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**Exploring the experiences of nurses
to understand what constitutes early
recognition of sepsis:
A phenomenographic study**

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PhD

2022

**Exploring the experiences of nurses
to understand what constitutes early
recognition of sepsis:
A phenomenographic study**

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A thesis submitted in partial fulfilment
of the requirements of the
University of Northumbria at Newcastle
for the degree of
Doctor of Philosophy

Research undertaken in the
Faculty of Health and Life Sciences

November 2022

Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approvals have been sought and granted through the Researcher's submissions to Northumbria University using the Ethics Online System and the Health Research Authority using the Integrated Research Applications System.

I declare that the Word Count of this Thesis is 84 583 words

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Date: 29th of October 2022

Abstract

Sepsis is a common but often unrecognised life-threatening condition, associated with a high rate of mortality. Health officials have emphasised that developing nursing expertise is critical to improving early recognition of sepsis. However, early recognition of sepsis is commonly challenging due to its complexity in a clinical context. Therefore, an improved insight into the educational needs on this topic from the experiential perspectives of nurses is needed. Phenomenography was used in this study to explore various nurses' experiential perspectives of early recognition of sepsis. A phenomenographic approach is based on the assumption that differences in the way of experiencing a phenomenon are related to differences of the meanings people ascribe to the phenomenon in a particular context. On the basis of commonalities and differences in meanings, the collective experiences of a phenomenon can be arranged into a structure of experiences. Exploration of variation in experience allows for understanding of the dynamics of variation in the experience of a phenomenon at a collective level. The present study explores variation in the experience of early recognition of sepsis by examining the experiences of twenty-six nurses working in various settings at two hospitals.

Findings revealed four different understandings representative of variation in the experience of early recognition of sepsis: protocol-based care, disease-specific care and emergent care and emergency care. According to research participants, variations in the experience of contexts, in the experience of process and in the experience of learning influence the meanings nurses assign to early recognition of sepsis. Variation in the experience of early recognition of sepsis revealed in this research has significant implications for the design of curricula and teaching methods related to recognition of sepsis and for educators facilitating early recognition of sepsis courses.

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To all these people I say: 'Thank you!'

DEDICATION

To my mum, Kvetoslava Bogarova, who invested in me. Also, to my memory of my dad, Ceslav Zyla.

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Chapter 1: Background and aim of the study

1.1 Introduction

This study examines the experiential perspectives of nurses to understand what constitutes early recognition of sepsis. It explores the variation in how early recognition is experienced by nurses in diverse situational contexts. This study was conducted as educational research; however, it focuses on the experiential perspectives of nurses and, as such, has a particularly experiential emphasis. The structure and characteristics of the Cynefin framework are drawn upon to direct the presentation of findings and their associated themes, although literature is also used to explain the findings and support the discussion. This chapter presents an overview of the key aspects related to sepsis recognition with the purpose of providing context and background. This chapter finishes with an overview of the subsequent chapters.

1.2 Background

Sepsis, one of the most prevalent but often unrecognised life-threatening conditions in the world associated with high mortality and morbidity (Rudd et al., 2020), has reportedly become a common and deadly complication of coronavirus disease 2019 (Guo et al., 2020, Murthy et al., 2020, Zhou et al., 2020). It appears to occur as one of the most severe manifestations of coronavirus disease 2019 and is a risk factor for poor outcomes and death. In a study published by The Lancet, sepsis was found to be the most frequent complication (59%) of COVID-19 infections and was diagnosed in all (100%) COVID-19 associated deaths (Zhou et al., 2020). Sepsis can affect individuals of any age. It is usually caused by a bacterial infection, but nearly any infection can cause sepsis, such as seasonal influenza or SARS-CoV-2 (Guo et al., 2020, Murthy et al., 2020, Zhou et al., 2020).

Incidence and mortality of sepsis

In 2017, there were 48.9 million cases, with 11 million deaths, related to sepsis globally (Rudd et al., 2020). In years with major public health events, like the COVID-19 pandemic, that can lead to viral sepsis, those numbers can rise much higher.

Other reasons why sepsis prevalence is expected to increase is the vulnerability of patients in intensive care due to therapy or the disease itself, as well as part of an ageing population (Vincent and Abraham, 2006). Other aspects that increase the demand for improvements is sepsis expenditure. Sepsis represents a major cost burden to the global healthcare economy and accounts for 40% of the ICU expenditure (Angus et al., 2001, York Health Economics Consortium, 2017).

In the past three decades, our understanding of the pathophysiology of sepsis has progressed, yet only a small reduction has been achieved in sepsis-related mortality (Vincent and Abraham, 2006). This is in sharp contrast compared to other conditions, such as acute myocardial infarction (MI), which have witnessed noteworthy decreases in mortality. Since the 1960s, the mortality rate of MI has decreased from 30% to 8% (Vincent et al., 2002). In the view of the burden of sepsis, it is evident that much needs to be done to tackle this important and increasingly frequent health problem. There is a great need for research to reduce the impact of sepsis and to find ways of improving early recognition and reducing mortality (NHS England, 2017).

In light of the global burden of sepsis and high mortality rates, in May 2017, the World Health Organisation (WHO) and World Health Assembly urged 194 United Nations Member states to strengthen efforts to improve measures for the prevention, diagnosis and management of sepsis (Reinhart et al., 2017).

Lack of universally accepted diagnostic criteria

However, there is no gold standard definition of sepsis, nor are there universally accepted diagnostic criteria in both clinical practice and clinical research (Fleischmann et al., 2016, Singer et al., 2016). Early detection is associated with improved outcomes, but this is hindered by a lack of diagnostic tools and the heterogeneous and difficult to understand nature of sepsis (Gauer, 2013). In the past, the drive to develop improvements in the recognition of sepsis resulted in attempts to define measures for early recognition of sepsis. The earliest effort to describe sepsis was made in ancient Egypt more than 3,500 years ago (Kempker and Martin, 2016); but the first attempt to reach consensus on a definition of sepsis did not occur until 1991 (Bone et al., 1992). Consequently, in 1991, the systemic inflammatory response syndrome (SIRS) criteria were conceived and regarded as central to the recognition of sepsis. In 2001, the sepsis definitions and criteria were re-evaluated and new criteria for organ dysfunction were added (Levy et al., 2003). The latest definition from 2016 describes sepsis as “a life-threatening organ dysfunction caused by a dysregulated host response to infection” (Singer et al., 2016). Despite such efforts, delays in the recognition of sepsis are common and lead to organ failure that is associated with high mortality and morbidity (Rudd et al., 2020).

Despite several decades of research in sepsis, there are no therapies that specifically target it (Sartelli et al., 2018). Therefore, sepsis management is limited to early resuscitation with fluids to support organ functions, the control of the source of sepsis and early antibiotic therapy to target infection (Evans et al., 2021).

Identifying people at risk of deterioration

The drive to develop improvements in early recognition of sepsis resulted in attempts to define measures for timely detection and response to patients at risk of clinical deterioration. A broad range of early warning score systems were designed and implemented worldwide, with a view of improving the timely detection of patients who are at high risk of deterioration, among them the Modified Early Warning Score (MEWS), the National Early Warning Score (NEWS) or the Early Warning Scoring System (EWSS) (Gardner-Thorpe et al., 2006, Roney et al., 2015, Smith et al., 2013, Stark et al., 2015). The National Early Warning Score (NEWS) and its modified version, NEWS2 are validated for detection of patient deterioration in a broad range of clinical settings (Hydes et al., 2018, Kim et al., 2020, Scott et al., 2020) and advocated for as screening tools for sepsis (Lim et al., 2019, Pullyblank et al., 2020, RCP, 2017). Despite this, timely detection and response to clinical deterioration remain suboptimal and a major risk to patient safety (Azimirad et al., 2020, Cho et al., 2020).

Disease complexity in a clinical context

Sepsis is difficult to recognise at an early stage due to a number of contributing factors. Due to the heterogeneity of the disease process, sepsis can present with a non-specific clinical presentation that could be attributed to any other condition (Gauer, 2013). The next thing to consider is that the diagnosis of sepsis in ICU patients can be challenging due to potential pre-existing organ dysfunction and possible confounding effects of ongoing organ support (Vincent et al., 2021). To maximise the chance of patient survival, sepsis needs to be recognised and treated early, but this can be difficult, particularly at the early stage of the disease.

Nurses' roles in early recognition of sepsis

In recent years, several studies have highlighted the important role of nurses in improving outcomes for patients with sepsis (Harley et al., 2019, Kleinpell, 2017,

Kleinpell et al., 2013, Kleinpell et al., 2019, Kleinpell and Schorr, 2014, Torsvik et al., 2016). Nurses, healthcare professionals' largest group, can have a major role in reducing the impact of sepsis, particularly the critical role in identifying sepsis early (Harley et al., 2019, Kleinpell et al., 2019). Nurses frequently observe patients during the initial stages of illness when clinical presentations have yet to develop, as nurses are directly involved in close observations and assessment of the patient's condition (Kleinpell and Schorr, 2014).

1.3 The problem statement

Health officials have emphasised that developing nursing expertise is critical to improving early recognition of sepsis (NHS England, 2015, NHS England, 2017b). Mortality and morbidity can be mitigated by early recognition of sepsis, but this is frequently challenging due to disease complexity in a clinical context (Rudd et al., 2020, Seventieth World Health Assembly, 2017). There is a lack of consensus about the definition of nursing expertise in the early recognition of sepsis and how it is developed. There is a general agreement that the ability to recognise sepsis is dependent upon the acquisition of a number of skills and knowledge (Harley et al., 2019, Torsvik et al., 2016), yet the description of what sort of knowledge and skills constitute early recognition of sepsis and what the most relevant ways are of learning this knowledge remain unknown. This lack of understanding may hinder educational efforts to improve early recognition of sepsis and potentially derive benefits from sepsis treatment.

1.4 The aim of the research

The aim of this study was to explore a range of nurses' experiential perspectives to understand what constitutes early recognition of sepsis.

Objectives

1. To explore nurses' experiential perspectives to understand what knowledge and skills constitute early recognition of sepsis.
2. To explore nurses' experiential perspectives to understand what the most relevant ways are of gaining knowledge.
3. To explore nurses' experiential perspectives to understand what learning environment nurses perceive as the most relevant for gaining knowledge.

1.5 Rationale and justification of the study

1.5.1 Educational programmes & guidelines for sepsis recognition

The recent drive to develop improvements in the recognition and management of sepsis resulted in an increase in sepsis educational initiatives (Alam et al., 2018, Bloos et al., 2017, Ferrer et al., 2008, Ferrer et al., 2018, Herran-Monge et al., 2016, Scheer et al., 2017), campaigns and guidelines, and decision aids produced (Dellinger et al., 2004, Dellinger et al., 2008, Evans et al., 2021, Rhodes et al., 2017, Singer et al., 2016). Despite such efforts, delays in recognition are common and lead to organ failure, which is associated with high mortality and morbidity (Rudd et al., 2020). Traditionally designed educational programmes may suffer from some drawbacks, which could influence their effectiveness. Sepsis is a complex and challenging syndrome that can have various clinical presentations and progress rapidly over time (Gauer, 2013). Given the complexity and unpredictability of sepsis, timely recognition may need more than factual knowledge that the educational resources, guidelines and decision tools primarily emphasise (Dellinger et al., 2004, Dellinger et al., 2008, Singer et al., 2016).

To date, the acquisition of expertise for nursing practice has been dominated by studies using a top-down approach in which education mainly incorporates the expertise of the author, but rarely seems to reflect knowledge and experience of practitioners (Chang et al., 2015, Kantor, 2010, Sun et al., 2014). There is a growing body of knowledge which indicates that such an approach may not fit with the varying educational needs of nurses (Earle and Myrick, 2009, Johanson, 2012, Kim and Choi, 2019, McCurry and Martins, 2010). Knowledge of what nurses perceive as the most relevant ways of gaining knowledge is limited (Earle and Myrick, 2009, Kim and Choi, 2019, McCurry and Martins, 2010).

Educational resources have mainly been designed by professional organisations and experts. These are important. Just as important, however, but relatively neglected, is the question of the educational needs of nurses (Chang et al., 2015, Flemming et al., 2019, Kim and Choi, 2019). It is suggested that an assessment of the educational needs of nurses can produce content for the educational programmes that is both clinically important and relevant to current practice (Chang et al., 2015, Flemming et al., 2019, Kim et al., 2011, Kim and Choi, 2019). This relevance is important, as education that is built on educational needs has a higher possibility to influence learner behaviour and can result in improved clinical outcomes (Mazmanian and Davis, 2002, Robertson et al., 2003). Furthermore, little research has been conducted that explores where and how nurses learn about sepsis recognition, and what they consider as the most relevant ways of gaining knowledge. Thus, such an approach would further enhance resultant courses or programmes.

A growing body of literature supports the importance of providing post-registration education for healthcare professionals about sepsis (Alam et al., 2018, Bloos et al., 2017, Ferrer et al., 2008, Herran-Monge et al., 2016, Scheer et al., 2017). However, the existing research appears more concerned with an evaluation of the educational programmes, rather than an evaluation of the educational needs around which the

programmes should be built. As a result of this, these traditionally designed training programmes may not fulfil nurses' educational needs. These unmet needs are important to consider if a significant improvement in early detection of sepsis is to be made and high-quality care for patients is to be delivered.

In addition, in a culture of ever-changing knowledge and skills, the necessity to match educational provision to the day-to-day needs of nurses seems greater than ever (Acedo and Hughes, 2014). As sciences advance, practice changes and educational needs of healthcare professionals develops, thus, the professional development and education of nurses needs to move forward in order to meet their needs, as it is they who are who are expected to provide high standard care and meet needs of patients.

Continuing with the current strategy would mean that, to understand sepsis recognition expertise better, we would seek to further explore the skills and knowledge which might be needed. The current strategy would also be entirely incompatible with the actual concept of sepsis recognition knowledge, which indicates that knowledge becomes rapidly outdated, and the recognition of sepsis necessitates continuous learning and relearning in the face of constant change.

1.5.2 Nurses' expertise

Despite decades of intense research, there have been no significant innovations in diagnostic tools to aid early recognition of sepsis (Fleischmann et al., 2016, Vincent, 2016). The approach to early recognition of sepsis, while shaped in some part by decision aids, is often in the hands of nurses caring for ill patients (Harley et al., 2019, Kleinpell, 2017, Kleinpell et al., 2013, Kleinpell et al., 2019, Kleinpell and Schorr, 2014, Torsvik et al., 2016). Even though nurses play such an important role in improving patient outcomes, I have not been able to find any research that has been concerned with understanding nurses' educational needs with regard to sepsis. We do know why

some nurses cope with the complexities of early recognition of sepsis better than others, and why some nurses learn to recognise sepsis better than others. Little is known about what knowledge nurses rely on in their clinical assessments. If relied-on knowledge could be identified and the most relevant ways of learning knowledge explored, this information could be invaluable to those who are learning how to recognise sepsis. Exploring what nurses rely on in their clinical assessment may also be valuable in providing a more comprehensive clinical evaluation of an ill patient. This is important because early recognition of sepsis, while shaped in some part by guidance, is still very much in the hands of practitioners who have experience in the recognition of sepsis patients. The decision to observe, monitor or escalate, at its core, is based on the application of diverse knowledge and skills. If we understand what knowledge and skills direct these decision-making processes, then we can apply them to safely allocate hospital resources and more effectively target those patients needing interventions (Vincent et al., 2021).

