi Metallo-Beta-lactamase-1.mp.
72. Norovirus/
73. surgical site infections.mp.
74. Urinary Tract Infections/
75. hospital acquired pneumonia.mp.
76. Pneumonia, Ventilator-Associated/
77. Clostridium difficile associated disease.mp.
78. bloodstream infections.mp.
79. Catheter-Related Infections/
80. Enterobacter/
81. 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80
82. 53 and 81
83. Disaster Planning/
84. Emergency Medical Services/
85. unexpected.mp.
86. Emergencies/
87. emergency preparedness.mp.
88. (disease outbreak* or outbreak*).mp. or Disease Outbreaks/
89. superbug.mp.
90. 83 or 84 or 85 or 86 or 87 or 88 or 89
91. 82 and 90
92. limit 91 to (english language and humans and yr="1999 -Current")

A.4 Resilient Unexpected Infection Events Psych Info 03 Oct 2012

1. Leadership/
2. Organization/ or Management/
3. Communication/
4. Inservice Training/
5. Professional Development/
6. hospital management.mp.
7. Hospital Administration/
8. Treatment Guidelines/ or guideline adherence.mp.
9. Human Resource Management/
10. Feedback/
11. Safety/
12. error correction.mp.
13. error discovery.mp.
14. resilience.mp.
15. Resilience, Psychological/
16. error recovery.mp.
17. error prevention.mp.
18. Task Analysis/ or Performance/
19. critical incident analysis.mp.
20. critical incident prevention.mp.
21. monitor.mp. or monitoring/
22. sentinel surveillance.mp.
23. risk reduction behavior.mp.
24. Awareness/
25. Risk Management/
26. defences.mp.
27. Management Planning/
28. intervention stud*.mp.
29. scenario planning.mp.
30. recover.mp.
31. mitigation.mp.
32. organizational systems.mp.
33. redundancy.mp.
34. Competition/
35. (hospital adj3 bed adj capacity).mp.
36. capacity building.mp.
37. organizational structures.mp.
38. Decision making/
39. Interpersonal Control/
40. adaptable.mp.
41. Adaptive Behavior/
42. flexible.mp.
43. Work Teams/
44. Role Taking/
45. bricolage.mp.
46. Organizational Climate/ or organisational culture.mp.
47. Organizational Learning/ or organisational learning.mp.
48. Policy Making/ or organi?ational policy.mp.
49. (organizational strategy or organisational strategy).mp.
50. Innovation/ or organi?ational innovation.mp.

51. Organizational Change/ or organisational change.mp.
52. Behavior Change/
53. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52
54. Infectious Disorders/ or (infection adj control).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
55. infection prevention.mp.
56. infection management.mp.
57. (cross infection or nosocomial infection).mp.
58. Staphylococcus aureus.mp.
59. Staphylococcal infection*.mp.
60. methicillin-resistant Staphylococcus aureus.mp.
61. MRSA.mp.
62. Clostridium difficile.mp.
63. Clostridium Infection*.mp.
64. Enterococcus faecium.mp.
65. Klebsiella pneumoniae.mp.
66. Klebsiella Infection*.mp.
67. Acinetobacter baumanni.mp.
68. Acinetobacter infection*.mp.
69. Pseudomonas aeruginosa/
70. (Influenza A Virus adj H1N1).mp.
71. Extended Spectrum Beta-Lactamase.mp.
72. New Delhi Metallo-Beta-lactamase-1.mp.
73. Norovirus.mp.
74. surgical site infection*.mp.
75. urinary tract infection*.mp.
76. Pneumonia/
77. ventilator associated pneumonia.mp.
78. Clostridium difficile associated disease.mp.
79. bloodstream infections.mp.
80. catheter infection*.mp.
81. enterobacter.mp.
82. 54 or 55 or 56 or 57 or 58 or 59 or 60 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81
83. 53 and 82
84. Disasters/
85. Emergency Services/
86. unexpected.mp.
87. Emergency Management/
88. Emergency Preparedness/
89. (disease outbreak* or outbreak*).mp. or exp Epidemics/
90. superbug.mp.
91. 84 or 85 or 86 or 87 or 88 or 89 or 90
92. 83 and 91
93. limit 92 to (human and english language and yr="1999 -Current")

Appendix B - What is a sensemaking perspective?

B.1 Defining Sensemaking

B.1.1 Interactive Sensemaking

I adopted the taxonomy of interactive sensemaking to assess the unexpected infection event as it derives from an ontological position of social constructionism which recognises the dynamic process of interaction amongst organisational actors.(153) For this reason, I consider static sensemaking studies are less relevant for this review. These studies, which form a large part of the sensemaking literature, tend to ignore the dynamics of sensemaking.(282) Instead, they examine the effect of continuous stressors such as organisational change and restructuring on individual groups e.g. middle managers and overlook the complex interaction between individuals and teams.

From a resilience perspective, interactive sensemaking is often associated with the initial identification of, and response to, an unexpected event. The contribution of sensemaking processes to later stages of an unexpected event are less well developed in organisational resilience frameworks (20;22;138) or empirical studies. This research will address that gap, by examining each stage of an unexpected event using the varied types of sensemaking concepts described in Table 10.1 to understand organisational resilience in practice. In the following sections, these sensemaking concepts are reviewed.

Table 10.1. Appendix B. Taxonomies of Sensemaking

Type of Sensemaking/ Sensegiving			Authors	Description	Relationship to organisational resilience	Empirical Examples
Sensemaking	Static	Social	Balogun & Johnson Luscher & Lewis Rouleau Dutton et al. Dutton & Ashford Bartunek et al. Bean & Hamilton Gioia & Chitipeddi Gioia & Thomas Isabella	Social sensemaking that assesses how one group influences the other group's understanding of a particular issue.	In the context of continuous stressors, the sensemaking responses of individual groups to a change which may improve or diminish organisational resilience.	Role of middle managers,(238;279;283-286) organisational change(239-241;287;288) and leadership(278;288)
	Interactive	Social	Weick and Sutcliffe Meyerson et al. Christianson et al.	Explores the dynamics of sensemaking between different groups, often in complex contexts.	In the context of an unexpected event, dynamic social sensemaking between different groups intensifies and organisational resilience strengthens.	Forest fire fighting(19), healthcare(18), museums(26)
		Embedded	Whiteman and Cooper	Embeddedness(deep familiarity with intricacies of the local environment/ ecology) heightens sensemaking through richer awareness of detail	In all contexts, having awareness of local environment/ecology facilitates more effective sensemaking and strengthens resilient practice.	Management practices of Cree hunters(263)
		Distributed	Weick	Distributed information access, equivocal meaning making and the development of different perspectives in complex contexts.	In all contexts, distributed sensemaking causes sensemaking fault lines and has an adverse effect on organisational resilience.	West Nile virus(276)
		Collective	Weick and Sutcliffe	Describes a pattern of heedful interrelating in a social system	In all contexts, collective sensemaking ensures constructive decision making and problem solving and contributes to organisational resilience.	Aircraft carrier flight decks(192)
Sensegiving		Social	Gioia & Chittipeddi Maitlis & Lawrence	Influencing the meaning construction of others towards a preferred organisational reality	In the context of an unexpected event, sensegiving intensifies between leaders and front-line staff or from front-line staff up to leaders, improving organisational resilience.	Subartic and forest fire fighting(263) Leader sensegiving(239) Orchestras(289)

B.1.2 Social sensemaking

Social sensemaking can be defined as the dynamic relationship between sensemaking and social structures. The basic process which supports social sensemaking activities is described using the enactment theory model which describes the four stages of sensemaking in which actors i) sense anomalies and begin to order undifferentiated flux ii) notice and bracket the anomalies in the flux (enactment) iii) assess these anomalies by labelling and connecting meanings from prior experiences to create a tentative yet plausible story (selection) and iv) solidify the story by relating it to past experience, retaining it and using it as a guide for future action (retention).(153) This is a circular process, with the results of retention feeding back to the enactment and selection stages.(153;263) From a research perspective, accessing and understanding these cognitive patterns can be difficult without rich qualitative primary accounts from those involved in events. Key empirical studies of sensemaking in the literature rely on secondary accounts or documents(18;19), which limits the scope for understanding the intricacies of sensemaking cognition. A further issue with the concept of social sensemaking is the increasing use of closely related words, such as mindfulness(154), heedful interrelating(192) and behavioural commitment(18) by the same authors that originally developed the sensemaking concept. There is a risk that the simplicity of the concept is confused by later, related terminology which may describe behavioural elements of the cognitive concept.

B.1.3 Embedded sensemaking

Whiteman and Cooper define embedded sensemaking as deep familiarity with the local peculiarities and interactive effects of the environment and local ecology.(263) Familiarity with the local ecology enables actors to access a richer repertoire of meanings and actions and be alert to likely consequences. Ecological embeddedness can enable ecological sensemaking as an individual's embedded knowledge and heightened awareness facilitates attention to anomalies, the ability to notice and bracket local cues, expand their skills and facilitate learning. I propose that a similar form of embeddedness could be transposed onto the clinical environment. In this case, clinically embeddedness might involve deep familiarity with the hospital environment, understanding of the local conditions, e.g. winter pressures on bed capacity, epidemiology of infections, typical case mix of patients, local population demographics and knowledge of individuals and groups within the hospital.

B.1.4 Distributed Sensemaking

Distributed sensemaking is a process in which individuals, but also groups, access distributed information, form different perspectives and develop equivalent rather than shared meanings of events. As significant effort would be involved in integrating these different perspectives across the various interest groups, ambiguity continues.(153) This type of sensemaking occurs when organisations are loosely connected and each individual or group within an organisation has a partial image of their complex environment. (276) Common features of distributed sensemaking in organisations include: coalitions of interest groups, unplanned organisational designs and the use of incomplete information to justify existing decisions or positions.(290) Weick suggests that distributed sensemaking can result in failures in sensemaking, where anomalies are normalised, categorised too quickly and confirmed on the basis of existing categorisations.(276) Individuals may rely too heavily on authority rather than mindfulness, are overconfident in their capabilities and are reactive to rather than anticipate cues. Distributed sensemaking can be overcome through interaction between interest groups which can build an organisational representation that is greater than the sum of its parts. Collective sensemaking, supported by heedful interacting, which will be defined in the next section, is the antidote to distributed sensemaking.

B.1.5 Collective Sensemaking

Collective sensemaking, also known as the 'collective mind'(192) is another sub-type of interactive sensemaking. The collective mind creates greater capacity amongst team members to make sense of unexpected events that unfold rapidly. It can be defined as a pattern of heedful interrelating in a social system and is more often found in a highly reliable organisations.(192) Weick and Roberts describe three elements in the conceptualisation of the collective mind; contributions (contributions by individual actors within the social system), representation (recognition that the system consists of connected actions between themselves and others) and subordination (appreciation of the interrelatedness of their actions within the system).(192) Heedful interrelating ensures greater interconnectedness and interrelation within the system, creating greater shared understanding between team members of the complexity of the system and ensuring fewer errors. When heedless interrelating occurs, attention becomes focused on the local situation, rather than the shared situation.(192) In this scenario, there is a greater chance of errors as the three elements of the collective mind break down: contributions become less complete, representation of the

system becomes narrower and subordination becomes less effective. Individuals become more isolated and the collective mind of the organisation is simplified.

A second feature of collective sensemaking is collective efficacy. This constitutes a group's shared belief in their conjoint capabilities to organise and execute the actions needed to produce the required results. Collective efficacy has been found to have a very positive effect on performance in adversity.(258;291) Characteristics are of an emergent group-level attribute that develops from individual's perceptions of a group's functioning and is a product of the interactive and coordinative dynamics amongst team members(258) Factors that contribute to these interactive dynamics include how well a group is led, structured and coordinated, the strategies that it adopts and the mix of knowledge and competencies in the group(258;259) If these factors are positive, this assists in loosening control to move decision making and problem solving to those who have the greatest expertise and ensuring that all the emotional, cognitive and behavioural resources that are available are utilised.(258)

B.1.6 Sensegiving

Described as a variant of sensemaking, sensegiving is undertaken to create meanings for a specific audience.(153) The process of sensegiving links individual meaning making across actors and is described by Gioia and Chittipeddi as 'the process of attempting to influence the sensemaking and meaning construction of others toward a preferred redefinition of organisational reality.'(239)p442 Symbols, symbolic gestures and actions may be used to communicate and influence a change from one scheme of sensemaking to another.(239)

Whiteman and Cooper suggest that sensegiving activities are dependent on a strong form of trust which either depend on established relationships based on experience or the rapid establishment of trust within temporary relationships termed 'swift trust.'(263) Meyerson et al argue that trust formed in temporary systems is different to conventional trust relations in more permanent systems. The former has unique properties of collective perception and relating that can be effective in coping with issues of risk, uncertainty and complexity. Swift trust can reflect a pragmatic strategy to cope with the uncertainties of a rapidly unfolding event that requires complex, interdependent actions using the specialist skills of relatively unknown individuals. However, when faced with high uncertainty, individuals may choose to adopt a position of either complete trust or total distrust, as this uses up less time than monitoring a partial trust position.(292) In this study we examine a scenario where not only are temporary groupings formed in a situation of high uncertainty but also individuals are

adopting different roles within those groups as a function of existing role systems breaking down and new, hybrid or extended roles being adopted to cope with the crisis. Trust is a critical component of managing uncertainty and is of particular relevance in this case, in understanding the dynamics of temporary groups that have formed to manage unexpected events.