1.5.3 Definition of nursing expertise

There seems to be a lack of consensus related to the definition of nursing expertise in the early recognition of sepsis and how it is developed. There is a general agreement that the ability to recognise sepsis is dependent upon the acquisition of a number of skills and knowledge (Harley et al., 2019, Torsvik et al., 2016), yet the description of what sort of knowledge and skills constitute early recognition of sepsis and what the most relevant ways are of learning this knowledge remain unknown. It is not clear whether the expertise derives from theoretical knowledge or is dependent on practising within specific clinical settings. When looking for the answer to such a question, the focus has traditionally been on attributes such as theoretical knowledge (Harley et al., 2019, Torsvik et al., 2016). Modern research into work pedagogy indicates that, although important, the acquisition of such attributes does not always guarantee the proficiency of practitioners' work (Sandberg, 2000). This lack of understanding may

hinder educational efforts to improve early recognition of sepsis and potentially derive benefits from sepsis treatment. Therefore, this study explored nurses' experiential perspectives to further clarify what knowledge and skills constitute early recognition of sepsis.

1.5.4 Learning environment

While there is a wealth of evidence to suggest that learning environment is an important prerequisite in the development of expertise (Mansutti et al., 2017), there is very little literature which suggests what learning environment is most relevant for the development of expertise in sepsis recognition. In order to inform the current knowledge base and future development of educational initiatives, this study seeks to examine nurses' experiential perspectives to understand what knowledge and skills constitute early recognition of sepsis, and what the most relevant ways for gaining this knowledge are. In order to gain a comprehensive understanding of nurses' educational needs, this study also seeks to understand what learning environment nurses perceive as the most relevant for learning.

1.6 Addressing the problem using a phenomenographic approach

Despite various efforts to improve early recognition of sepsis, there are not universally accepted criteria for early recognition of sepsis (Fleischmann et al., 2016). Early recognition of sepsis is complex and no single solution is likely to be universally beneficial, particularly when sepsis can present in many different ways (Gauer, 2013). This appears to confirm that what early recognition of sepsis practice means lacks comprehensive understanding from the experiential perspectives of nurses. This lack of understanding may hinder educational efforts to improve early recognition of sepsis and the potential to derive benefits from sepsis treatment. The lack of understanding of what it means to nurses in terms of what forms of knowledge they use at work, and how and why and in what contexts they use them to recognise sepsis, indicated that an

effort to accomplish a comprehensive understanding of various nurses' experiences of early recognition of sepsis would be the appropriate approach.

To obtain a comprehensive understanding of nurses' experiences of early recognition of sepsis, this study employed a phenomenographic approach to explore variation in nurses' experiential perspectives of early recognition of sepsis. A phenomenographic approach is based on the assumption that differences in the experience of a phenomenon are related to differences in the meanings people ascribe to the phenomenon in a particular context (Marton and Booth, 1997). More specifically, variation in the experience of a phenomenon is related to differences in the way of understanding the phenomenon in a particular context. A phenomenographic approach assumes that experiencing is linked with understanding, apprehending, and conceptualising. Phenomenography is based on the assumption that experiencing a phenomenon cannot be detached from experiencing the situation in which it is experienced. Therefore, this study explores various ways that early recognition can be understood at work by examining the experiences of nurses engaged in a wide range of situational contexts.

This approach to early recognition expertise is:

- **Experiential**, as it is based on the lived experiences of people engaging with the world of knowledge (Bruce, 1997).
- **Relational**, as it studies neither the object under investigation nor the people, but instead the relation between the person and the object under investigation.
- **Second order perspective**, as it represents the perspectives of knowledge users through their discourse rather than the perspectives of experts.

There are several reasons for adopting a relational approach to describing sepsis recognition expertise. Firstly, this approach permits the descriptions of early recognition practice as it is experienced, within a given situational context, before attempting to

generalise about its characteristics. Secondly, understandings are holistic descriptions of ways of experiencing as they focus on interaction with diverse situational contexts. Thirdly, it does not reduce human competence to a list of context-free attributes, and instead the concept of competence is interpreted in terms of various ways of understanding the phenomena in a given situational context. This does not mean that attributes are not considered essential, as they are, but rather that attributes are an integral part of understanding a phenomenon.

A considerable body of research shows that the way in which someone understands professional work forms the foundation for competence and its development (Dall'alba, 2002, Dall'Alba, 2004, Dall'Alba and Sandberg, 1996, Sandberg, 2000, Sandberg, 2001). Depending on how someone understands their work, knowledge and skills are proceeded by and founded upon how they understand the phenomenon. It is the people's ways of understanding of the phenomenon that constitute, shape and organise their knowledge and skills into different expertise in carrying out sepsis recognition. Since particular knowledge and skills that professionals utilise doing professional work are related to particular understanding of their practice, rather than defining a set of attributes, this study uses the phenomenographic approach to explore diverse ways of understanding practice. This qualitative study explores a variety of experiential perspectives for the purpose of understanding a range of ways that early recognition of sepsis can be understood.

1.7 Thesis overview

The thesis consists of six chapters. Chapter 1 provided pertinent introductory information essential for the background of the research. Chapter 2 will review literature pertinent to the concepts briefly discussed in Chapter 1, including the key conceptualisation of knowledge, the educational needs of practitioners, competence and its development, work-based learning, learning theories and students' conceptions

of learning. A literature review from these areas provides a platform from which to scrutinise the design and delivery of educational programmes for sepsis recognition. Chapter 3 will describe the philosophical underpinnings of the study and the selection of a suitable methodology. This chapter will describe phenomenography, including the concept of categories of descriptions. This chapter will also present the research design, and describe the recruitment of participants, data collection, data analysis, trustworthiness and ethical considerations. Chapter 4 will present the research outcomes in the form of the outcome space, and provide instances of participants' accounts from the transcripts. This account is underpinned by diagrammatic illustrations. Chapter 5 discusses the findings with reference to the literature. The last chapter will draw conclusions from the research findings and offer recommendations for education, practice and future research.

Chapter 2: A review of the literature

2.1 Introduction

This chapter will review academic and professional literature pertinent to the concepts briefly discussed in Chapter 1, including:

- Clinical deterioration and sepsis
- Key conceptualisations of knowledge.
- Educational needs of practitioners.
- Competence and its development.
- Work-based learning.

There are several reasons for undertaking a broader analysis of all these concepts.

As this study aims to report on the experiential views of nurses participating in the timely detection of patient deterioration, albeit in a specific context, it was important to explore the global contemporary literature around the context of deteriorating patient. It was hoped that a review of the literature from this area would help understand the issues arising from the current understanding of timely recognition of patient deterioration and sepsis and lay a foundation from which to explore and address the issues in these areas.

As one of the objectives of this study is to understand what sort of knowledge and skills constitute sepsis recognition, a literature review from the key conceptualisation of knowledge can establish a platform from which to address issues within the content and design of educational programmes for sepsis recognition. The literature on educational needs as perceived by practitioners can help illuminate some of the potential issues related to education.

The key to the review is the identification of nursing competence and its development.

Exploring the literature into these areas can help reveal the directions in, and influences on, our conceptualisation of the educational needs for effective performance at work. In addition, it can allow competence to be scrutinised within existing paradigms of competence development. As a background to critically review the current understanding of professional competence and its development, it was essential to review the concept of professional practice itself. The literature findings from this area aid in the interpretation of the research outcomes and fill the gaps in terms of conceptualisation of the educational needs for effective performance at work.

As the purpose of this study is to report on the experiential views of nurses participating in work-based learning, albeit in a specific context, it was important to explore the literature into the current conceptualisation of work-based learning. It was hoped that a review of literature from this area would help understand the issues arising from the current conceptualisations of work-based learning and that would lay a foundation from which to explore and address the issues in these conceptualisations.

As the purpose of this research is to report on the experiential learning, albeit in a specific context, it was important to explore the literature into relevant learning theories, including community of practice, experiential learning and adult learning theory. It was hoped that a review of literature from this area would help this study to build on the strengths of these theories, whilst seeking to overcome their limitations. The findings from these areas would help understand whether a relational approach is required, especially when considering how different learning methods might influence the different experiences of learners in the process of learning.

In conducting this literature review, the researcher reviewed literature from conceptual accounts and empirical findings in various formats, including academic and professional journals, internet websites and books. The particular databases accessed were ProQuest, ERIC and Google Scholar.

Although the researcher performed a search using the databases, it was not a traditional systematic search. The researcher conducted a search using keywords and then the literature review had developed iteratively, meaning it had evolved and the researcher looked for more literature where it seemed more relevant and pertinent for the research topic. The rationale for not conducting a traditional systematic search is that it was considered inappropriate for this type of research as it is not a positivist type of research in which the researcher ensures every piece of research is located. Instead, the researcher sought to ensure that pertinent concepts are presented.

The research presented and examined in this literature review is representative, or in some instances, unique and ground-breaking. The purpose is to present an understandable, rather than needlessly exhaustive, overview of pertinent research and views in the fields applicable to this research, particularly with the intention to highlight its context and prospective novelty.

2.2 Clinical deterioration and sepsis

The literature surrounding the timely response to clinical deterioration is a critical area of research, particularly in light of the global burden of sepsis and the high mortality rates associated with delayed recognition and treatment (Rudd et al., 2020). Therefore, this literature review will examine contemporary global literature on this topic, including educational initiatives, policy and educational drivers and global initiatives related to deterioration and sepsis.

2.2.1 Sepsis

Sepsis is the leading cause of death and critical illness throughout the world (Rudd et al., 2020). In an effort to decrease sepsis mortality, the Surviving Sepsis Guidelines produced guidelines for the recognition and treatment of sepsis to decrease sepsis

mortality worldwide (Evans et al., 2021, Rhodes et al., 2017). Despite this, clinical deterioration continues to go unrecognised among patients in hospitals, resulting in adverse clinical outcomes, with studies reporting that one in five patients deteriorate within 48 hours following admission (Glickman et al., 2010, Holder et al., 2016).

The challenge of sepsis recognition lies in the fact that common indicators of infection may not always be evident. Campanelli et al. (2022) highlighted that signs and symptoms often do not clearly and imminently indicate infection. To demonstrate this, Filbin et al. (2018) reported that one-third of patients with septic shock have had vague clinical presentations and non-specific to infection, leading to delayed treatment and a high risk of mortality. In addition, recognition of sepsis in ICU patients is often challenging due to potential pre-existing organ dysfunction and possible confounding effects of ongoing organ support (Vincent et al., 2021). However, sepsis, if not effectively responded to, can progress to multiple organ failure, septic shock and potentially death (Singer et al., 2016).

Detecting and responding to patient deterioration in a timely manner is a crucial goal for healthcare professionals worldwide (Burke et al., 2022). Deterioration refers to a transition from one clinical condition to a worse clinical condition, increasing the patient's risk of morbidity and involving organ failure, a prolonged hospital stay, disability and death (Jones et al., 2013). Despite its importance, timely detection and response to patient deterioration have been reported as suboptimal and a major risk to patient safety, leading to the development of potentially preventable adverse clinical outcomes (Azimirad et al., 2020, Cho et al., 2020). The Intensive Care National Audit and Research Centre reported that more than 60000 patients every year deteriorate in UK hospital wards to the extent that they need to be admitted to ICU (Intensive Care National Audit and Research Centre, 2014). The issue is reflected in the National Confidential Enquiry into Patient Outcome and Death report, demonstrating that delays

in the recognition and management of sepsis are common, resulting in adverse clinical outcomes (NCEPOD, 2015). These findings are consistent with several other studies that reported that a delayed response to clinical deterioration is common and is associated with adverse clinical outcomes (Barwise et al., 2016, Brown et al., 2014, Subbe et al., 2017). Timely detection and response to clinical deterioration, while critical to early recognition of sepsis, continues to be a formidable challenge, demonstrating a need for improvements.

The Global Sepsis Alliance has been involved in attempts to obtain a United Nations resolution that would result in the acknowledgement of sepsis as a serious public health threat and lead to greater attention from governments and organisations to work together to reduce the global burden of sepsis (Reinhart et al., 2013). The alliance has been urging policymakers and governments to explore possibilities to engage in improving patient outcomes. In May 2017, the World Health Organisation (WHO) and World Health Assembly urged 194 United Nations Member states to strengthen efforts to improve measures for the prevention, diagnosis and management of sepsis (Reinhart et al., 2017).

2.2.2 Identifying patients at risk of deterioration

The need to develop improvements in the timely recognition of sepsis resulted in attempts to define measures for detecting patients at risk of deterioration, among them staff education and screening tools (Vincent et al., 2018).

The Surviving Sepsis Campaign Guidelines recommend sepsis education as part of sepsis performance improvement programmes (Evans et al., 2021). Various organisations in the UK have also recognised the importance of training healthcare professionals on improving early recognition of sepsis. Health Education England (2016) has been focusing on improving the knowledge and skills of healthcare professionals working in healthcare organisations within the NHS to ensure they are

competent in identifying and responding to deteriorating patients and sepsis. Health Education England produced a report describing the current provision and future needs for the education of healthcare professionals in England. The report reveals substantial shortcomings in the educational and training provision in healthcare organisations. In addition, since the features of educational programs offered to healthcare professionals differed widely, no single approach to educational programs was recommended. According to Health Education England, when and how to best combine educational interventions warrant strategies, ideally through training appropriate to the level matching their individual needs.

In recent years, early warning score systems have become increasingly popular within healthcare systems throughout the world, aimed at improving the detection of patients who are at high risk of deterioration (Gerry et al., 2020, Pedersen et al., 2018, Smith et al., 2019, Smith et al., 2016). Originally, Morgan et al. (1997) observed that clinical deterioration is generally preceded by warning signs and symptoms numerous hours prior to the response to that deterioration. They proposed that timely detection and response to those signs can prevent further deterioration and serious adverse outcomes (Ghosh et al., 2018). Subsequently, an increasing number of studies have highlighted that patient deterioration is frequently preceded by warning signs and symptoms numerous hours prior to adverse outcomes in acutely ill or septic patients (Andersen et al., 2016, Pedersen et al., 2018, Roney et al., 2015). Failure to recognise these signs during admission and a hospital stay has been associated with adverse clinical outcomes (Roney et al., 2015).

Andersen et al. (2016) found the prevalence of abnormalities in vital signs 1-4 hours prior to adverse clinical outcomes. In a similar way, Bleyer et al. (2011) reported that warning signs happened early within 48 hours of admission and accounted for 78% of the assessment of patient physiological symptoms in hospitalised patients with deteriorating conditions. Based on the reported evidence, a timely response to patient

deterioration is critically important to the survival of any hospitalised patient. This has been endorsed by Health Education England (2016), who recommended that healthcare professionals need to consider sepsis whenever a patient presents with an acute deterioration or becomes acutely unwell. This recommendation has also been supported by the National Institute for Health and Care Excellence on sepsis recognition, diagnosis and early management (NICE, 2016). NHS England (2017) further explained that at an advanced phase, when a patient presents with many abnormalities in physiological variables, recognition of sepsis is fairly straightforward. However, at this phase, sepsis is associated with higher mortality rates, highlighting the need to implement measures focusing on suspecting sepsis early to commence prompt treatment.

The Surviving Sepsis Campaign Guidelines recommended sepsis screening of likely infected patients with potential sepsis to improve the timely recognition of sepsis as part of sepsis performance improvement programmes (Evans et al., 2021, Rhodes et al., 2017). Sepsis screening is reportedly linked with reduced mortality (Gatewood et al., 2015, Hayden et al., 2016). The implementation of qSOFA is part of the Surviving Sepsis Campaign Guidelines; however, its screening value has been frequently challenged (Jiang et al., 2018, Maitra et al., 2018).

Accordingly, a broad range of early warning scores were designed and implemented worldwide, with a view of improving the detection of patients who are at high risk of deterioration, among them the Modified Early Warning Score (MEWS), the National Early Warning Score (NEWS) and the Early Warning Scoring System (EWSS) (Gardner-Thorpe et al., 2006, Roney et al., 2015, Smith et al., 2013, Stark et al., 2015). The National Early Warning Score (NEWS) and its modified version, NEWS2 are validated for the detection of patient deterioration in a broad range of clinical settings (Hydes et al., 2018, Kim et al., 2020, Scott et al., 2020) and advocated for as screening tools for sepsis (Lim et al., 2019, Pullyblank et al., 2020, RCP, 2017). Early Warning

Scores are widely implemented in acute care and recommended in UK hospitals by the NHS (NHS England, 2017a), the National Confidential Enquiry into Patient Outcome and Death (NCEPOD, 2015) and the National Institute for Health and Care Excellence (NICE, 2016).

Despite the wide dissemination, demonstrating the effectiveness of early warning scoring systems to decrease morbidity and mortality has proven challenging, and serious, avoidable adverse outcomes presaged by deterioration in vital signs are still a major source of morbidity (Pedersen et al., 2018, Petersen et al., 2014). This view is complemented by others who reported that despite the implementation of early warning score systems, potentially avoidable adverse clinical outcomes continue to occur among patients in hospitals (Pimentel et al., 2021).

The discussion about why this occurs has been the subject of much debate, with many referring to their simplicity and questioning whether such scoring systems correctly reflect markers of patient deterioration. Some questioned early warning score systems on the grounds that the systems are merely based on abnormal vital signs measures and combine them into a single early warning score (Gao et al., 2007, Smith et al., 2008). Given the simplicity, Pimentel et al. (2021) argue that early warning score systems cannot account for other markers of patient deterioration, among them chronic abnormalities in physiology, increasing the possibility that deterioration goes unrecognised. Therefore, despite the breadth of vital signs and observations, monitoring intervals, trigger thresholds and responses included, their definition of markers of patient deterioration seems limited.

Much debate about an alternative view of the detection of patient deterioration has occurred in the literature that seeks to overcome the simplification of the conventional view on this topic. Some argue that the nature of the process, beginning from the

detection of a patient's abnormal physiology to triggering a practitioner response, is complex and demands an understanding of this process to design effective tools for professional practice (Petersen, 2016). This view is complemented by Odell et al. (2009), who argue that the detection of patient deterioration is vastly complex and affected by the context, demanding an improved insight into the context within which deterioration is detected and reported, which can help design more effective education and systems that support the detection of patient deterioration. However, the nature of the contexts within which deterioration is detected remains unclear.

Based on this literature, it is clear that the timely detection of clinical deterioration and sepsis continues to gain prominence in contemporary healthcare literature. A number of studies demonstrate that the delayed response to clinical deterioration is a common problem worldwide. The literature often discusses early warning scores as a solution to address this problem. Some proposed qSOFA for timely identification of patients at risk of deterioration, while others debated the advantages of the National Early Warning Score (NEWS) and its modified version, NEWS2.

While the literature on the timely detection of clinical deterioration discusses the diversity of screening tools to address the problem, one common theme has emerged. Researchers seem to find important yet limited value in using screening tools for the timely detection of clinical deterioration and sepsis. Some see it as a problem of disregarding the context within which deterioration is detected; others see the systems as inadequate for capturing the complexity of the process, beginning from the detection of patient presentations to triggering a practitioner response. These discussions, nevertheless, despite the tensions and conflicting issues raised, have been influential in opening up new ways of discussing the area of the timely detection of clinical deterioration and sepsis. An improved insight into the challenges related to this topic is required as the requirement for improvements in timely response to patient deterioration increases. Traditionally, scholars and theorists have been expressing

their views on what timely detection of clinical deterioration entails, however, what has been the subject of a little debate is the inclusion of nurses who engage in timely response to patient deterioration and whose contribution to these debates could confirm any assertions claimed in the literature.

2.3 The key conceptualisation of knowledge

As one of the objectives of this study is to understand what sort of knowledge and skills constitute sepsis recognition, it was important to explore what types as well as dimensions of knowledge are conceptualised in the literature as central to effective performance. A literature review from this area could establish a platform from which to scrutinise the design and delivery of educational programmes for sepsis recognition.

The literature describes many sorts and dimensions of knowledge. Aristotelian viewpoints of knowledge are often considered as a helpful starting point (Abbasi, 2011, Greenhalgh and Wieringa, 2011). Aristotle described knowledge as being composed of facts (episteme) (scientific, context independent, research-informed knowledge), skill (techne) (pragmatic, variable, context dependent, originating from experience, directed toward production), and practical wisdom (phronesis) (judgment, practical wisdom, variable, directed toward action). Aristotle portrayed knowledge as a connection of these three interrelated components (episteme, techne and phronesis). Such conceptualisation assumes that no single element constitutes knowledge by itself, instead, knowledge is mixture of these types (Brown and Duguid, 2001), and every type plays an imperative part in knowing, performing, and context-specific comprehending.

Gilbert Ryle (1949) critiqued the theories of knowledge as they focus on the discovery of truth or facts while ignoring the discovery of ways and methods of accomplishing things. The idea that there are at least two forms of knowledge was first made

prominent by Gilbert Ryle (1949). This includes, on the one hand, the knowledge which is expressed in 'knowing what' (sometimes called factual knowledge) as an explicit type of knowledge and described as knowing about something (Blackler, 1995). On the other hand, there is the knowledge which is expressed in 'knowing how' (sometimes called practical knowledge), which is described as an incorporated practice of applying explicit types of knowledge (Brown & Duguid, 2001).

Gilbert Ryle (1949) found a notable distinction between the two forms, theorising that knowledge how is not possible to explain with regard to knowledge that, and that knowledge how is a concept logically before the concept of knowledge that. Although they are distinct, equally there is a link between them. Ryle compared it to the game of chess to display the link between these types (Brown and Duguid, 2001). He described that although there is a link between knowing the instructions of chess, which he referred to as know that, and knowing how to play chess, they are distinct entities. Knowing how is frequently directed toward activities of an individual person, demonstrated in the exhibition of abilities, and therefore cannot be separated from the knower (Blackler, 1995). As a result of this distinction, Ryle further separated content-based subject matter from skill-based capability.

Although some may argue that knowing and doing are distinct entities, others are quite explicit in their beliefs and perceive that there is a link and interconnection between the two (Cook and Brown, 1999, Star, 2005). To illustrate, repairing a car involves know that (demonstrated in reasoning such as having appropriate information about mechanical issues and how to solve them), and functioning know how (demonstrated in particular abilities and their acts). While being involved in the process of repairing a car, new knowledge and insight might emerge and skills refine, therefore heightening the capability of knowing that and knowing how. Knowing how is "to a great extent the product of experience and the tacit insights experience provides...and is critical in

making knowledge (knowledge that) actionable and operational” (Brown & Duguid, 1998, p. 95).

Michael Polanyi (1966) suggested that knowledge can be divided into two dimensions. The division was that whilst explicit sorts of knowledge can be communicated, tacit knowledge cannot (Brown and Duguid, 2001). Despite this division, Polanyi’s perception was that explicit and tacit knowledge are interconnected dimensions rather than unrelated to each other. The explicit sorts of knowledge, although articulable, do not reflect all that the individual knows. Polanyi believed that certain sorts of knowledge are rooted profoundly inside the person and cannot be articulated and transferred.

In a similar way, more recently, Nonaka et al. (2001) proposed that tacit knowledge is far more than sorts of knowledge which are noncommunicable, but instead are sorts that are impossible to be communicated and transferred (Tsoukas, 2003). The subjection of tacit knowledge misconceives what, as a whole, knowledge is. Such as Aristotle’s interrelated elements, both the explicit and tacit knowledge equally construct ways of knowing (Cook & Brown, 1999).

Taken together, the literature describes many forms of knowledge which are central to effective performance. Yet, the current definition of sepsis recognition (Daniels et al., 2011, Singer et al., 2016) focuses mainly on explicit knowledge alone, and rarely takes account of various forms of knowledge, which the literature emphasises as central to effective performance. As such, the current conceptualisation of effective judgemental performance in sepsis recognition continues to be based on explicit knowledge alone, and as a result, sepsis recognition education operates at a disadvantage. Little is known about what knowledge nurses rely on in their clinical assessment. The lack of understanding suggests that an attempt to complete a more comprehensive understanding of what knowledge nurses rely on in their clinical assessment would be valuable for those who are learning to recognise sepsis.

2.4 Educational needs of practitioners

2.4.1 Research into educational needs

The review of literature shows that there is a growing body of research that highlights the importance of identifying educational needs (Chang et al., 2015). Several studies point out that Identifying educational needs of nurses can help to ensure that they are sufficiently prepared to deal with challenges of clinical practice.

In the literature, there is little research into the educational needs related to sepsis, but some parallels can be drawn from other areas of practice, which help illuminate some of the potential issues related to education. Pauls and Ackroyd-Stolarz (2006) conducted a survey-based needs assessment of Canadian emergency medicine (EM) residents (N=129), physicians (N=94) and nurses (N=87). The survey enabled identification of ethical challenges for which EM residents considered as being inadequately prepared for practice. Residents, physicians and nurses all recognised challenges in end-of-life care as the most important bioethics learning needs of the residents. Further learning needs included discussing consent, assessing capacity and discussing truth and bad news. This data could potentially guide and shape educational programmes for EM residents. Identifying the educational needs of nurses can contribute towards the development of evidence-based clinical education that can ensure the provision of nursing performance is delivered to a higher degree of nursing competency.

A recent study investigated nurses' perceptions of preceptors concerning their educational programmes (Chang et al., 2015). The findings of surveys of 386 nurse preceptors found that the majority of training programmes did not meet the perceived learning needs of nurse preceptors and were perceived to be clinically impractical. The

emerging themes from the data showed that participants felt that training was predominantly theoretical rather than practical.

Similarly, a UK-based study reported that educational programmes have not met the learning needs of nurse preceptors, and suggested that they have thus inadequately prepared them for their role (Panzavecchia and Pearce, 2014). Similar effects of educational initiatives have been reported in other studies (Smedley et al., 2010). Likewise, a further study reported that several nurse preceptors perceived the educational programme as excessively theoretical rather than practical (Madhavanpraphakaran et al., 2014).

A systematic review of qualitative research explored the educational needs of more than 900 carers providing care to patients at the end of life with various life-limiting conditions (Flemming et al., 2019). These studies have provided important insights into the educational needs of caregivers throughout the disease process and shown how the educational needs of caregivers may vary depending on the progression of the illness. It has enabled identifying the kind of information needed to prepare caregivers for the role and support them in providing the care for the patients.

Kim and Choi (2019) conducted a study that investigated the educational needs of Korean nurses (N=211) on clinical practice with the purpose of providing evidence for an educational programme. The method employed in this study was a self-reported questionnaire. The Hennessy-Hicks training needs analysis questionnaire was selected to measure a variety of clinical, interpersonal, and research performances that provide data on current performance levels, the types of skills that require development and the methods in which these developments may be likely to be reached (Hennessy and Hicks, 2011). The major educational needs emerging from this study relate to basic nursing science including nursing theory, interpreting laboratory tests, fundamental nursing and advanced nursing practice. The results of this study can be beneficial for

developing evidence-based clinical education that can ensure the provision of nursing performance to healthcare services is delivered to higher degree of nursing competency.

Several research studies have indicated that identifying the learning needs and knowledge gaps of nurses enables the ability to determine the topics that need to be addressed in training programmes for the purpose of satisfying their learning needs (Gould et al., 2004, Lai, 2013). Moreover, the benefits of such a valuable insight of understanding the learning needs can potentially inform research, practice and educational policy (Flemming et al., 2019). Yet, despite positive findings regarding its outcome, undertaking an educational needs assessment to develop an educational programme remains controversial and far from the norm in clinical practice.

Furthermore, the literature on educational needs suggests that these can be diverse in practitioners. Although the literature on the educational needs explored is not based on sepsis recognition research, it does help us to understand that educational needs are not universal across the board, and that different learners might prefer one way of learning over the other, depending on the context. Researchers have not treated in much detail whether any learner can use various learning approaches to learn more effectively. Additionally, little is known about educational needs in terms of context-specific learning, which takes into account a complexity spectrum ranging from the least to the most comprehensive ones to aid effective pedagogy and curriculum mapping.

Moreover, despite the fact that the literature on educational needs shows the diversity of the topic, one common theme has emerged. Practitioners seem to find limited value in the pursuit of academic knowledge alone. Some see it as a problem of inadequate preparation for practice; others see academic knowledge as impractical. In order to support educational efforts to improve our understanding of what is needed, a further

review of the literature is needed to explore how the educational needs for effective performance at work are conceptualised.

Based on this literature, it is clear that the educational needs of practitioners continue to gain prominence. An improved insight into the challenges related to matching educational provision to the educational needs of nurses is required as the necessity of improvements in early recognition of sepsis increases. What needs to be the subject of further debate in this improvement are the key conceptualisations of professional competence and its development, which contribute to these debates by helping to understand any assertions claimed in the literature explored in this section.

2.5 Competence in professional practice and its development

This section will explore the key conceptualisations of professional competence and its development. This will help explore various directions in, and influences on, our conceptualisation of the educational needs for effective performance at work. Donald Schön's viewpoints are often considered as a helpful starting point on this point. He was among the main practical contributors to professional competence development. In his work, Donald Schön criticised traditional views of competence on the grounds that "what aspiring practitioners need most to learn, professional schools seem least able to teach" (Schön, 1987, p.8.) and defined it as a "crisis in professional education" (Schön, 1987, p.8.).

The issue is regarded as evidence of the technical-rationality used in professional education (Cheetham and Chivers, 2000), which involves primarily applying technical or specialist knowledge (Cheetham and Chivers, 2000). In emphasising lived experience, Schön (1987) claims that, in actual practice, practitioners embrace a more reflective approach than assumed by this conventional approach, since it yields

context-free knowledge informed by research which does not represent the context-specific issues from the actual practice outside of school.

In stressing the significance of learning from lived experience in real world practice, Schön (1987) highlights two components of competent practice, termed 'knowing-in-action' and 'reflection-in-action'. The former means knowing is in our skilful spontaneous action, while the latter happens when reflection is incorporated in ongoing action. Nevertheless, Cheetham and Chivers (2000) conducted a study with the intention to verify Schön's theory and discovered that practitioners' decision making frequently relies on a mixture of epistemologies, drawing on a combination of intuition, expert and tacit knowledge (Hatsopoulos and Hatsopoulos, 2009). This implies that no conclusive explanation about the reality of professional practice can be derived from Schön's 'knowing-in action', nor the technical-rational epistemology.