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Appendix C - Interview Schedule Trust staff

Topic area	Questions
Introduction	• Participant to sign consent form before proceeding (if not already signed) • Turn voice recorder on • Confirm interview being recorded and will last for up to an hour • Interviewer to introduce themselves • Confirm confidentiality of information • Confirm that if there are any questions, participant does not wish to answer, they don't have to • Confirm participants profession, grade and title (if consent provided) • When research analysed, ask participant for agreement to check back intended meaning and themes with them [member checking]
Role of participant in Trust	• Describe your current role in relation to infection prevention and control? • Has your role changed over the last five years (2003-2008)?
Pinpointing critical incidents	• Explanation of critical incidents – over the past five years, recall the times when infection problems/outbreaks occurred (take notes of incidents so that each can be referred to in turn) • Confirm dates as accurately as possible • What was your role in relation to each of these incidents?
Critical incident 1	• Describe the infection problem/outbreak that stood out for you? • Why did it stand out? • What were the circumstances of that outbreak? • How long did the outbreak last? • When did you become aware of the outbreak? *[Testing awareness of failures]* *[Prompt – how far in, how many cases]* • Did you, or any other staff anticipate the outbreak? *[Testing mindfulness, response to unexpected or unplanned events/experts relation to authority]* • What data was available on the outbreak? *[Managing failures]* *[Prompt - Did you trust it? How was the outbreak measured?]* • Were there any indicators that the outbreak might be about to happen? *[Testing preoccupation with failure/opacity]* • Were there any significant stresses linked to the outbreak? *[Testing stressors]* *[Prompt – short term, long term, continuous, internal, external, individual, team, organisational?]* • What factors influenced the outbreak? *[Testing contributory factors/new organisational structures]* *[Prompt: type of infection, internal issues: financial, workforce, leadership, capacity, operational; external issues: policy, political, social]* • Were you/your team prepared for the outbreak? *[Testing preparedness]* *[Prompt: what was in place, how quickly, state of readiness]* • How flexible/adaptable were you in being able to respond to the outbreak? *[Testing flexibility/responding rapidly to events]* • How flexible/adaptable were others in being able to respond to the outbreak? *[Testing flexibility/responding rapidly to events]* • How open were staff to the fact of the outbreak happening? *[Testing learning culture, just culture]* *[Prompt: denial or reform]*

	• Did the leaders in the organisation support the management of the outbreak? [Testing leadership/management commitment/balance of safety v performance/experts relation to authority] *[Prompt: which leaders, at which levels, managers/clinicians, style of management, nature of support]* • How was the outbreak managed? [Testing decision making/collective mindfulness/organisational structures/communications] *[Prompt: structure to manage outbreak, who was involved, at which levels, were decisions made ,timeliness of decision making, who made them, how were they communicated, were they implemented]* • What resources were used to manage the outbreak? [Testing resource levels/mobilisation of resources/management of front line operations] *[Prompt: nature of resource, e.g. financial, human, equipment etc, were they readily available, who made them available, when were they made available, prioritisation of operational/safety]* • What role, if any, did external organisations play in the outbreak? [Testing changing environment/ heightened public and political awareness/performance demands] *[Prompt: policy, monitoring, support, penalties]* • Do you think there were any other significant issues in how the outbreak was managed? • What happened after the outbreak? [Testing capabilities for resilience] *[Prompt: if changes made, were they maintained, did changes occur subsequently, checks and balances developed or not, systems, meetings, processes, procedures, behaviours, who led them, how sustainable were they]*
Other critical incidents – prior to significant incident	• Reflecting back on the infection incidents that occurred prior to this one, were they different in any way? • Were the conditions in/outside the organisation different or similar? • Did people react in the same way? • Were there any aspects of previous incidents that influenced the management of this incident? • Is there anything you would like to add?
Other critical incidents – post significant incident	• Reflecting back on the infection incidents that occurred after this one, were they different in any way? • Were the conditions in/outside the organisation different or similar? • Did people react in the same way? • Were there any aspects of the incident that stood out for you that influenced the management of subsequent incidents? • Were any changes made in the organisation? • How effectively were they implemented? • Were preventative methods put in place? • Is there anything you would like to add?
Routine events	• When things are calm, what routine tasks are undertaken in relation to infection control?
Further questions	• Do you have any questions?
	Thank participant for their time Provide contact details of Quality and Safety team Remind them that you will arrange a mutually convenient time to check back themes with them [if agreement given]

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Appendix D - Interview schedule Arm's Length Body staff

Version 2 - 06.11.08

Topic area	Questions
Introduction	• Participant to sign consent form before proceeding (if not already signed) • Turn voice recorder on • Confirm interview being recorded and will last for up to an hour • Interviewer to introduce themselves • Confirm confidentiality of information • Confirm that if there are any questions, participant does not wish to answer, they don't have to • Confirm participant's job role and title (if consent provided) • When research analysed, ask participant for agreement to check back intended meaning and themes with them [member checking]
Organisation's aims and objectives	• Please can you describe your organisation's aims? • Please can you describe your organisation's objectives? • Please can you describe your role in the organisation?
Role in relation to infection prevention and control	• Please can you describe the organisation's role in relation to infection prevention and control? • Has that role changed in the last five years? • What has influenced any changes that have occurred?
External environment	• What, if any, external issues have your organisation faced over the last five years? *[Prompt: nature of issues, other organisations involved, political perspective, media influence]*
Approach with NHS Trusts	• What is your organisation's stated approach/style with NHS Trusts? • Does this equate to the actual approach/style in practice? *[Prompt: impact of foundation trusts, private sector providers, Trust compliance]*
Policy approach	• How would you describe your policy approach? *[Prompt: style of approach; influencing, advisory, educational, instructive?]* • Has that changed in the last five years? • What has influenced any changes that have occurred?
Effectiveness of	• What are the key interventions that your organisation has made in relation to infection control over the last five years? • How effective do you feel these interventions have been?

interventions	• Would you adjust/alter any of them in hindsight?
Areas for change	• What are the key areas of change identified for the future for infection prevention and control in your organisation?
Areas of key improvements in infection control and prevention	• What do you see as the key improvements nationally in infection prevention and control? • What has been your organisation's contribution to those improvements?
Areas of outstanding concern in infection control and prevention	• What do you see as the main areas of outstanding concern nationally in infection prevention and control? • What do you see your organisation's role being in relation to these concerns in the future?
Further questions	• Do you have any questions?
	Thank participant for their time Remind them that you will arrange a mutually convenient time to check back themes with them [if agreement given]

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Appendix E - Consent Form for Interviews

Version 2 6.11.08

Title of study: an exploration of organisational resilience, focusing on infection prevention and control

- I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information and ask questions and these have been answered satisfactorily.
- I understand that my participation is voluntary and that I am free to withdraw at any time, without any reason, and without my legal rights being affected.
- I consent to the processing of my personal information for the purposes of this study only and understand that my information will not be used for any other purpose by the investigators. I understand that my information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- I understand that data collected during the study may be looked at by responsible individuals from Imperial College, London or certain regulatory authorities, where it is relevant to my taking part in the research. I give permission for these individuals to have access to my records.
- I consent/refuse consent [please circle preferred option] for my job title to be used in the research study to provide context to the study information.
- I consent to the interview being recorded.
- I consent to take part in the above study.