2.5.1 Exploring the concept of practice

2.5.1.1 A traditional understanding of practice

As a background to further review the current understanding of professional competence and its development, it is essential to review the very concept of professional practice. In dominant theories related to professional competence and learning, Jane Lave (1993) highlights that the practice of a profession is viewed as an objective container for specific sort of social interaction. More precisely, the container that represents the practice of a profession is commonly viewed as an objective structure comprising established social instructions and standards. Such understandings view the content of the container as detached from its container (McDermott, 1993), and thus content is possible to decontextualise and formalise into professional education programmes (Dall'Alba and Sandberg, 1996). It assumes that internalisation of this content produces the ability to function effectively within the profession.

However, the container understanding of practice has been questioned on the grounds that “practitioners cannot be meaningfully be separated from their activities and the situations in which they practice” (Dall’Alba and Sandberg, 1996, p.413), demanding a different understanding of knowledge and competence to design effective programmes for professional practice.

2.5.1.2 An Alternative understanding of practice

An alternative understanding of practice is proposed that defines practice in a distinct sense. Anthony Giddens (1984) proposed that practice is constituted in an intersubjectively way via mutual comprehension of a particular established order executed by the practitioners, rather than by an objective structure that constrains practice of practitioners or as is sometimes asserted, merely by the subjectivity of practitioners. The intersubjective view of practice is complemented by Lave’s (1996) investigation into how apprentice tailors learn their craft, giving the conclusion that “the subjects and the world within which they were engaged mutually constituted each other” (Lave, 1996, p.157). This describes a shift in the starting point from an objective structure that constrains action of practitioners merely by the subjectivity of practitioners to an alternative view of professional competence. In this alternative view, practice is viewed as a dynamic flow that practitioners produce and reproduce, rather than a fixed or static container (Giddens, 1984). With this view of practice, practitioners can have one or even multiple understandings of practice at any particular time, which might vary or even contradict, thus representing a holistic and reductionist understanding of practice simultaneously (Dall’Alba and Sandberg, 1996).

The problematic areas raised by the reviewed literature concerning professional practice include intersubjectivity, its dynamic nature and its pluralistic characteristics. This view of practice is in a sharp contrast to the views of professional practice which

are fundamental to the current understanding of professional competence development. This will be critically examined in the section below in terms of the definition of professional competence and its development.

2.5.2 Competence in nursing

2.5.2.1 Traditional approaches to competence in nursing and its development

Literature on defining nursing competence seems to lack conceptual clarity. Garside and Nhemachena (2013) discuss that a variety of conceptualisations of nursing competence occur in the literature, among them the behaviourist and holistic approach. According to the authors, although these approaches provide two different conceptualisations of competence, they share numerous similarities both in the method of identifying competence and the position taken towards competence.

The behaviourist approach, which is common to nursing, views competence primarily as constituted by tasks and skills. Accomplishing overall competence within this approach is regarded as attaining a satisfactory degree of performance in every element of a specific task (McMullan et al., 2003, Watson et al., 2002). The relevant attribute is commonly captured via direct observation of the individual's performance. The behaviourist approach to competence has been subject to criticism for being reductionist and more focused on what an individual is able to perform as opposed to what they know, while ignoring other essential attributes that are central to nursing care including nursing judgment.

Eraut (1994) argues that competence is the term frequently associated with the details of what a competent individual can do in particular contexts. Thus, it is critical to consider the definition of competence in general, as well as under particular situations and circumstances associated with the nurse role (Eraut, 1994). The role of nursing is

multidimensional in that it cannot simply be limited to a mechanistic set of competencies. It is context-dependant as it entails a wide range of abilities that vary, depending on the needs of each clinical speciality in which nursing care is being provided.

This view is complemented by Epstein and Hundert (2002), who considered this concept in conjunction with the scope of competence of practitioners which needs to be linked to the clinical environment where it happens. The authors further state that a nurse may be entirely competent in a clinical area in which they have many years of experience, but their competence might be more debateable if they are transferred to a less familiar environment. The behaviourist approach to competence has been subject to criticism not only because it views competence in terms of attributes, but also as it disregards people's meaningful experience of practice (Dall'Alba and Sandberg, 1996).

In addition to the behaviourist approach, there are also advocates of the holistic approaches to competence. Advocates of the holistic approaches also view competence as constituted by a set of attributes. What differentiates the holistic approach to competence from others is that it does not reduce competence to a mere sum of individual competencies, but rather treats it as an entity in itself (McMullan et al., 2003). Competence is constituted by wide range of general attributes, typically represented by motives, personal interests, perceptiveness, and receptivity required for effective performance (Cowan et al., 2005). These fundamental attributes offer the foundation for transferable skills in providing care (McMullan et al., 2003). Eraut (1994) describes the holistic approach to competence as an individual's whole capacity and competency, which allows the practitioners to accomplish their role.

In the UK, nursing competence has been primarily focusing on the practical skills essential for independent implementation of nursing care. For example, in 2002, competence has been defined by the NMC as "the skills and ability to practise safely

and effectively without the need for direct supervision” (NMC, , 2002, p.38). This definition predominantly emphasises the know-how and relates to the practical skills necessary to autonomously deliver nursing care (Ryle, 1949). Ironside et al. (2014) suggested that the confusion about the definition and identification of those competences nurses need in their practice poses a challenge for determining learning experiences which would most effectively assist the development of competence.

2.5.2.2 Critical evaluation of the current approaches to competence

Although these approaches have contributed to our understanding of professional competence, in the literature they have been a subject to criticism. Several studies questioned whether such knowledge correctly reflects human actions (Benner, 1984, Dall'Alba and Sandberg, 1996, Dreyfus and Dreyfus, 1986).

According to Sandberg (2009), approaches to competence vary in how they assess the phenomena itself, yet they offer similar theories of competence at a workplace level as they all view it as an attribute-based phenomenon. In those approaches, competence is viewed as constituted by a definite set of attributes that people utilise to accomplish their professional work. Additionally, attributes are mainly viewed as context-free. In other words, a fixed attribute is perceived as having a fixed meaning in itself; it is viewed as separate from context and thus as able to be implemented in a variety of work performances.

According to Sandberg (2009), the view of competence is then reflected in the simplified view of competence development, which is based on a principle of transferring knowledge and skills as efficiently as possible to a learner who lacks them. In addition, it is the human resources specialists who select from a list of selected attributes which need to be incorporated in a training intervention. Taken together, although the conventional approaches have continued to contribute to understanding of

competence at work, their definition of competence as a set of attributes seems oversimplified and founded on a false premise that defines knowledge and practice as separate entities.

2.5.2.3 Alternative approaches to competence and its development

Much debate about alternative approaches to competence that seek to overcome the simplification of conventional approaches has occurred in the literature (Benner, 1982, Dall'Alba and Sandberg, 1996, Dall'Alba and Sandberg, 2006, Sandberg, 2000, Sandberg, 2009). Perhaps the most significant contribution to addressing a shortcoming of conventional approaches to competence is derived from the study of Benner (1982). Benner (1982) viewed nursing competency as being able to accomplish a task with the intended results in a variety of real-world contexts. In her research of professional competency in nursing, Benner used extensive descriptions of lived experience of nursing practice to demonstrate the situational and context-specific nature of competence, rather than seeing it as mainly consisting of knowledge and skills.

Characterise competence as fragmentary

Despite the significant contribution to addressing a shortcoming of conventional approaches competence is derived from the study of Benner (1982), the author was unable to address a shortcoming of conventional approaches that characterise competence as fragmentary. From descriptions of lived experiences of nursing practice, Benner described a variety of nursing competencies and arranged them into domains of nursing practice, including the helping role and the diagnostic and patient-monitoring function, amongst others (Dall'Alba and Sandberg, 1996). However, Benner did not treat the domains to show how they are interrelated to, or incorporated with, each other in forming nursing competence. In this regard, Benner was unable to address a shortcoming of conventional approaches that characterise competence as

fragmentary (Norris, 1991, Sandberg, 2000). As a result, Benner did not describe the domains of nursing in a manner that explains the way in which competence development and its incorporation should be adopted in nursing education.

Decontextualised method of instructions

Even though Benner advocated for context-based competence, the recommendations for how to educate nurses generally rely on type or method of instructions in a way that is rather decontextualised. Commenting on method of instruction, Benner recommended that “since novices have no experience of the situation they face, they must be given rules to guide their performance” (Benner, 1984, p.21). In contrast, “proficient performers are best taught by use of case studies where their ability to grasp the situation is solicited and taxed” (Benner, 1984, p.30).

According to Dall’Alba and Sandberg (1996), the challenge with such principles for educating nurses is that the effectiveness of a specific method or learning environment is dependent on how it is used and for what intention. The complexity of professional competence is unlikely to be captured with one type of learning strategy by itself. Therefore, even though Benner contributed to our understanding of how to educate nurses, this rather decontextualised type or method of instruction is still limited.

Professional practice and learning were also extensively studied in fields as diverse as architecture and physiotherapy by Donald Schön (1983, 1987). Similar to Benner, Schön highlighted the significance of an opportunity to learn via lived experience of practice in real situations. A key element of the contextualised view of competence is its tacit dimension (Polanyi, 1966). According to Giddens (1984), work duties in which practitioners engage are undertaken just partly in discursive consciousness, in which actions, and their rationale, can be explicitly articulated. Practitioners’ competence in achieving activities is mainly executed in practical consciousness’, which “consists all

of those things which actors know tacitly about how to 'go on' in the contexts of social life without being able to give them direct discursive expression" (Giddens, 1984, p. xxiii). Therefore, a decontextualised view of attributes results in disregarding the tacit dimension of competence (Schön, 1983).

According to Schön (1983), the discrepancy between scientific knowledge and knowledge regarded by practitioners is an issue of decontextualization. Schön (1983) performed an investigation of performance of workers and revealed that when workers face their work, the attributes used in accomplishing it are not independent from their experience of it. Instead, it is internally related via the way they framed the particular situation. Taking into account this view, in which attributes gain their context-dependent nature via experiencing the work, it needs be concluded that practitioners' way of experiencing the work may be more central than the attributes involved alone. As such, practitioners' competence that is separated from context is problematic in a dualistic view. Dall'alba and Sandberg (1996) argue that, as practitioners' competence cannot be detached from practice, it is therefore embedded in practice. In addition, if accomplishment of practitioners' competence mainly occurs in practical consciousness then competence cannot be entirely separated from context.

2.5.3 Development of competence in professional practice

Benner (1984) also detailed the acquisition of nursing competencies and identified five possible levels of competence acquisition originally identified by Dreyfus and Dreyfus (1986), and labelled as novice, advanced beginner, competent, proficient, and expert. They studied competence acquisition among airline pilots, chess players, automobile drivers, and adult learners of a second language and identified similar patterns of competence acquisition in all of them. These patterns were then organised into five stages of competence development. In Benner's study, the author sought to determine the ways in which practice between nurses at diverse stages of their professional

experience differ via examination of the critical incidents that her research participants experienced. She was able to match the data of the nurses' experiences to the model of competence development and espoused by Dreyfus and Dreyfus (1980). By drawing on this concept of competence acquisition, Benner (1984) positioned competence at the centre of a continuum that ranges from novice through to advanced beginner, competent, proficient, and expert. According to Benner (1984), progressing through these five levels results in beneficial improvements and competence development. What follows is the description of the model.

Stages

Novice

Beginners are learners who are in the novice stage and are anticipated to have abilities for which they have no previous knowledge or experience. The beginner learner discovers standardised rules that help them in accomplishing the particular skills (Benner, 1984). Beginner learners who are in the novice stage are still in nursing education.

Advanced beginner

The advanced beginner level is the next stage in the process. They apply learned procedures and rules to identify what actions are required for the imminent situations. According to Benner, newly graduated nurses are in this stage of clinical competency. Benner confirmed that the learner's performance is marginally acceptable in this advanced beginner stage.

Competent

Competent nurses are task orientated. Benner claims that competent nurses are anticipated to be those with a consistent exposure to the same clinical environment in which they can perform the task independently and begin to deliberately organise their

work with regard to planning for goal accomplishment. In this stage, nurses have the ability to view efforts with regard to long-term goals and plan their actions with deliberate and analytical reasoning for the purpose of accomplishing improved efficiency. Nurses at this stage can respond to many clinical situations, however the ability to recognise situations holistically is absent. According to Benner, it takes a nurse about two to three years to reach the competent level.

Proficient

Proficient nurses perceive situations holistically and possess the ability to recognise and respond to changing contexts.

Expert

Expert nurses recognise unforeseen clinical responses and can make others aware of possible issues in a timely manner before they happen. Experts can intuitively grasp the situations as a whole and have the ability to diagnose and respond without unnecessary deliberation of unproductive possibilities. Because of their superior performance, others frequently seek consultations with expert nurses. Most nurses will advance to the competent level of expertise, however not many will reach the expert level (Benner, 1984).

Critique of Benner's and Dreyfus' competence development

The Dreyfus and Dreyfus and Benner approaches improve our understanding of competence development in comparison to earlier models yet incorporate some notable drawbacks. The fundamental critique of the Benner and the Dreyfus models is the notion of a fixed sequence of professional development. Their view is that competence development occurs via progressing through the five levels of competence acquisition as they acquire knowledge and develop skills, starting as a novice and progressing from one stage to another towards expert, even though not everyone

accomplishes expert level. However, other authors (Dall'Alba and Sandberg, 1996) question the likelihood of such a fixed stepwise development, taking into account a variety of practitioners' experiences during the development of competence.

Taken together, the literature on competence focused mostly on the approach adopted by the behaviourist paradigm. Around this, other methods of identifying competence were inspected to determine the difference between this approach and others.

Approaches to competences developed within the interpretative paradigm were reviewed to further explore the conceptualisation of the educational needs central to effective performance.

This study suggests that the limitations of current approaches are not regarded as to be related to the attributes themselves, but due to the dualistic ontology which underlies the approaches to competence. These views simply stipulate that competence constitutes a list of competencies which are retained by people at work. In addition, defining competence at work and its development is mainly determined by philosophical arguments supported by experts and government organisations (Pillay et al., 2003), but rarely seems to reflect knowledge and experience of practitioners. The inclusion of work-based learners whose contribution to these improvements could confirm any assertions claimed by experts.

2.6 Work-based learning

As the purpose of this study is to report on the experiential views of nurses participating in work-based learning, albeit in a specific context, it was important to explore the literature into the current conceptualisation of work-based learning itself. It was hoped that a review of literature from this area would help understand the issues arising from the current conceptualisations of work-based learning to lay a foundation from which to explore and address the issues in these conceptualisations.

2.6.1 The value of work-based learning

In literature, the debate about work-based learning is gaining popularity in economic and workplace discussions. The discussion about the value of work-based learning in the workplace has gained a fresh prominence with many, like Boud and Solomon (2001), emphasising the value of work-based learning in higher education. They argue that work-based learning in higher education is one of the few post-graduate teaching and learning novelties that can address economic, social and educational needs in our era.

With respect to work-based learning in the workplace, as is the context of this research, Williams (2010) argues that that work-based learning is gaining popularity since organisations are urged to search for work-based learning solutions to address cuts to the resources for training introduced by increasing economic pressures. Eraut (2007) put forward an additional argument in support of work-based learning, claiming that formal learning strategies have only a negligible impact on learning in comparison to the work-based learning.

While some argue in favour of work-based learning, other broader debates have raised concerns about the generation of knowledge in the context of work-based learning, thus questioning the place of work as a sustainable learning environment (Fuller and Unwin, 2002). Based on these issues, it is clear that work-based learning continues to gain prominence in economic and workplace discussions. Need for an improved insight into the challenges related to work-based learning is required as a requirement for work-based learning increases. What has been the subject of little debate in this improvement is the inclusion of learners who engage in work-based learning, even though their contribution to these debates could confirm any assertions claimed in the literature.

2.6.2 Definition of work-based learning

According to the literature, there are two groups of work-based learning approaches; the learning that comes from daily practice in the work and learning that comes from formal university courses that draw upon learning from work. In the literature, the learning which happens at work is generally referred to as organisational learning, continuing professional development, the learning organisation or company training (Boud and Garrick, 1999). This research primarily focuses on this kind of work-based learning.

2.5.3 Benefits of work-based learning

While diverse groups of work-based learning exist, the literature offers a convincing case for the workplace as an appropriate learning environment. Supporters of learning that occurs within the workplace have questioned the concept of restricting learning to the formal university programmes, arguing that theory and practice should not be separated (Raelin, 2007). Some argue that learning in a formal environment has only a minor impact on learning in the comparison to learning in the workplace (Eraut, 2007). Existing research that promotes the benefits of work-based learning in the workplace (Attenborough et al., 2019) found that the participation of a learner in unpredicted situations offers learning opportunities on multiple levels.

2.6.4 Different conceptualisations of work-based learning

Broader debates in literature indicate that there are many different conceptualisations of work-based learning. Some researchers' conceptualise work-based learning in terms of identifying attributes central for professional development. For instance, Wilson, McCormack and Ives (2006) point out that attributes for professional development could be described from different perspectives, one being the ability to merely adopt new knowledge and the other to even critically examine practices in workplace.

In addition, identifying attributes central for professional development do not provide an understanding of limitations or applicability of each attribute in different contexts, and in what context it needs support and in what context it is challenging. With regard to the different perspectives, learning can have different meaning to different learners (Govranos and Newton, 2014). Some may limit their understanding of learning-directed and structured education, and not perceive learning as seeking information beside work.

Some authors' conceptualisations of work-based learning have been interested in highlighting teaching methods and descriptions of how learning takes place within the workplace (Helyer, 2015, Kim et al., 2018, Wofford et al., 2013). This is exemplified in a review that examined workplace learning and reported conceptualisations of the concept of work-based learning, ranging from individual knowledge acquisition to learning within communities of practice (Fenwick, 2008). Others have focused on learning through mutual interaction among workers. Nisbet et al.'s (2013) definition of work-based learning is that informal learning happens within the working community through mutual interaction among workers. This definition is complemented by Eraut (2007), who describes that work-based learning includes involvement in work processes, collaborating with co-workers, and involvement in challenging tasks. This definition is also supported by Moore (2007), who describes that learning occurs through mutual interaction among workers and the interchange of each other's experience.

However, in many disciplines, learning in the workplace is still regarded as being barely something more than obtaining training to carry out a work assignment (Williams, 2010). In contrast, Raelin (2007) claimed that learning in the workplace is even more than merely experiential learning that only involves supplementing an additional experience to conceptual knowledge. He asserted that one can acquire theory and practical experience simultaneously. Some authors have attempted to draw distinctions

between learning in the workplace and learning in a formal environment. This includes Raelin (2007), who described that deliberate reflection on real experience is what distinguishes work-based learning from traditional learning. Nevertheless, the breadth of these views provides understanding of various possible conceptualisations of work-based learning.

While some authors provide conceptualisation of the term work-based learning, others suggest issues with some of these conceptualisations when discussing learning methods. According to Jensen (2007) and Williams (2010), a major issue is that some conceptualisations of work-based learning focus on learning which provides employees with knowledge in the absence of active seeking for and processing that knowledge themselves. However, knowledge transfer never occurs from one individual to the next as it stands, since the new knowledge is constantly created through the thinking process of the person (Nevalainen et al., 2018). Accordingly, a meaningful reconceptualization of work-based learning would pay attention to the process of learning in the workplace environment. In addition, since experiences influence the significance an individual assigns to their learning and professional development (MacKeracher, 2004), looking into the variation in the experience might be beneficial in reframing work-based learning from the viewpoint of the learner. This view, that there are many different conceptualisations of work-based learning, is complemented by a review examining workplace learning conducted by Fenwick (2008). This found multiple views of the concept of work-based learning, with some opposing perspectives related to learning contexts. Based on the findings, the author discussed the potential relationship between distinct systems' components and suggested a need to examine the relationships between these components, and to investigate how knowledge emerges and practices are framed in their relationships.

2.6.5 Challenges of learning within the workplace

Some authors have raised concerns whether workplaces themselves are sustainable environments for learning (Fuller and Unwin, 2002). Jedaar et al. (2009) contribute to that discussion by claiming that nobody can predict the form of clinical scenarios or to ensure that learner can notice and participate in them. In a similar vein, Nevalainen et al. (2018) discussed the challenge of integration of learning situations into complexities and difficulties of everyday work. The authors reported that work-based learning is negatively influenced by two contradictory issues: learning needs and the reality of nursing practice and courses. According to these authors, learning in different contexts might introduce other challenges for learners who already deal with numerous demands on their attentiveness and time.

Taken together, although some highlight the advantage of work-based learning in terms of variety of learning opportunities (Attenborough et al., 2019), others debate the disadvantage in terms of complexities and challenges of learning within this environment (Govranos and Newton, 2014). These discussions, nevertheless, despite the tensions and conflicting issues raised, have been influential in opening up new ways of discussing the area of preparation for participating in work-based learning.

2.6.6 Readiness for work-based learning

Nevalainen et al. (2018) responded to such debates by discussing the strategy of the integration of learning situations into the complexities and challenges of everyday work, rather than viewing them as unrelated issues. Since work-based learning is negatively influenced by the tension of two contradictory issues (learning needs and the reality of nursing practice and courses), this strategy would capitalise on learning opportunities within complex working environments while reducing the tensions of work-based learning. Therefore, the challenge remains of how do we integrate learning situations

into complexities and difficulties of everyday work while capitalising on learning opportunities within complex working environments.

Williams (2010) responded to this challenge by discussing the need to ensure learner readiness to participate in work-based learning, especially with regard to guaranteeing the ability to learn in a context full of uncertainty. Several authors recommend that learning in the workplace needs to go beyond the conventional views of learning, in which employees are provided with knowledge to a more comprehensive view of actively searching for and processing that knowledge themselves (Jensen, 2007, Williams, 2010). Gregory et al. (2014) argued from a learning viewpoint that workplaces need to have awareness of applicable sources of knowledge and the contexts of knowledge, and direct their attention to exploring these contexts that generate knowledge and learning. If we seek assurance that learners are ready to participate in work-based learning (Williams, 2010) then educators may also need to be prepared how to facilitate such learning.

Govranos and Newton (2014) argued from a learning viewpoint that clinical nurse educators need to understand that learning needs of nurses may inspire the establishment of work-based learning if there are effective systems in place to facilitate support in challenging and complex learning environments. Based on these discussions, it is clear that learners' readiness to learn in the workplace continues to gain prominence in the literature. The need for an improved insight into the preparation for participating in work-based learning is required as the necessity for work-based learning increases.

Although scholars and theorists have been expressing their views on what the preparation for participating in work-based learning entails, limited research has attempted to investigate the phenomenon with the inclusion of work-based learners,

whose contribution to these debates would confirm any assertions claimed in the literature.

2.7 Learning theories

This section will discuss learning theories through which work-based learning is conceptualised in literature. Their diverse theoretical views can offer different lenses via which learning can be conceptualised. It can provide a means to potentially interpret the findings of the present study and address issues which have yet to be considered in relation to learning theories. Literature describes multiple learning theories through which work-based learning can be conceptualised, including community of practice, experiential learning and adult learning theory.

2.7.1 Social learning theory

The social theory of learning is one through which work-based learning can be conceptualised. The theory highlights that learning takes place via social interaction (Lave and Wenger, 1991). The most widely used notion in this area of work-based learning is the community of practice, which refers to groups of people with a common interest in a specific field who engage on a regular basis to develop expertise in the domain (Wenger et al., 2002). The initial notion of community of practice stems from a partnership between Wenger and Lave, which resulted in the publication *Situated Learning: Legitimate peripheral participation*, where they argue that learning is more than merely to receive and absorb information. Instead, in their observation, learning is “increasing participation in community of practice” (Lave and Wenger, 1991, p.49).

In this social view of learning, Wenger suggested that all learning takes place through social interaction, which challenged the notion that learning was derived from teaching of subject-matter content (Wenger, 1999). Despite the recognition that theoretical models may inform learning, Wenger argued that codified knowledge into subject-

content can act as impediments among learner and learning endeavour. In line with this notion of integrating theory and practice, Marton (2014, p.9) claimed that pedagogy is “far from a necessary condition for all learning”. He claimed that participation, in addition to learning under instruction, can result in learning. Considering these views, the message from the authors here is that learning not only occurs in the form of formal learning, but also within the workplace via social interaction. This also suggests the need to broaden this notion of learning and develop an understanding in practice, which is the focus of next section.

The notion of community of practice has evolved, and the theory has continued to develop in complexity and focus. In his influential book *Community of Practice, learning, meaning and identity*, where the focus is learning within workplace, Wenger broadens this concept (Wenger, 1999). Wenger describes the process of how a novice gradually progresses from the periphery to the centre of a community of practice through negotiating identity and practice (Wenger, 1999). However, Wenger’s community of practice theory’s use of peripheral participation has been challenged by a number of writers. On principle critique of the model is that the main attention on novice expert differences overlooks more central characteristics of professional development (Dall’Alba and Sandberg, 2006).

For example, Engeström and Miettinen (1999) highlight a drawback of much research on communities of practice that emphasise novice expert differences, including other novice to expert models (Benner, 1984, Dreyfus and Dreyfus, 1980). They point out that skill development is mainly viewed as:

“a one-way movement from the periphery, occupied by novices, to the center, inhabited by experienced masters of the given practice. What seems to be missing is movement outward and in unexpected directions: questioning of authority, criticism, innovation, initiation of change. Instability and inner contradictions of practice are all but missing” (Engeström and Miettinen, 1999, p.12).

Support of the critique of the model that focuses on novice expert differences can also be found in empirical research that explored distinctions between novice and expert teachers (Carter et al., 1988, Livingston and Borko, 1989). Even though reporting results emphasise variation among groups, variation within the groups is also found. In the studies, variation within groups can potentially be deemed a significant finding, however the main emphasis was redirected on variation between two different phases of development, such as novices and experts. Therefore, although the distinctions within individuals between two different phases of development are mentioned, in both studies little attention is paid to their significance.

The gap in knowledge is that the model which emphasises variation between the groups seems limited in its scope. This is emphasised by Sturmborg and Martin's (2008) view that even if people predominantly process information in one way of reasoning, they also process them some of the time in all or some of the other forms of reasoning or shift to and from one way of reasoning to another depending on the context.

The support of the critique of the model that focuses on novice expert differences also comes from one study that used longitudinal data to explore this notion of variation within one skill level in more depth (Dall'Alba, 2004). This examined variation in understanding of professional practice among 13 medical students. These students were monitored while engaging in consultations with patients throughout clinical training that took place in a 5.5-year medical programme. Results of this study show differences in the ways of understanding professional practice within one skill level. Dall'Alba (2005) discussed the significance of such research findings, arguing that seeking an exposure to an alternative understanding of practice and evaluating a relationship among them can potentially challenge and advance one's understanding.

This view of variation within individuals is in agreement with the view of practice as dynamic and pluralist (Giddens, 1984). In a similar vein, Åkerlind et al. (2005) described that phenomenography accounts for the possibility that the meaning of the phenomenon for any one individual might differ under diverse contexts, owing to the context-sensitive nature of experience. More precisely, phenomenography accounts for the possibility that the meaning of the phenomenon may vary within and among individuals. The whole set of differences offers a complete picture of how people can experience the phenomenon with a specific group at a specific time and in response to a specific context. Much of the research has been carried out that draws on this concept that meaning of the phenomenon may vary within individuals, as well as among individuals (Dall'alba, 2002, Dall'Alba, 2004, Watson, 2019), yet few studies have explored its implication for professional development.

Considering all of these views, the messages from the literature here appear to place emphasis on variations between skill levels, including novice to expert models. The message from the literature also suggests the need for a more complete picture of how people can experience the phenomenon in such way that provides a better understanding that the meaning of the phenomenon may vary within and among individuals.

2.7.2 Experiential learning

Another learning theory through which work-based learning could be conceptualised is experiential learning. The origins of experiential learning can be traced back to the works of such prominent thinkers as Dewey, Piaget, Lewin and others (Kolb, 1984), who situated experience within the concept of human learning and development.

Dewey's (1933) pragmatic approach to learning has been influential globally and endured over time. Dewey's emphasized theories of practical sense that place value on learning from experience in practical situations instead of acquisition of isolated skills. Dewey viewed the goal of education as the cultivation of thoughtful, critically reflective, and socially constructed learners instead of passive recipients of knowledge. A classic example of this is the introduction of the concept of reflective processes when Dewey noticed that reflecting on experience is a more effective way of learning than experience alone, as it proceeds intelligent actions (Dewey, 1933).

Dynamic nature of habit

Dewey believed that a huge amount of routine human conduct is not deliberative or planned, but is instead based on habit (Hansen and James, 2016). However, Dewey's approach to habit deviates from approaches espoused from mentalists who advocate for the autonomy of a thought and believe that habit is secluded within an individual. In contrast to this view, Dewey's views are a relational, embodied process that recognise that habits are developed through our interaction with the environment and argue against indoctrination of habits (Dewey, 1938). Several authors share Dewey's pragmatic view of habit and describe it as being dynamic and disposed towards manipulation, rather than static or routinised, as well as embodied and adaptable to the environment (Crossley, 2013, Hansen and James, 2016, Pedwell, 2017).

This antidualistic view of habit has been fully articulated in *Logic*, published in 1938 and subtitled *Theory of Enquiry* (Dewey, 1938). For Dewey, inquiry is viewed as a blend of both cognitive reasoning and activities in the world (Schön, 1992). This explains why Dewey rejects the autonomy of a thought that had been promoted by mentalists and the image of the ladder of knowledge that views theoretical knowledge as superior to practical skills and wisdom of daily matters. Dewey (1922) also made a distinction between routine and intelligent habits. The former is a form of repetition

which is commonly nondeliberate with goal of supporting the ability to replicate a preconceived set of practices, despite of changing contexts. The latter is a form of habit complemented by critical reflection, which involves reconstruction of habits based on gathered experience. According to Hansen and James (2016), the goal of the form of habit is to remain open to change and cultivate them to allow improved responses to changing contexts. While the cultivation of routine habits can be achieved through training, intelligent habits include continual and persistently increasing exposure to challenge and complex problems, as well as reflection and adjustment, as this demands reacting in flexible and diverse ways rather than just pursuing repetitions (Glăveanu, 2012).

Based on this distinction, according to Dewey, the world can be approached in two ways. One is experimental and reflective and results in development, and the second is experiential and upholds established practices and routine (Hickman and Alexander, 1998). Dewey claimed that the central principle of reflective practice and learning is not purely thinking but testing the effects of theory in reality. Dewey placed value on deliberate, functional processes that aim on learning something formerly undetected in order to complete an intellectual task, while also referring to learning as a passive recipient of knowledge as intellectually ineffective.