_____	_____	_____
Name of participant	Signature	Date
_____	_____	_____
Name of interviewer	Signature	Date

Appendix F - Organisational Resilience Questionnaire

Imperial College London *Management of Infection Outbreak Questionnaire*

Please read this section before completing the questionnaire:
This survey is designed to understand outbreak management in the acute hospital setting. When completing this survey, please recall the most recent major infection outbreak or incident that had an impact on more than one ward or site. The area of particular interest is the management of Norovirus but if you cannot recall a Norovirus outbreak in the last 3 years, a major *C.difficile* problem or influenza during periods of increased incidence would be suitable. If no relevant example, please tick this box ☐ and complete using a minor outbreak as an example. This survey will be anonymised and your answers are confidential.

Respondent										**Outbreak Details**	
Post/Title					ICT member	Yes				Organism causing outbreak	
						No				Approx. outbreak start date	
Dept/Unit										Approx. outbreak duration	
Profession	Nurse		Doctor		Pharmacist		AHP			No. of wards affected	
	Manager (non clinical)		Other		[Please state]					Total no. of wards in Trust	
Specialty										Key individuals/teams involved in managing outbreak	
Grade	(AfC Band or medical level, e.g. Foundation 1, Consultant)										
Trust											

These statements relate to ***routine practices*** in the Trust ***pre-outbreak***:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Minor infection outbreaks were managed effectively.					
Monthly infection control data was provided to clinical areas.					
Performance targets for infection were used in clinical areas.					
Clinical teams were accountable for their infection performance.					
Infection policies were ignored in practice by clinical teams.					
Ward staff were willing to implement new infection practices.					
These statements relate to the ***discovery*** of the outbreak:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
The outbreak was identified within 48 hours.					
The outbreak was escalated to Trust executive directors within 48 hours.					
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified.					
The ward closure policy was clear to all staff.					
Clinical leaders were involved in decision making.					
The significance of the outbreak was underestimated.					
These statements relate to the ***immediate management*** of the outbreak:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
A clear structure was implemented to manage the outbreak.					
Information on cases was available daily.					
Bed capacity was created rapidly.					
A clinical strategy for controlling the outbreak was implemented.					
The isolation policy operated effectively.					
These statements relate to the ***ongoing management*** of the outbreak:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Staff groups were willing to work flexibly during the outbreak (e.g. working different roles).					
Additional resources were made available when needed.					
Innovative solutions were developed for unplanned problems.					
An effective leader took control of the outbreak.					
The balance between patient safety and performance goals was achieved.					
Communication to clinical teams was haphazard during the outbreak.					
The elective pathway was severely impacted by the outbreak.					
Outbreak-related policies were implemented rigorously.					
These statements relate to the ***aftermath*** of the outbreak:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
The hospital Trust recovered rapidly from the outbreak.					
Policies resulting from the outbreak were implemented systematically.					
Learning from the outbreak informed future outbreak management.					

Appendix G - Characteristics of Questionnaire Responses

	N		Mean	Median	Mode	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis	Range
	Valid	Missing										
Minor infection outbreaks were managed effectively	150	0	4.2600	4.0000	4.00	.64952	.422	-.910	.198	2.158	.394	3.00
Monthly infection control data was provided to clinical areas	149	1	4.1342	4.0000	5.00	1.01780	1.036	-1.326	.199	1.167	.395	4.00
Performance targets for infection were used in clinical areas	150	0	4.0467	4.0000	4.00	1.05128	1.105	-1.218	.198	.838	.394	4.00
Clinical teams were accountable for their infection performance	148	2	3.7568	4.0000	4.00	1.03425	1.070	-.805	.199	.034	.396	4.00
Infection policies were ignored in practice by clinical teams (inverted)	150	0	3.3733	4.0000	4.00	.99358	.987	-.267	.198	-.712	.394	4.00
Ward staff were willing to implement new infection practices	147	3	3.8571	4.0000	4.00	.74943	.562	-.848	.200	1.496	.397	4.00
The outbreak was identified within 48 hours	150	0	4.2133	4.0000	4.00	.85598	.733	-1.403	.198	2.460	.394	4.00
The outbreak was escalated to Trust executive directors within 48 hours	148	2	4.2297	4.0000	5.00	.88136	.777	-1.254	.199	1.680	.396	4.00
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified	149	1	4.0940	4.0000	4.00	.89550	.802	-1.217	.199	1.596	.395	4.00
The ward closure policy was clear to all staff	149	1	4.0336	4.0000	4.00	.83355	.695	-.773	.199	.306	.395	3.00
Clinical leaders were involved in decision making	149	1	4.2416	4.0000	4.00	.70376	.495	-.849	.199	1.115	.395	3.00
The significance of the outbreak was underestimated (inverted)	149	1	3.5101	4.0000	4.00	1.19468	1.427	-.615	.199	-.677	.395	4.00
A clear structure was implemented to manage the outbreak	150	0	4.1733	4.0000	4.00	.69269	.480	-1.104	.198	2.535	.394	3.00
Information on cases was available daily	150	0	4.3400	4.0000	4.00	.72195	.521	-1.267	.198	2.249	.394	3.00
Bed capacity was created rapidly	150	0	3.4267	4.0000	4.00	1.05134	1.105	-.401	.198	-.499	.394	4.00
A clinical strategy for controlling the outbreak was implemented	149	1	4.2617	4.0000	4.00	.61946	.384	-.411	.199	.278	.395	3.00
The isolation policy operated effectively	150	0	4.1000	4.0000	4.00	.73958	.547	-.767	.198	.870	.394	3.00

Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)	150	0	3.4933	4.0000	4.00	.87275	.762	-.041	.198	-.662	.394	3.00
Additional resources were made available when needed	150	0	3.6933	4.0000	4.00	.97586	.952	-.535	.198	-.497	.394	4.00
Innovative solutions were developed for unplanned problems	149	1	3.5168	4.0000	4.00	.88991	.792	-.226	.199	-.429	.395	4.00
An effective leader took control of the outbreak	148	2	4.1486	4.0000	4.00	.83597	.699	-1.137	.199	1.546	.396	4.00
The balance between patient safety and performance goals was achieved	148	2	3.8716	4.0000	4.00	.85937	.739	-.792	.199	.872	.396	4.00
Communication to clinical teams was haphazard during the outbreak (inverted)	149	1	3.7584	4.0000	4.00	1.03748	1.076	-.972	.199	.476	.395	4.00
The elective pathway was severely impacted by the outbreak (inverted)	149	1	2.8859	3.0000	2.00	1.19983	1.440	.104	.199	-1.003	.395	4.00
Outbreak-related policies were implemented rigorously	148	2	4.0000	4.0000	4.00	.73771	.544	-.824	.199	1.149	.396	3.00
The hospital Trust recovered rapidly from the outbreak	150	0	4.0400	4.0000	4.00	.80168	.643	-1.261	.198	2.662	.394	4.00
Policies resulting from the outbreak were implemented systematically	149	1	3.7919	4.0000	4.00	.75583	.571	-.300	.199	-.107	.395	3.00
Learning from the outbreak informed future outbreak management	150	0	4.1400	4.0000	4.00	.75999	.578	-.613	.198	.059	.394	3.00

Appendix H - Kendall's tau: non-parametric correlation

Kendall's tau		Routine practice						Discovery of Outbreak						Immediate Management of Outbreak					Ongoing management of Outbreak							Aftermath of Outbreak		
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). c. Listwise N = 132 Thresholds for effect sizes r=0.5 (large effect) r=0.3 (medium effect)		Minor infection outbreaks were managed effectively	Monthly infection control data was provided to clinical areas	Performance targets for infection were used in clinical areas	Clinical teams were accountable for their infection performance	Infection policies were ignored in practice by clinical teams (inverted)	Ward staff were willing to implement new infection practices	The outbreak was identified within 48 hours	The outbreak was escalated to Trust executive directors within 48 hours	Staff understood the necessary measures to manage the outbreak within 36 hours of the	The ward closure policy was clear to all staff	Clinical leaders were involved in decision making	The significance of the outbreak was underestimated (inverted)	A clear structure was implemented to manage the outbreak	Information on cases was available daily	Bed capacity was created rapidly	A clinical strategy for controlling the outbreak was implemented	The isolation policy operated effectively	Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)	Additional resources were made available when needed	Innovative solutions were developed for unplanned problems	An effective leader took control of the outbreak	The balance between patient safety and performance goals was achieved	Communication to clinical teams was haphazard during the outbreak (inverted)	The elective pathway was severely impacted by the outbreak (inverted)	Outbreak-related policies were implemented rigorously	The hospital Trust recovered rapidly from the outbreak	Policies resulting from the outbreak were implemented systematically	Learning from the outbreak informed future outbreak management
Minor infection outbreaks were managed effectively	Correlation Coefficient	1.000	.304**	.373**	.263**	.131	.050	.226**	.261**	.270**	.310**	.273**	.163*	.429**	.309**	.158*	.398**	.281**	.237**	.294**	.167*	.423**	.372**	.330**	.020	.346**	.286**	.141	.218**
	Sig. (2-tailed)	.	.000	.000	.001	.095	.539	.006	.001	.001	.000	.001	.037	.000	.000	.042	.000	.001	.003	.000	.034	.000	.000	.000	.796	.000	.000	.078	.007
Monthly infection control data was provided to clinical areas	Correlation Coefficient	.304**	1.000	.589**	.418**	.136	.130	.244**	.272**	.352**	.324**	.309**	.186*	.335**	.362**	.173*	.304**	.312**	.172*	.162*	.179*	.336**	.255**	.139	.096	.217**	.224**	.254**	.287**
	Sig. (2-tailed)	.000	.	.000	.000	.072	.096	.002	.001	.000	.000	.000	.014	.000	.000	.022	.000	.000	.024	.033	.019	.000	.001	.070	.199	.006	.005	.001	.000
Performance targets for infection were used in clinical areas	Correlation Coefficient	.373**	.589**	1.000	.522**	.193*	.186*	.260**	.295**	.319**	.333**	.335**	.062	.352**	.437**	.253**	.359**	.275**	.162*	.163*	.170*	.478**	.292**	.207**	.076	.296**	.200*	.237**	.268**
	Sig. (2-tailed)	.000	.000	.	.000	.011	.017	.001	.000	.000	.000	.000	.413	.000	.000	.001	.000	.000	.033	.031	.026	.000	.000	.007	.305	.000	.011	.002	.001
Clinical teams were accountable for their infection performance	Correlation Coefficient	.263**	.418**	.522**	1.000	.226**	.241**	.296**	.261**	.368**	.269**	.308**	.158*	.329**	.324**	.208**	.334**	.295**	.223**	.238**	.297**	.353**	.357**	.206**	.111	.385**	.222**	.170*	.213**
	Sig. (2-tailed)	.001	.000	.000	.	.002	.002	.000	.001	.000	.000	.000	.034	.000	.000	.005	.000	.000	.003	.001	.000	.000	.000	.006	.128	.000	.004	.026	.005
Infection policies were ignored in practice by clinical teams (inverted)	Correlation Coefficient	.131	.136	.193*	.226**	1.000	.170*	.051	.003	.175*	.045	.115	.236**	.208**	.207**	.073	.216**	.097	.066	.094	.141	.237**	.089	.261**	.097	.147	.045	.127	.083
	Sig. (2-tailed)	.095	.072	.011	.002	.	.026	.508	.968	.022	.548	.138	.001	.007	.008	.319	.006	.206	.375	.204	.058	.002	.235	.000	.182	.054	.560	.094	.273
Ward staff were willing to implement new infection practices	Correlation Coefficient	.050	.130	.186*	.241**	.170*	1.000	.114	.080	.217**	.096	.259**	.048	.150	.244**	.190*	.364**	.298**	.263**	.217**	.172*	.198*	.171*	.238**	.006	.251**	.106	.180*	.283**
	Sig. (2-tailed)	.539	.096	.017	.002	.026	.	.148	.307	.006	.218	.001	.524	.061	.002	.012	.000	.000	.001	.004	.025	.012	.027	.002	.940	.001	.178	.021	.000
The outbreak was identified within 48 hours	Correlation Coefficient	.226**	.244**	.260**	.296**	.051	.114	1.000	.430**	.509**	.334**	.475**	.249**	.344**	.326**	.197**	.434**	.493**	.165*	.223**	.246**	.293**	.175*	.181*	-.001	.286**	.252**	.179*	.158*
	Sig. (2-tailed)	.006	.002	.001	.000	.508	.148	.	.000	.000	.000	.000	.001	.000	.000	.010	.000	.000	.033	.004	.001	.000	.025	.020	.989	.000	.002	.023	.046
The outbreak was escalated to Trust executive	Correlation	.261**	.272**	.295**	.261**	.003	.080	.430**	1.000	.411**	.368**	.488**	.194*	.419**	.423**	.220**	.415**	.273**	.030	.205**	.205**	.380**	.333**	.275**	.036	.302**	.313**	.227**	.241**