CRITIQUE

In terms of the distinction, Dewey (1973) has called attention to the concept of thoughtless mastery of the daily practice that occurs in the absence of thoughtful deliberation. Dewey (1932) pointed out that even when intuitive decisions appear evident, it might not necessarily be an optimal decision and, thus, prior to responding, prolonged mental contemplation might be needed. Intuitive decisions may need to be treated as subject to improvements, validation and reconsideration through examining, inquiring, or turning things over in the mind.

Drawing upon the concept of a distinction between routine and intelligent habits, Dewey presented the division between *knowing-how* and *knowing-that*. This distinction is grounded in deliberate observations and reflections that generate insight. According to Dewey (1922), we *know-how* via our habits expressed in many activities, and this occurs in the absence of thoughtful deliberation. Based on this sort of knowledge, we know how to do something. However, knowledge of distinct forms is knowledge of and about things described as *knowledge that*, which entails reflection and deliberate appreciation.

Benner et al. (1996) endorsed this distinction between *knowing-how* and *knowing-that*, discussing how little of our lifetime is spent in a conscious, thoughtful mode of cognition that requires *knowing-that* compared to the great amount of our lifetime spent in the absence of conscious judgment, manifested as *know-how*. This includes being receptive to less obvious changes in clinical scenarios, responding to salient information, and attending to problems or complaints of patients.

FORMATION OF HABIT

Within the literature on Dewey's account of habit, the question still remains in contemporary discussions about how a change in action can happen when habit, which favors stability, is influential in human actions (Weiss, 2008). Weiss argued that the question is as critical for today's education like it was when John Dewey claimed a century earlier about the dynamic function of habits in people's reactions to novel stimuli and situations. According to Hansen and James (2016), Dewey's view of habit is highly relevant to the current educational system that continues to promote a high-stakes assessment and top-down accountability procedures that contribute to the formation of personal habits which may prevent any efforts to participate in community contemplation and activities.

Some argue that change in context can influence the inclination for repetitions or routines and dissolve fixed habit (Bourdieu and Wacquant, 1992, Hickman and Alexander, 1998). In particular, in the context of deep uncertainty, we are often driven to think and act in novel ways (Dewey, 1910). Several creativity researchers have also observed that encountering ill-defined issues may triggers creativity and imagination (Craft, 2015, Greene, 1995, Pretz et al., 2003). This might explain why Dewey viewed habit formation as “an expansion of power not its shrinkage” (Dewey, 1922, p.41). The causes of that change have been subject to intense debate. Several authors reported that changes in context might lead to a conflict, and therefore the formation of new habits (Bourdieu and Wacquant, 1992, Hickman and Alexander, 1998).

CONDITIONS FOR LEARNING

However, Dewey (1987) indicated that experiential learning does not occur in just any environment with just any individual or every instance. Dewey (1987) proposed that learning environments for experiential learning need to be enriched. The conditions under which experiential learning occur include rich performance feedback, and opportunities to communicate and reflect on experiential learning which are deliberately planned.

MULTIDIMENSIONAL EXAMINATION OF LEARNING

Dewey's (1932) views on the dynamic role of habits can contribute to a multidimensional examination of learning and the context in which it happens. In *Human Nature and Conduct* (1920), Dewey critiqued former accounts of philosophy that regard habit as a thoughtless and repetitive routine, that has a restrictive role rather than an essential and flexible influence on engagement with the environment. Dewey and Bourdieu view habit as the principle that produces strategy and enables individuals to handle unanticipated and evolving situations (Bourdieu and Wacquant, 1992, Hickman and Alexander, 1998). In a similar vein, the context of increasing

uncertainty in clinical practice may be the stimulus to seek novel ways of approaching practice (Klemola and Norros, 1997).

Thus, the literature of Dewey's account of habit underscores how responses and habits constitute potential transformations that are worth exploring within work-based learning.

2.7.3 Adult learning theory

Up until the early 1920s, adult learning was essentially associated with pedagogy described as the art and science of educating children (Knowles, 1975). This section will describe the context of adult learning theory pedagogy while demonstrating commonalities with previously discussed theories.

In the middle of the 1920s, teachers of adults started to question the application of the pedagogical assumptions to adult learners, once they realised that their learners' features did not correspond to pedagogically derived beliefs of learners. In pedagogy, education is viewed as a passive transmission of knowledge and skills that have withstood the test of time. Pedagogy was driven by content and loaded by fact-laden lectures, and rote memorisation. However, the adult learner-focused *Journal of Adult Education*, between 1929 and 1948, reported results of experimentation with teaching alternative ideas. Despite improved outcomes in teaching, teachers still articulated shame about disregarding academic norms. This resulted in examination of the findings and research into adult learning by developmental psychologists, resulting in a more logical theory of adult learning (Knowles, 1975).

In the 1970s, Malcolm Knowles further expanded upon the theory of andragogy. He is also credited with popularising andragogy. He proposed this as a solution to address the inadequacy of pedagogy. According to Knowles, pedagogy's concept of the aim of

education does not apply to adult education. The assumptions included in andragogy were that adult learners are autonomous and independent; and adult learners gathered experience that is a great source of learning. These beliefs enabled the descriptions of andragogy and differentiation between adults' and children's learning. Accordingly, the term andragogy was adopted to explain the art and science of helping adult to learn

The 20th century saw the onset of the changed world we currently live in. The world of readily available information created a change that was rapid enough that traditional ways of training became insufficient, and discipline-centred knowledge became irrelevant for preparation for contemporary workplaces. This created the need for flexible and adaptable practices, and for immediacy of learning (Hase and Kenyon, 2001). Education and its role in holistic development of people and societies needed to be redefined. Transmission of what was known was no longer sufficient for education (Knowles, 1980). It required the development of the skills of learning how to learn and the cultivation of the skill of self-directed inquiry.

Merriam (2001) pointed out that andragogy has been criticised for too much focus on individual learners, while disregarding the sociocultural context in which learning takes place. The author also pointed out that no single theory has been developed about the adult learner, the diverse contexts where the learning occurs or the learning approaches alone. Rather, multiple theories and sets of assumptions exist that combine within the knowledge base of how adults learn. The more important learning theories include andragogy and self-directed learning.

The practical implications of andragogy's principles about adult learners can be derived for the ways in which work-based learning is designed and delivered. The applicable assumptions incorporate the adults' demand for a reason for learning something, as they need to learn via experience, focus on specific problem solving and require

imminent application to what gained knowledge. Unless educators take this into account when working with adult learners, the learners' needs may not be met.

2.8 Students' conceptions of learning

The previous section has demonstrated different theories of learning through which work-based learning is conceptualised in literature. Their diverse theoretical views offer different lenses via which learning can be conceptualised. What follows is the review literature on conceptions of learning, providing examples of studies which has been undertaken into this topic. The literature in this area can provide the platform from which the findings can be critically evaluated. It is followed by a summary of the gaps and issues found in the literature review. Lin, Tsai and Liang (2012) observed that conceptions of learning are a reflection of the beliefs of the learner with respect to their reasons for learning something, the way they learn and the best environment of learning. In addition, conceptions are a reflection of understanding and relationships to the phenomenon under investigation (Marton, 1981, Marton, 1986).

Research on conceptions of learning

A considerable amount of literature, beginning from the 1970s, has examined learning with an attempt to reveal why certain learners learn better than others (Marton and Booth, 1997). The evidence suggests that a learner's conception of learning is a valuable determinant which explains how they go about learning and how it is responsible for qualitatively different learning outcomes (Marton and Säljö, 1976, Trigwell and Prosser, 1991). Research on students' conceptions of learning have also demonstrated some commonalities in the conceptions of learning (Marton et al., 1993, Säljö, 1979, Trigwell and Ashwin, 2006), with variations predominantly depending on the context. Of relevance to this study is Säljö's (1979) notion concerning awareness of individuals with a completely developed conception of learning, and that is how various

processes of learning can be adopted for various purposes. It also gives the ability to adopt processes appropriate to various duties.

With respect to the contextually-specific conceptions of learning, one can see similarities with Trigwell & Ashwin's (2006) suggestions that conceptions of learning are contextually specific, which means that students have to develop methods of learning appropriate to the particular subject being studied, and even goals of the particular teaching methods. Similarly, others also observed that the development of conceptions of learning takes place in a specific context and is dependent on this context (Grácio et al., 2012).

The contextually-specific conceptions of learning are exemplified in one study which reported that the dividing line between conceptions of learning occur when the focus of the ways viewing learning change to meaning making (Paakkari et al., 2011). At this point, nature of knowledge is seen as uncertain, the importance of reflection is brought up, and the role of implicit learning in a social context is seen as having the capability to detect a tacit clue. According to Marton (1981), what the contextually-specific conceptions of learning signify is that while the pattern of experience may remain constant, participants may move from one pattern to another as they describe various situations in different contexts (Marton, 1981).

This section above discussed the research into conceptions of learning, providing the basis for the process in which the findings can be critically evaluated. What follows is a summary of the gaps and issues found in the review of the literature, as well as a short summary of this research potential contribution to addressing those issues and filling those gaps.

A gap in research

The literature examined on conceptions of learning suggested a paucity of research. Many studies have been conducted on conception of learning to inform the design and delivery of educational interventions in general. The challenge is that research on conceptions of learning have studied learning mainly from an instructional point of view, and this has been conducted within traditional university learning contexts (Entwistle and Peterson, 2004, Marton et al., 1993, Marton et al., 1997, Negovan et al., 2015, Trigwell and Ashwin, 2006). Yet, research examining conception of learning outside the formal learning context is scarce. Some have predominantly examined work from conceptions of learning from a pedagogical practice point of view (Costley and Dikerdem, 2012). Others have examined work predominantly from a competence point of view. One such example is a phenomenographic study on human competence at work (Sandberg, 2000). This study suggested that it is not a particular set of attributes that constitute competence at work, as generally assumed, but rather it is the meaning workers assign to work in their experience of it.

The additional gap suggested by the literature concerns the significance of the differences in learners' conceptions of learning. The challenge is that the studies on conceptions of learning conducted within formal university learning settings have not incorporated other sources of variation that may emerge from students who have a comprehensive understanding of learning which incorporates, but is not restricted to, classroom instructions and possess conceptions of learning which are facilitated by contexts and experience from work. This indicates a need to broaden the spectrum of research into the conception of learning and make comparison between conceptions of learning in those who possess experience from work and those who are newly qualified.

Lastly, the research sought to examine the experiential perspectives of nurses to understand how they conceptualised learning to recognise sepsis. The literature review reveals that there is no study of this kind of work-based learning conducted within the context of recognising sepsis.

2.9 Summary

This chapter reviewed the literature and examined the areas relevant to the study performed here, thus providing the basis for the process in which the findings can be critically evaluated.

This review began by exploring the key conceptualisation of knowledge. The literature describes many forms of knowledge, which are regarded as central to effective performance, and this challenges the current definition of sepsis recognition (Daniels et al., 2011, Singer et al., 2016) by focusing mainly on explicit knowledge alone, thus hindering educational efforts to improve sepsis recognition. Next, the literature on educational needs demonstrates that while there are diverse educational needs described by practitioners, one common theme emerged from the literature.

Practitioners seem to find a limited value in the pursuit of academic knowledge alone. Some see this as a problem of inadequate preparation for practice, while others see academic knowledge as impractical.

A further review of literature was conducted to explore the directions in, and influences on, our conceptualisation of competence and its development at work. Based on that review, it can be concluded that competence development is conceptualised as acquisition of defined knowledge and skills, and this appears not only oversimplified but also founded on a premise which views learners and objects of learning as separate entities. In addition, defining competence at work and its development is mainly driven by philosophical arguments advocated by experts and government agencies, and this rarely seems to reflect the knowledge and experience of

practitioners. The inclusion of work-based learners whose contribution to these improvements could confirm any assertions claimed by experts.

As the aim of this research is to report on the experiential views of nurses participating in work-based learning, a further review of literature was conducted to explore the current conceptualisations of work-based learning itself. Literature shows that there are many different conceptual interpretations of work-based learning, which have focused on a wide range of, yet isolated, issues of work-based learning. This includes teaching methods and descriptions of how learning takes place within the workplace, thus identifying attributes of learners central for professional development, and challenging unpredictable learning contexts. While these conceptual interpretations of work-based learning differ in the areas of interest, they provide a similar theory of work-based learning. Within their interpretations of work-based learning, the methods, learners and contexts within which learning takes place are predominantly viewed as unrelated entities. Nevertheless, the inclination towards this view of work-based learning is not universal. Some significant papers which examined the views of learners do not emphasise it at all in their conceptualisation of work-based learning. Nevalainen et al. (2018), for example, discussed work-based learning in terms of the potential integration of learning situations into the complexities and challenges of everyday work, rather than viewing them as unrelated issues.

In light of these findings, this study suggests that the failure to make the work-based learning effective is perhaps not regarded as related to the learning methods and work-based learning environment themselves, but more due to the dualistic ontology that underlies the conceptualisation. Based on this review, this study proposed a relational approach for this research to build on the strength of previous approaches, while seeking to overcome their main limitations. The relational approach focuses neither on the object under investigation nor the people, but instead the relationship between learner and the object under investigation (Marton and Booth, 1997).

The following chapter will present a more in-depth description of this relational approach, as well as the procedures adopted in this research. In this chapter, the reader is presented with the explanations how phenomenography was adopted as a methodology to explore the experiential perspectives of nurses and understand what constitutes early recognition of sepsis. Research on learners' conceptions of learning have frequently adopted phenomenography, a methodology that brings an insight into how people experience and perceive the world around them. Examining nurses' experiential perspectives using a phenomenographic approach could clarify why some nurses cope with the complexities of early recognition of sepsis better than others, and why some nurses learn to recognise sepsis better than others.

Chapter 3: Methodology

3.1 Introduction

This chapter describes the methodology of the study. It is composed of two main parts. The first provides an in-detail description of the phenomenographic approach and the second describes procedures adopted in this research.

The first part of this chapter outlines the rationale for using this approach to fulfil the aims of this study. It will present the reader with the ontological and epistemological standpoint of phenomenography. The insight into ontological and epistemological standpoints can help readers to appreciate the methodology adopted in this study. This part of the chapter further discusses knowledge and the theory of phenomenography. It also discusses the development of phenomenography and the theoretical underpinning of phenomenography.

The second part of this chapter presents in detail a description of the procedures adopted in this research. The reader is presented with explanations how phenomenography was adopted as a methodology to explore the experiential perspectives of nurses to understand what constitutes early recognition of sepsis. It describes the methods used and how the data were collected.

3.2 Selecting a research methodology

Numerous aspects had to be taken into consideration in the selection of a methodology. Among the most important aspects taken into account were the research objectives and how they could be fulfilled. The objectives were:

1. To explore nurses' experiential perspectives to understand what knowledge and skills constitute early recognition of sepsis.

2. To explore nurses' experiential perspectives to understand what the most relevant ways of gaining knowledge are.

3. To explore nurses' experiential perspectives to understand what learning environment nurses perceive as the most relevant for gaining knowledge.

It was important to select an appropriate methodology that fit the purpose of obtaining a complete examination of issues, thus allowing all the objectives of this study to be fulfilled. The appropriate methodology would have to allow for description of the contexts under which different learning approaches are more or less relevant, as well as identify the type of knowledge that nurses need to justify using a particular approach.

A selection of methodology has been shaped by my philosophical perspective and how I see reality, particularly my views on meaningful research which involve inductive processes grounded in data and applicability. My theoretical standpoint fit within the interpretivist position of phenomenography, which builds on a non-dualistic ontology (Marton & Booth, 1997).

The methodology would have to potentially address gaps identified in literature, such as the scarcity of research into conceptions of work-based learning within the workplace as viewed by the learners. The research reviewed in Chapter 2 demonstrated a successful application of a phenomenographic approach to examination of conceptions of learning in diverse contexts, especially in formal university programmes. This rendered phenomenography desirable for the investigation into conceptions of learning in workplace context. Additionally, in Chapter 2, directions in, and influences on, our current understanding of nursing competence, the development of nursing competence and the nursing competence research were examined. Based on the literature review, it is argued that researching sepsis

recognition expertise in terms of the varying ways in which it is understood or experienced in nursing community could lay a foundation for adopting a relational view of sepsis recognition competence and its development. This could be possible as a result of the use of phenomenographic approach to research.

The introduction to this chapter has provided an overview of why phenomenography was deemed an appropriate methodology for this research. The subsequent section will explain and justify the selection with respect to some of the central aspects highlighted in the literature.

3.3 Philosophical underpinnings

Singh (2019) highlighted the importance of situating research under a particular paradigm or philosophy. The author asserted that all research is performed within a philosophical position, and has viewpoints on how the world is viewed (Guba and Lincoln, 1994).

Singh (2019) emphasised the importance that researchers properly understand their paradigm within which the research is positioned before embarking on their journey. According to Gemedda (2010), a clear understanding about the paradigm within which research is positioned allows easier decisions about methodology, methods and design of research (Mackenzie and Knipe, 2006). Hitchcock and Hughes (1996) explained that clear specification of the researcher's viewpoints on the nature of reality (ontological viewpoints) is beginning of any research, after which decisions about how the nature of reality is studied (epistemological viewpoints), methodology and methods follows. In addition to that, Hitchcock and Hughes (1996) pointed out this is the framework that determines what role the researcher takes and the ways in which questions are asked. Moreover, Guba and Lincoln (1994) highlighted that this framework also guides how reality is interpreted.

There are a number of research paradigms; among them positivism and interpretivism, which are different in many aspects. These paradigms differ in their ontology, epistemology, and methods used (Singh, 2019). They contrast in terms of how research is approached, what research methods are selected (Kivunja and Kuyini, 2017), what is regarded worth investigating and what criteria are adopted to assess the quality of the research (Singh, 2019).

The ontology of positivism is realism (Guba and Lincoln, 1994), which believes that object exists separate of the knower (Scotland, 2012). Positivists' assumption of reality is that it is fixed and therefore measurable, identifiable and comprehensible. Other characteristics of positivisms are that knowledge is out there awaiting to be discovered and is independent of context (Kivunja and Kuyini, 2017). Positivists believe that knowledge can only be derived from the scientific method of investigation (Scotland, 2012). Meanwhile, the epistemology of positivism is objectivism. The focus is on dualism, meaning that the researcher and subjects are regarded as separate entities and that the meaning rests in subjects (Crotty, 1998). Researchers engage with the subjects objectively and study them without having an influence on them.

Interpretivism is on the opposite side of positivism. Ontologically speaking, interpretivism is in entire disagreement with positivism (Scotland, 2012). The ontological stance of interpretivism is relativism, which believes that reality is subjective (Scotland, 2012). As such, the primary focus of interpretivism is understanding the subjective reality of human experience (Kivunja and Kuyini, 2017). As individuals vary in many different aspects and various people hold various views on the same topic, they can hold various views on the social world (Wahyuni, 2012). In addition, here context is considered important in the pursuit of knowledge. Thus, the role of the researcher is to be involved with the subjects being examined to gain an insight into

the context-dependent meaning that subjects make of the world around them. A main goal is to obtain an insight into the perspective of the subjects under examination instead of the perspective of the researcher (Kivunja and Kuyini, 2017).

Epistemologically speaking, interpretivism is also in an absolute disagreement with positivism. The epistemology of interpretivism is subjectivist since the researcher and subjects under investigation are viewed to be related in an interactive way (Singh, 2019) and research outcomes are constructed as examination processes (Guba and Lincoln, 1994). Interpretivists do not intend to challenge beliefs and recognise them as they exist (Scotland, 2012).

Taken together, it is clear that various paradigms have a contrasting set of core beliefs. While positivists assume that a single version of reality exists, interpretivists assume that there are multiple versions of reality. Interpretivists focus on the subjects' views of the world and their interpretations of reality (Kivunja and Kuyini, 2017). This viewpoint implies that an understanding of the reality is constructed by people, suggesting that understanding is subjective, and meaning is always context dependent. By its very nature, the interpretivist philosophy supports research methodologies which enable the understanding of multiple versions of reality. It favours research methodologies of an inductive nature, which allow understanding meaning from the subjects' experiences and developing theory. These differences clearly indicate that there are different paradigms for different research purposes.

As this study's purpose is to explore learners' diverse experiential perspectives, this paradigm seemed more appropriate for this study. This paradigm enables the learners to express their understanding of learning in the workplace based on their contexts and experiences (Rubin and Rubin, 2012). This paradigm has no predetermined hypothesis

at the point of departure. Instead, it allows questions to be answered and themes or theory to emerge from the learner's experiential learning perspectives on learning that takes place in the workplace. Positivism does not offer this expression of self-direction and overlooks context-dependent understanding of reality. This context-dependent understanding of reality was of central importance to the identification of the most relevant ways of gaining knowledge on the understanding of work-based learning held by nurses who take part in this study.

In addition to this way of viewing reality, an additional significant aspect considered when determining an appropriate approach to studying learning was a comparison of a variety of experiential perspectives of learning and the ways in which the learner relates to the external world. Some argue that those who view the learner and world as separate entities are limiting the study of learning (Cohen et al., 2017). These arguments can potentially provide an explanation why qualitative methodologies have been deemed more appropriate in researching learning.

Choosing a research methodology

With respect to the philosophical issues described in the previous section, a number of methodologies were considered in order to fulfil the research objectives of this study (Cohen et al., 2017). As such, following the elimination of the positivist approaches, interpretivist approaches and the related methods were considered.

Considering perspectives on learning examined above, such as a dualistic perspective on learning and its potential to limit study into student learning (Cohen et al., 2017), the choices for selecting an appropriate methodological approach were significantly reduced. This view was endorsed by Trigwell and Prosser (1991), who also recommended a non-dualistic approach to examining student learning, with a focus on context as an influence on student learning. Consequently, given the limitations of the

other approaches, this study proposed an interpretative approach, specifically phenomenography for this research, which seeks to overcome the limitations of positivist approaches described above.

3.3.1 Comparison of phenomenography with other research methodologies

Qualitative research methods

There has been an increase in the application of qualitative methods to research issues in education, including grounded theory, phenomenology and ethnography, all of which aim at discovering new meaning or explanation of phenomena (Polit and Beck, 2017). Therefore, it will be useful to compare some of them with a phenomenographic approach. Accordingly, I begin with the key conceptual, epistemological and methodological aspects of phenomenography, before turning to the comparison.

3.3.1.1 The key conceptual, epistemological and methodological aspects of phenomenography

Phenomenography fits within the interpretivism paradigm (Bowden and Green, 2005). It is based on a non-dualistic ontology which believes that the person's internal relationship with the external world constructs reality. New experience changes the reality, making it more complex and bringing a greater comprehension of the world (Marton and Booth, 1997). The assumption of phenomenography is that people's action in respect to a phenomenon depends on their understanding of it (Marton, 1981). Therefore, the aim of phenomenographic research is to examine people's understanding of a phenomenon.

Phenomenography believes that there are many different versions of reality (Bowden and Green, 2005) and proposes examining the diverse ways that the phenomenon is experienced (Marton, 1981). Phenomenography assumes that variation in the way that a phenomenon is experienced is related to differences of the meanings people ascribe to it in a particular situational context (Marton and Booth, 1997). Phenomenography provides a way to examine the differences to improve the quality of learning and the understanding of various phenomena (Stenfors-Hayes et al., 2013). In regards to the theoretical framework, phenomenography is based on the assumption that only a limited number of ways of understanding of any phenomenon exist, commonly four or five variants (Tight, 2016). The different ways of understanding a phenomenon can be arranged in a hierarchical manner, with the lowest representative of the least complex way of understanding the phenomena.

3.3.1.2 Comparison of phenomenography with other research methodologies

Phenomenography, compared to other qualitative methods, is distinct in a number of respects. Awareness of the distinctions enables understanding why phenomenography is preferred to the others. Broadly speaking, phenomenography is distinct as it has the ability to identify interrelated rather than independent meanings, awareness rather than beliefs, context-sensitive awareness rather than fixed products and collective rather than individual conceptions (Åkerlind, 2005). Numerous methodologies alongside phenomenography were inspected in more detail to ensure the most appropriate approach is selected for this study. Phenomenography was consequently chosen as it appeared to have all of the characteristics required to fulfil the research aims. A brief comparison of phenomenography with other methodologies is provided below:

Phenomenography and phenomenology

There are similarities between phenomenography and phenomenology, such as their shared interest in human meaning and awareness (Bowden and Green, 2005).

Phenomenography and phenomenology, nevertheless, vary in respect to their basic ontology and the outcomes of their analyses. Awareness of these distinctions enables understanding why the former was preferred to the latter.

While phenomenology is important for examining the essence of a phenomenon, it does not examine different ways of understanding and conceptualising the phenomenon from different viewpoints, as it overemphasises the similarity (Larsson and Holmström, 2007). As a result, phenomenography, by collecting qualitatively different viewpoints of the same entity from many different perspectives, offers a more comprehensive insight into the phenomenon as a whole. With this approach in mind, phenomenology offers a valuable, yet limited, way for dealing with ever-changing and complex entities encountered in the contemporary healthcare practice. In contrast, phenomenography is a research approach which pays attention to complexity and change, and therefore is well situated to inform educational research (Bunniss and Kelly, 2010).

The outcome in phenomenographic analysis is concerned with the variation in experiences of a phenomenon under investigation. In phenomenology, the focus is on the description of the essence of the lived experience of a phenomenon being investigated. Consequently, given the limitations of the other qualitative approaches, this study proposed an interpretative approach, named phenomenography, for this research as this builds on the strengths of these approaches, while seeking to overcome their limitations. In addition, phenomenography is the only approach capable of performing all of the essential tasks required to fulfil the aim of the study, those being to perform interpretations of participants' experience in non-dualistic way and to allow for differences in personal experience (Marton, 1986). While the variation of understanding a phenomenon is the target of the approach, this can still be definable and limited.

Phenomenography provides a way to examine the differences to improve the quality of learning and understanding of various phenomena (Stenfors-Hayes et al., 2013). By mapping the variations of experiences, and the relationships among them, an outcome space is created which can offer educators a thorough and complete picture of a variation in ways in which the phenomenon could be understood by a group of people (Marton, 1986). Within an outcome space different contexts (different learning environments or learning methods) within which the phenomenon is experienced can be identified, described and explored, and this may bring various aspects of the phenomenon into awareness.

The relationships between the variations in experience can become meaningful and increase the power and usefulness of the research outcomes in guiding educational change. The following section will describe phenomenography as a methodology and its development.

3.4 Phenomenography

Phenomenography is an empirically-based educational research design that seeks to map a range of qualitatively different ways in which individuals understand, experience and conceptualise numerous phenomena of the external world (Marton, 1981, Marton, 1986).

3.4.1 Origin of phenomenography

Phenomenography was first developed by a group of educational researchers at Gothenburg University in Sweden in the late 1970s through a series of studies of learning in higher education (Marton, 1981, Marton and Booth, 1997). Subsequently, phenomenography expanded worldwide, having a special influence in Australia and, to a lesser degree, the United Kingdom (Tight, 2016). The original educational research within which phenomenography has been developed concentrated on the ways

students approached an activity of reading a text (Marton, 1981, Marton and Booth, 1997). Prior to this original study in the 1960s and 1970s, phenomenography focused on developing educational research in Sweden with the goal to view the world from the viewpoint of students. Subsequently, the goal of phenomenography was focused on the differences in conception of a particular phenomenon in the external world. The focus is therefore on the different ways people can experience or understand the phenomenon, rather on the phenomenon alone.

3.4.2 Various forms of phenomenography

Phenomenography has been described by numerous researchers who have expanded upon the original phenomenography from the 1980s. As such, various forms of phenomenography have been defined. Bowden and Green (2009) describe pure phenomenography and developmental phenomenography, and the distinctions between them based on the aims of the study. The distinctions between them and the methodological implications follow.

3.4.2.1 *Phenomenography*

Phenomenography can be described as a qualitative, empirical research approach that enables examination of different ways in which people experience or conceive a particular phenomenon in the world (Marton, 1981, Marton and Booth, 1997).

3.4.2.2 *Pure phenomenography and developmental phenomenography*

Pure phenomenography is a methodology guided mainly by curiosity with the aim to merely produce research outcomes (Green and Bowden, 2009). On the other hand, developmental phenomenography aims to produce research outcomes for the purpose of addressing a certain educational issue (Bowden, 2005). The research outcomes of developmental phenomenography are not a final product; but instead, they are a means to solving or addressing an educational issue. Such distinctions in research

purpose have methodological implications. Both pure and developmental phenomenographic research are conducted within the general principles of the phenomenographic approach. However, the methods used in developmental phenomenography are determined both by the general parameters of phenomenography and also the requirements of the original practical problem that is the foundation of the study (Green and Bowden, 2009).

In the present study, generating the research outcomes are not the intention per se. The rationale for conducting the study is concerned with a way I can apply the research outcomes to address or solve the educational issue pertaining to early recognition of sepsis. In order to yield research outcomes that can provide a means to inform educational issues, which is the genesis of the study, the methods used in this study also draw on the principles of developmental phenomenography

3.4.3 Knowledge interest in phenomenography

Phenomenography aims at uncovering qualitatively different ways in which people experience and is interested in things as they are experienced by people (Marton, 1981, Marton, 1986), and it is this experience that is the aim of research. However, numerous terms have been used to define this. Experiences, understanding (Sandberg, 2000) or conceptions (Marton, 1981) have all been used.

Phenomenography assumes that differences in the experience of a phenomenon are related to differences in the way of understanding the phenomenon in a given context (Marton and Booth, 1997). In this sense, a phenomenographic approach assumes that experiencing is linked with understanding, apprehending and conceptualising.

Phenomenography assumes that experiencing a phenomenon cannot be detached from experiencing the situation in which it is experienced. Ways of understanding something are viewed as an internal relationship between the experience and

experiencer, rather than cognitive entities existing in mind (Marton and Booth, 1997). Contrary to the psychological perspective in which understandings are described in terms of cognitive process, phenomenography's perspective is that understandings are understood as dynamic and variable depending on the situational context and work in which they are investigated (Trigwell and Prosser, 1991). Therefore, in the present study, experiences, understandings or conceptions are used interchangeably. Irrespective of the terms used, they are viewed in an experiential sense.