directors within 48 hours	Coefficient																													
	Sig. (2-tailed)	.001	.001	.000	.001	.968	.307	.000	.	.000	.000	.000	.010	.000	.000	.004	.000	.001	.699	.007	.007	.000	.000	.000	.634	.000	.000	.004	.002
Staff understood the necessary measures to manage the outbreak within 36 hours of the outbreak being identified	Correlation Coefficient	.270**	.352**	.319**	.368**	.175*	.217**	.509**	.411**	1.000	.441**	.505**	.441**	.421**	.459**	.183*	.433**	.409**	.199**	.263**	.231**	.415**	.207**	.275**	-.027	.398**	.278**	.276**	.315**
	Sig. (2-tailed)	.001	.000	.000	.000	.022	.006	.000	.000	.	.000	.000	.000	.000	.000	.015	.000	.000	.009	.001	.003	.000	.007	.000	.718	.000	.000	.000	.000
The ward closure policy was clear to all staff	Correlation Coefficient	.310**	.324**	.333**	.269**	.045	.096	.334**	.368**	.441**	1.000	.440**	.184*	.300**	.332**	.235**	.391**	.329**	.286**	.285**	.231**	.414**	.359**	.146	-.009	.378**	.348**	.241**	.220**
	Sig. (2-tailed)	.000	.000	.000	.000	.548	.218	.000	.000	.000	.	.000	.014	.000	.000	.002	.000	.000	.000	.000	.002	.000	.000	.056	.899	.000	.000	.002	.005
Clinical leaders were involved in decision making	Correlation Coefficient	.273**	.309**	.335**	.308**	.115	.259**	.475**	.488**	.505**	.440**	1.000	.290**	.511**	.506**	.308**	.654**	.511**	.236**	.316**	.295**	.506**	.423**	.308**	.006	.501**	.382**	.382**	.315**
	Sig. (2-tailed)	.001	.000	.000	.000	.138	.001	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.002	.000	.000	.000	.000	.000	.933	.000	.000	.000	.000
The significance of the outbreak was underestimated (inverted)	Correlation Coefficient	.163*	.186*	.062	.158*	.236**	.048	.249**	.194*	.441**	.184*	.290**	1.000	.343**	.154*	-.003	.229**	.201**	.024	.114	.056	.194*	.141	.322**	.156*	.229**	.276**	.250**	.095
	Sig. (2-tailed)	.037	.014	.413	.034	.001	.524	.001	.010	.000	.014	.000	.	.000	.049	.964	.003	.009	.745	.121	.450	.011	.059	.000	.031	.003	.000	.001	.212
A clear structure was implemented to manage the outbreak	Correlation Coefficient	.429**	.335**	.352**	.329**	.208**	.150	.344**	.419**	.421**	.300**	.511**	.343**	1.000	.531**	.362**	.551**	.468**	.225**	.266**	.220**	.471**	.479**	.425**	.010	.502**	.423**	.293**	.332**
	Sig. (2-tailed)	.000	.000	.000	.000	.007	.061	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.004	.001	.005	.000	.000	.000	.898	.000	.000	.000	.000
Information on cases was available daily	Correlation Coefficient	.309**	.362**	.437**	.324**	.207**	.244**	.326**	.423**	.459**	.332**	.506**	.154*	.531**	1.000	.434**	.535**	.357**	.113	.301**	.292**	.442**	.391**	.284**	.038	.408**	.301**	.348**	.326**
	Sig. (2-tailed)	.000	.000	.000	.000	.008	.002	.000	.000	.000	.000	.000	.049	.000	.	.000	.000	.000	.151	.000	.000	.000	.000	.000	.621	.000	.000	.000	.000
Bed capacity was created rapidly	Correlation Coefficient	.158*	.173*	.253**	.208**	.073	.190*	.197**	.220**	.183*	.235**	.308**	-.003	.362**	.434**	1.000	.363**	.331**	.310**	.405**	.352**	.262**	.364**	.140	.112	.365**	.230**	.274**	.253**
	Sig. (2-tailed)	.042	.022	.001	.005	.319	.012	.010	.004	.015	.002	.000	.964	.000	.000	.	.000	.000	.000	.000	.000	.001	.000	.059	.118	.000	.002	.000	.001
A clinical strategy for controlling the outbreak was implemented	Correlation Coefficient	.398**	.304**	.359**	.334**	.216**	.364**	.434**	.415**	.433**	.391**	.654**	.229**	.551**	.535**	.363**	1.000	.542**	.316**	.417**	.393**	.582**	.495**	.363**	.030	.629**	.446**	.397**	.482**
	Sig. (2-tailed)	.000	.000	.000	.000	.006	.000	.000	.000	.000	.000	.000	.003	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.694	.000	.000	.000	.000
The isolation policy operated effectively	Correlation Coefficient	.281**	.312**	.275**	.295**	.097	.298**	.493**	.273**	.409**	.329**	.511**	.201**	.468**	.357**	.331**	.542**	1.000	.315**	.342**	.336**	.393**	.366**	.212**	.036	.440**	.445**	.304**	.262**
	Sig. (2-tailed)	.001	.000	.000	.000	.206	.000	.000	.001	.000	.000	.000	.009	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.006	.629	.000	.000	.000	.001
Staff groups were willing to work flexibly during the outbreak (e.g. working different roles)	Correlation Coefficient	.237**	.172*	.162*	.223**	.066	.263**	.165*	.030	.199**	.286**	.236**	.024	.225**	.113	.310**	.316**	.315**	1.000	.452**	.274**	.188*	.326**	.083	.032	.324**	.236**	.111	.153*
	Sig. (2-tailed)	.003	.024	.033	.003	.375	.001	.033	.699	.009	.000	.002	.745	.004	.151	.000	.000	.000	.	.000	.000	.014	.000	.270	.663	.000	.002	.144	.045
Additional resources were made available when needed	Correlation Coefficient	.294**	.162*	.163*	.238**	.094	.217**	.223**	.205**	.263**	.285**	.316**	.114	.266**	.301**	.405**	.417**	.342**	.452**	1.000	.409**	.336**	.420**	.248**	.156*	.464**	.364**	.252**	.329**
	Sig. (2-tailed)	.000	.033	.031	.001	.204	.004	.004	.007	.001	.000	.000	.121	.001	.000	.000	.000	.000	.000	.	.000	.000	.000	.001	.032	.000	.000	.001	.000
Innovative solutions were developed for unplanned problems	Correlation Coefficient	.167*	.179*	.170*	.297**	.141	.172*	.246**	.205**	.231**	.231**	.295**	.056	.220**	.292**	.352**	.393**	.336**	.274**	.409**	1.000	.405**	.440**	.091	.041	.453**	.215**	.406**	.409**
	Sig. (2-tailed)	.034	.019	.026	.000	.058	.025	.001	.007	.003	.002	.000	.450	.005	.000	.000	.000	.000	.000	.000	.	.000	.000	.223	.579	.000	.005	.000	.000
An effective leader took control of the outbreak	Correlation Coefficient	.423**	.336**	.478**	.353**	.237**	.198*	.293**	.380**	.415**	.414**	.506**	.194*	.471**	.442**	.262**	.582**	.393**	.188*	.336**	.405**	1.000	.566**	.317**	.029	.509**	.382**	.319**	.408**
	Sig. (2-tailed)	.000	.000	.000	.000	.002	.012	.000	.000	.000	.000	.000	.011	.000	.000	.001	.000	.000	.014	.000	.000	.	.000	.000	.703	.000	.000	.000	.000
The balance between patient safety and performance goals was achieved	Correlation Coefficient	.372**	.255**	.292**	.357**	.089	.171*	.175*	.333**	.207**	.359**	.423**	.141	.479**	.391**	.364**	.495**	.366**	.326**	.420**	.440**	.566**	1.000	.272**	.089	.510**	.425**	.266**	.338**
	Sig. (2-tailed)	.000	.001	.000	.000	.235	.027	.025	.000	.007	.000	.000	.059	.000	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.229	.000	.000	.001	.000
Communication to clinical teams was haphazard during the outbreak (inverted)	Correlation Coefficient	.330**	.139	.207**	.206**	.261**	.238**	.181*	.275**	.275**	.146	.308**	.322**	.425**	.284**	.140	.363**	.212**	.083	.248**	.091	.317**	.272**	1.000	.180*	.282**	.244**	.205**	.205**
	Sig. (2-tailed)	.000	.070	.007	.006	.000	.002	.020	.000	.000	.056	.000	.000	.000	.000	.059	.000	.006	.270	.001	.223	.000	.000	.	.014	.000	.002	.007	.008
The elective pathway was severely impacted by the outbreak (inverted)	Correlation Coefficient	.020	.096	.076	.111	.097	.006	-.001	.036	-.027	-.009	.006	.156*	.010	.038	.112	.030	.036	.032	.156*	.041	.029	.089	.180*	1.000	-.072	.161*	-.052	-.002

	Sig. (2-tailed)	.796	.199	.305	.128	.182	.940	.989	.634	.718	.899	.933	.031	.898	.621	.118	.694	.629	.663	.032	.579	.703	.229	.014	.	.337	.033	.487	.974
Outbreak-related policies were implemented rigorously	Correlation Coefficient	.346**	.217**	.296**	.385**	.147	.251**	.286**	.302**	.398**	.378**	.501**	.229**	.502**	.408**	.365**	.629**	.440**	.324**	.464**	.453**	.509**	.510**	.282**	-.072	1.000	.475**	.497**	.399**
	Sig. (2-tailed)	.000	.006	.000	.000	.054	.001	.000	.000	.000	.000	.000	.003	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.337	.	.000	.000	.000
The hospital Trust recovered rapidly from the outbreak	Correlation Coefficient	.286**	.224**	.200*	.222**	.045	.106	.252**	.313**	.278**	.348**	.382**	.276**	.423**	.301**	.230**	.446**	.445**	.236**	.364**	.215**	.382**	.425**	.244**	.161*	.475**	1.000	.339**	.244**
	Sig. (2-tailed)	.000	.005	.011	.004	.560	.178	.002	.000	.000	.000	.000	.000	.000	.000	.002	.000	.000	.002	.000	.005	.000	.000	.002	.033	.000	.	.000	.002
Policies resulting from the outbreak were implemented systematically	Correlation Coefficient	.141	.254**	.237**	.170*	.127	.180*	.179*	.227**	.276**	.241**	.382**	.250**	.293**	.348**	.274**	.397**	.304**	.111	.252**	.406**	.319**	.266**	.205**	-.052	.497**	.339**	1.000	.503**
	Sig. (2-tailed)	.078	.001	.002	.026	.094	.021	.023	.004	.000	.002	.000	.001	.000	.000	.000	.000	.000	.144	.001	.000	.000	.001	.007	.487	.000	.000	.	.000
Learning from the outbreak informed future outbreak management	Correlation Coefficient	.218**	.287**	.268**	.213**	.083	.283**	.158*	.241**	.315**	.220**	.315**	.095	.332**	.326**	.253**	.482**	.262**	.153*	.329**	.409**	.408**	.338**	.205**	-.002	.399**	.244**	.503**	1.000
	Sig. (2-tailed)	.007	.000	.001	.005	.273	.000	.046	.002	.000	.005	.000	.212	.000	.000	.001	.000	.001	.045	.000	.000	.000	.000	.008	.974	.000	.002	.000	.

Appendix I - Organisational Resilience Questionnaire Reliability

I describe the process of testing the internal consistency of the structure of the organisational resilience questionnaire. The aim of undertaking reliability analysis was to test the reliability of the scale to check whether it was a consistent manifestation of the construct it was measuring. Cronbach's alpha was used, as a common measure of scale reliability.(267) Prior to conducting reliability analysis, the four reverse-phrased items' scores on the questionnaire were inverted, as reverse-scored items affect Cronbach's Alpha equation.(267) As a preliminary step, the mean scores of all the items on the questionnaire were ranked in descending order (see Appendix J) to assess whether any items should be excluded. It is proposed that the last, lowest scoring item, 'the elective pathway was severely impacted by the outbreak (inverted)' is excluded as the confidence intervals were outside those of the other items.

As the questionnaire was based on five chronological stages of outbreak management, Cronbach's alpha was applied separately to each of these stages in the first instance (see Table 10.2), in line with Cronbach's guidance(293) leaving in the proposed excluded item in the equation: 'the elective pathway was severely impacted by the outbreak' (inverted) to test how it affected the reliability analysis. Field proposes that a Cronbach's Alpha in the magnitude of .7 - .8 is an acceptable value and that anything lower indicates an unreliable scale.(267) All stages of outbreak management indicated a Cronbach's Alpha score of over .7 with the exception of the aftermath of the outbreak which showed a score of .63. Having assessed the Cronbach's Alpha of each item if it were deleted, five items were identified that had a corrected item-total correlation score of less than .3 (see Table 10.3). The corrected item-total correlation score identifies items that fail to correlate with the overall score from the scale. Field proposes that any item with a low correlation (less than .3) should be reviewed and potentially excluded as that item would reduce scale reliability.(267) The identified items were excluded on this basis as all other items had a corrected item – total correlation score of greater than .3 and revised Cronbach's Alpha scores were recalculated for each stage of outbreak management indicated by the revised scores in brackets in Table 10.2. All revised scores were over .7, indicating that the remaining subscale items were a reliable measure of the subscale construct.

Table 10.2. Appendix I. Cronbach's Alpha by Stage of Outbreak

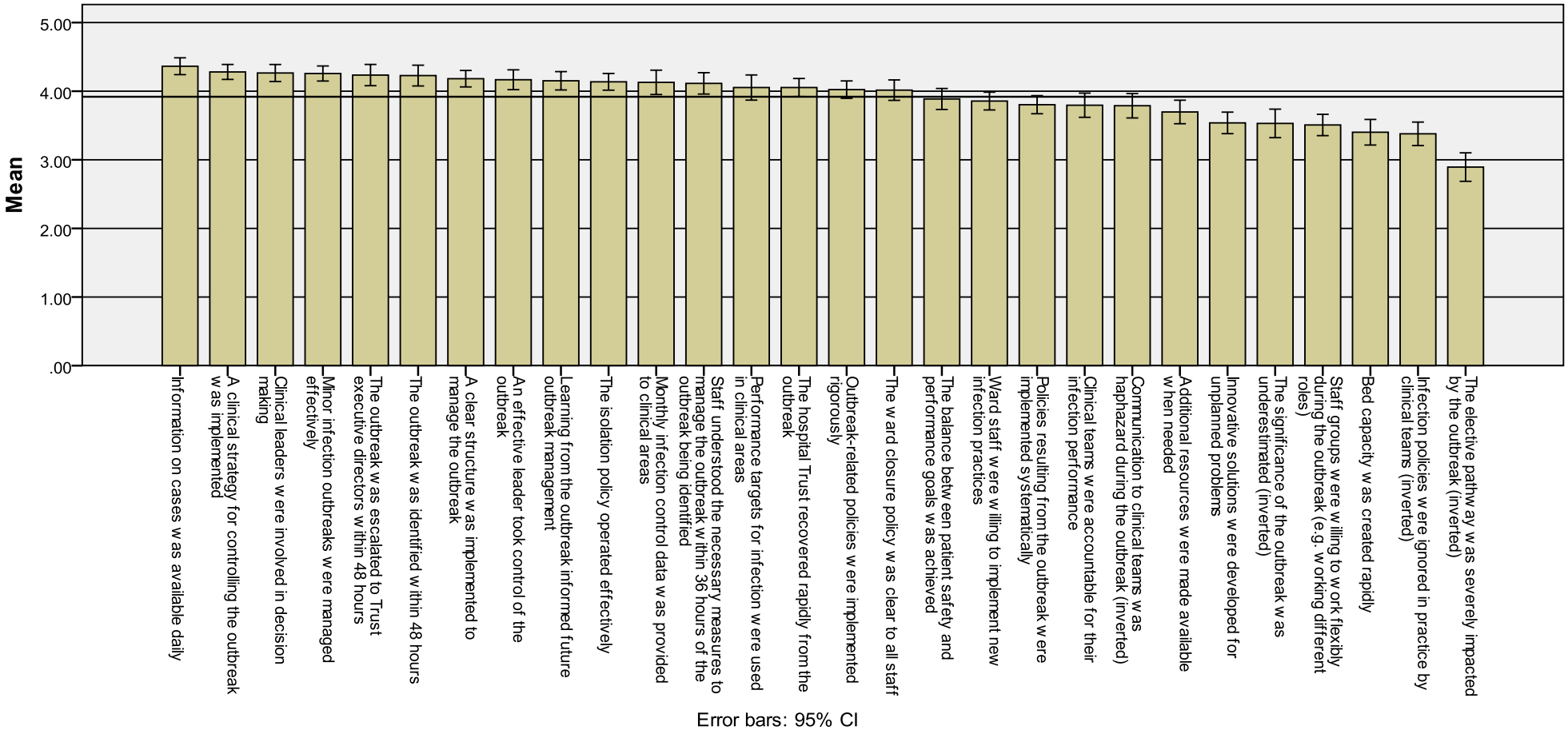
Chronological Stage of Outbreak Management	Case Processing Summary				Reliability Statistics		
			N	%	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items (28 prior to revision)
Routine Practice	Cases	Valid	144	96.0	.722	.713	6
		Excluded[a]	6	4.0			
		Total	150	100.0	(Revised .795	.792	4)
Discovery	Cases	Valid	145	96.7	.771	.785	6
		Excluded[a]	5	3.3			
		Total	150	100.0			
Immediate Management	Cases	Valid	149	99.3	.774	.796	5
		Excluded[a]	1	.7			
		Total	150	100.0			
Ongoing Management	Cases	Valid	142	94.7	.734	.760	8
		Excluded[a]	8	5.3			
		Total	150	100.0	(Revised .810	.813	6)
Aftermath	Cases	Valid	149	99.3	.629	.633	3
		Excluded[a]	1	.7			
		Total	150	100.0	(Revised .733	.733	2)

a. Listwise deletion based on all variables in the procedure.

Table 10.3. Appendix I. Question items for deletion

Questionnaire Item	Corrected item – total correlation	Cronbach's Alpha if item deleted
Routine practice		
Infection policies were ignored in practice by clinical teams (inverted)	.232	.750
Ward staff were willing to implement new infection practices	.224	.740
Ongoing management		
Communication to clinical teams was haphazard during the outbreak (inverted)	.264	.742
The elective pathway was severely impacted by the outbreak (inverted)	.165	.775
Aftermath		
The hospital Trust recovered rapidly from the outbreak	.291	.733

Appendix J - Mean ranked scores of questionnaire items with 95% confidence intervals



Appendix K - Thesis-related publications and presentations

K.1 Published papers

- Murray E; Holmes AH. (2012). Addressing healthcare-associated infections and antimicrobial resistance from an organizational perspective: progress and challenges. Journal of Antimicrobial Chemotherapy. 67:i29-i36.
- Brannigan ET; Murray E; Holmes AH. (Dec 2009). Where does infection control fit into a hospital management structure? Journal of Hospital Infection. 73:392-396.
- Boyce T; Murray E; Holmes AH. (2009). What are the drivers of the UK media coverage of meticillin-resistant Staphylococcus aureus, the inter-relationships and relative influences? Journal of Hospital Infection. 73:400-407.

K.2 Oral and poster presentations

- Murray E; Holmes A; Vincent C; Ferlie E. The recruitment of ICT to design a web-based Foucauldian surveillance mechanism: disciplinary accountability or democratic transparency? Oral and paper presentation at the 28th European Group of Organization Studies Colloquium, 5 Jul 2012 - 7 Jul 2012. (7 Jul 2012).
- Murray EJ; Holmes A; Vincent C; Ferlie E. Characterising organisational control modes in healthcare: the case of infection prevention and control. Oral and paper presentation at the 27th European Group of Organization Studies Colloquium, 7 Jul 2011 - 9 Jul 2011. (9 Jul 2011).
- Murray EJ; Edwards R; Holmes A. Managing Norovirus outbreaks – opportunities for organisational learning. Poster presentation at the 1st International Conference on Prevention and Infection Control, 29 Jun – 2 Jul 2011.