3.4.5 Framework for understanding experience

Marton and Booth (1997) developed a framework in order to explain the nature of experience. The authors used two terms to describe the aspects of experience, namely structural and referential aspects. The structural aspect of experience is related to the aspects of experience and a relationship between the aspects and how the aspects are related to a context in which they are positioned. The referential aspect of experience is related to the meaning an individual ascribes to experience. The referential and structural aspects take place simultaneously when a person experiences something, and are thus interwoven (Marton and Booth, 1997).

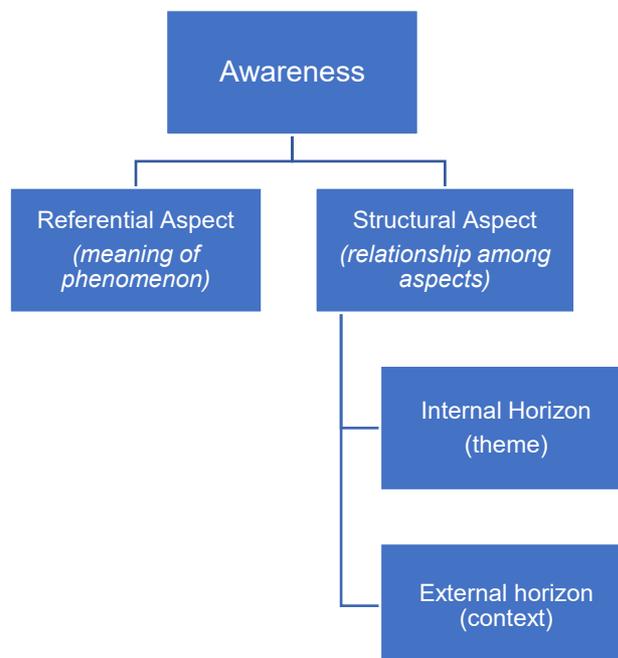
In order to develop the framework further, Marton and Booth (1997) highlighted the internal and external horizon, which are components of the structural aspects of experience. The internal horizon consists of aspects related to the theme. The external horizon describes the context within which participants experience the phenomenon.

Phenomenography assumes that the experiences are qualitatively different (Marton and Booth, 1997). The qualitatively distinct experiences are related to a distinct structure of awareness, in which the aspects, the relationship between the aspects and their relationship to the whole are distinguished in distinct ways. The distinct aspects of what is distinguished in the internal horizon has been referred to as

dimensions of variations (Marton and Booth, 1997). Every specific aspect of the phenomenon can potentially introduce variation and thus be regarded as a dimension of variation.

By using this framework, ways of understanding a phenomenon, the critical differences and the logical relationship among them can be described. In this framework, the understanding is assumed to consist of referential and structural aspects. The structural aspect includes the internal and external horizons. The internal horizon is the theme of awareness and incorporates descriptions of dimensions of variation of the phenomenon. The external horizon provides the context within which the theme develops. The referential and structural aspects are interwoven and take place simultaneously when a person experience something (Marton and Booth, 1997). The framework is illustrated in figure one.

Figure 1: The structure of awareness



3.4.6 Categories of descriptions

In phenomenographic research, the primary research outcomes are the categories of description and the relationship between them, which are then arranged in an outcome space. Categories of description are representative of the distinct ways of understanding a phenomenon identified as a result of phenomenographic data analysis. Participant descriptions of the experience are then grouped based on meaning. Every group of meanings creates one category, even though during the analysis process the categories are presented in inclusive ways in the outcome (Marton and Booth, 1997).

3.4.7 Data analysis

The transcriptions of the interviews were analysed following Åkerlind's approach (Åkerlind, 2005). The focus of the analysis is on the different ways of understanding the phenomenon across the entire sample, rather than on the characteristics of individual experiences. Therefore, these variations of experiences are not treated individually, but inclusively and in relation to each other. These variations are presented in the form of categories of description. The researcher seeks to constitute key meanings, a dimension of variations and relationships between the categories, which involves organising the categories in a diagram called an outcome space (Åkerlind, 2005). The outcome space is representative of a variety of potential ways of understanding the phenomenon. As a result, the phenomenon, in this case learning about sepsis or educational needs relating to sepsis recognition, that is understood in different ways by various learners can be analysed at a collective level.

The understandings are organised in an outcome space in a hierarchal way (Marton and Booth, 1997). In the hierarchy, the categories are positioned at a higher level to:

- signify expanding awareness
- incorporate additional aspects of experiencing the given phenomenon
- represent increasing complexity or sophistication
- show a better understanding of one aspect of the phenomenon

3.5 Research design

The first part of this chapter described the theoretical underpinnings of the phenomenographic approach. This part of the chapter will describe procedures adopted in this research, including the participant recruitment, data collection and analysis, ethical considerations and trustworthiness.

3.5.1 Recruitment of participants

In developmental phenomenography, the sampling strategy is especially important as the final research outcomes are influenced the nature of sampling process (Green and Bowden, 2009). Bowden and Green referred to Patton's (2002) maximum variation strategy for achieving adequate variation for manageable and valid sample. The sample size is established by maximum variation strategy as well as data saturation (Åkerlind, 2005).

Research participants were recruited from two large hospitals in the North East of England. The recruitment process began with approaching members of hospital staff with appropriate access to staff details who identified all eligible staff members. This was a voluntary opt-in study and participants willing to participate could opt-in. An appropriately-trained staff member, who is employed by the hospitals trust, circulated information about the study and consent forms to these lists and asked that, if they are willing to participate, they contact the researcher (researcher contact details were included) to arrange suitable times for participation in the individual interviews. In addition, posters were placed in clinical areas, publicising the project to nursing staff.

The posters asked anyone interested in knowing more about the study and /or being involved to send a text to a mobile telephone number specified on the poster. This was a mobile phone dedicated to the project and used only for the project. The mobile phone was held in a locked filing cabinet and only accessed by the researcher.

Multiple channels were utilised to publicise the research. However, the distribution of a poster particularly enabled reaching the wider population within the Trust from a variety of specialities, drawn entirely from two different hospitals, which would otherwise be difficult to access due to restrictions imposed by the pandemic.

Eligibility criteria

Inclusion criteria

- Registered nurses who have experience of caring for patients with sepsis.
- Nurses who wish to participate in this study and provide written informed consent.
- Agreed to use audio to record the interviews.
- Agreed to attend the planned session.

Exclusion criteria

- Nurses involved in any other studies.
- Any other healthcare professionals.

Sample size

The researcher aimed to recruit a sample of up to 30 nurses of varying experience from across various clinical areas. Drawing on the principle of developmental phenomenography, the sample required to be sufficiently large enough to ensure adequate variations, but not too large to make the analysis of data unmanageable, particularly considering the thorough method required for the analysis (Green and Bowden, 2009).

The sample size of a maximum of 30 participants was because the goal of this study was to examine the nature of variation rather than the amount of variations among participants (Marton and Trigwell, 2000). The amount of variation is likely to be of a little value to informing educational issues. Examining the nature of a variation allows for exploring the educationally-critical aspects, which provided a powerful means to inform educational resources.

As the data collection and analysis evolved in parallel, the number of participants was tailored to the range of experiences attained, in line with the principles of phenomenography (Green and Bowden, 2009). The rationale for aiming for a maximum variation in specialty was to maximize the likelihood of finding variation in experience of the phenomena under investigation in the sample. Within these parameters, the sample comprised 26 nurses from various departments, such as research, intensive care, oncology, neurosurgery, sepsis, and medical and surgical wards, drawn entirely from two different hospitals in one hospital Trust.

The closure of recruitment

The closure of the recruitment was reached when no additional previously undescribed experiences emerged for several interviews, meaning data saturation had arrived. It involved studying the potential variants in the population and ensuring that the sample was as heterogenous as possible in respect to each. Following careful examination, further interviews were conducted that enabled exploring characteristics not yet covered by the sample and expanding some concepts into more detail. As the data collection had now progressed to 26 interviews, it was becoming clearer that the data saturation was near to being reached.

Research sample

In order to investigate the variations of the contexts in which the phenomenon is experienced, the sample consisted of nurses recruited from a variety of clinical backgrounds. This variety provided a more complete understanding of the phenomenon and improved the transferability of results.

It was not always possible to recruit nurses from ward settings; however, many intensive care nurses were willing to take part. Some may argue that the sample might be limited by their exposures to a single speciality, meaning their experiences might be limited. Contrary to expectations, the sample instead enabled obtaining much richer data than anticipated. The sample provided valuable comparisons of different settings and contexts owing to the former multiple exposures of the subjects to different kinds of specialities or different clinical environments. Utilising these resources resulted in gaining a sample that was representative with respect to a variation in experience, length of time working in hospital and gender.

Characteristics of participants

Sample variables

Participants varied widely in regard to several criteria:

- Age (20s to early 60s)
- Professional experience (1 year to more than 20 years)
- Gender (24 females; 2 males)
- Nursing specialism and role (critical care, gastro and surgery research; research; sepsis; intensive care, oncology, neurosurgical and surgical; practice development)
- Seniority (nurse practitioners; staff nurses; team lead; specialist nurse; senior nurses).
- Location (two hospitals located in the northeast of England)

- Variation in the degree of education (bachelor's degree; master's degree; PGCert; diploma)

3.5.2 Data collection and fieldwork

Drawing on the principles of developmental phenomenography (Bowden, 2005), a single method of data collection was used in order to fulfil the aim of this study. The data collection in phenomenographic research is mainly performed via semi-structured interviews. In order to get a detailed understanding of how early recognition of sepsis is experienced and perceived, in-depth interviews were conducted, using an author-designed interview protocol.

The interviews were arranged outside of participants' working hours to minimise the burden of this study on clinical services during the COVID-19 outbreak. In keeping with University guidelines and strict social distancing measures, the interviews were undertaken remotely by telephone or by other university-approved means, such as Microsoft Teams, depending on the participant's preference. While the interviews were undertaken remotely, the researcher ensured that all necessary security arrangements were in place to ensure the confidentiality of collected data.

The researcher's aim was to conduct all interviews in one single-phase (8 months) to ensure the quality of the interview process, but that was also determined by the participants' availability. The researcher conducted all the interviews herself to ensure consistency in the method of questioning, prompting and comparing the responses (Bowden and Green, 2005).

3.5.2.1 Interviews

In order to study the phenomenon under relatively natural conditions, the interviews took place at a time which was convenient for the participants, inside or outside of their work. The interview took approximately 25 to just over 60 minutes, that was determined by the participant's availability.

Consent

Before every interview, information about the nature of the study was presented in the form of a plain-language statement and informed consent was obtained from participants, in keeping with the research ethics guidelines. Consent was taken by the researcher running the interviews. Consent was also verbally checked at interview. An electronic method was used for seeking, confirming and documenting informed consent for participation in this research by following the Health Research Authority guidance on an electronic method for seeking consent. Informed consent was documented using electronic signatures. A copy of the signed consent form was sent to the participant and a copy was kept.

In-depth semi-structured individual interviews were used to gather data in this study. This approach suggests the use of one open-ended question formulated as an incomplete sentence, which allows for capturing a variety of perceptions within the research sample (Han and Ellis, 2019). I have minimised my involvement to the content of the interviews in order to allow the participants to elaborate their own ways of viewing the phenomenon (Green and Bowden, 2009). It was important to ensure that I did not introduce a new subject that is unrelated to the planned interview schedule. The same principles for opening scenarios were followed in each interview, with the focus on the description of experience instead of a description of theoretical or hypothetical ideas. During the interview, the participants were asked to reflect on their

experiences and describe their ways of handling early recognition of sepsis, and to explain what influenced the choice of aspects on which she/he decided to concentrate.

All interviews were recorded. To record a phone interview, digital voice recordings were made using a digital voice recorder. While recording the interviews, I ensured that background noise was minimal to prevent distractions during the interview. All necessary security arrangements were in place to ensure the confidentiality of the collected data. I ensured that all the arrangements are in line with the participant information sheet.

3.5.2.2 Type of questions

The researcher conducted all interviews using an interview schedule which was intentionally broad to encourage free expressions of aspects participants perceived as important, in line with the principles of phenomenography (Green and Bowden, 2009). The researcher intentionally did not pose direct questions, such as “what is X”? Instead, the researcher chose an alternative. The researcher asked people to share an experience that concerns the phenomenon under investigation. There are several plausible reasons for that, including that the outcomes would not be as diverse, and the answers would potentially reflect the standard, adopted theories found in the literature. It is not as difficult to obtain the description of their own experience than to make participants philosophise about a matter to which they may not have paid much attention previously. Also, this method enabled exploring and probing in a relaxed and non-threatening way, providing that I was interested in more details about their own experience than looking to be assessing their theoretical knowledge.

The aim was to obtain underlying meanings and intentional attitudes to the phenomenon under investigation by asking for concrete examples of the phenomenon.

The details of the examples provided valuable resources for investigating the way in which the interviewee was conceptualising the phenomenon. More specifically, the researcher was interested in those aspects of the phenomenon that they show awareness of. Using this method involved asking not only “What did you do?’ but also ‘Why did you do it that way?’. In a phenomenographic interview, the follow-up prompt questions are frequently more central to extracting underlying meaning than the primary questions.

Some may argue that the interviewee might be describing ideal practice and that reality could be different. These forms of arguments demonstrate a lack of understanding of the goal of the phenomenographic interview method and the difference among the questions “What did you do?’ and ‘Why did you do it that way?’ If the interest of this study would be the descriptions of practice, the argument would be valid, but since the interest is investigating awareness or understanding of the nature of learning, this awareness should come to light regardless of the description of their practice.

3.5.3 Data analysis

This section describes how the principles of phenomenography discussed in the previous section have been used in the analysis of data gathered from participants.

This section describes how the categories of descriptions have been formed, rather than what they are, as this is only the descriptions of the process of the data analysis.

The phases of the data analysis are highlighted below:

Table 1: Data analysis process



Methods of data analysis – the holistic transcript approach

As proposed for this study, the Åkerlind method was used as a foundation for the analysis (Åkerlind, 2005). Also, a new framework was introduced to the analysis process. The Åkerlind method was selected instead of Marton's approach, focusing on a pool of meanings (Marton, 1986). The choice for the former was founded on the basis of a higher possibility of participants' responses to be found within context (Åkerlind, 2010). The advantage of this holistic transcript approach is that it would improve the interpretation and validity of the data, since the responses are likely to be contextually situated or even contextually confirmed.

Stage 1. Transcription of, and familiarization with the data

The process of data analysis started with familiarisation with the data. The familiarisation process began during conducting all the interviews while actively listening to participants. The process continued during the transcriptions of the first eight interviews. Preferably, the researcher wanted to transcribe all the interviews herself, but time was more wisely spent by familiarising with transcribed data. All the interviews were transcribed verbatim.

In order to better manage large amounts of data (Åkerlind, 2005), ten interview transcripts were read first. At a subsequent phase of the analysis, the outstanding interviews were added to this first set. The interviews were read holistically several times to gain a sense of the whole, as the Åkerlind's approach requires the entire interview to be considered. This holistic familiarity of each transcript is the key requirement for the development of accurate dimensions of variation described in stage 3.

Stage 2. Grouping the transcript by *theme*

Following reading the transcripts, transcripts were classified together according to similarity of a theme or context.

Upon gaining holistic familiarity with transcripts, it became clear that the nature of the data in this study resonates well with many of the characteristics of the Cynefin framework, proposed by Snowden and Boone (2007). Therefore, the subsequent stages of the analysis were informed by the framework.

As well as making sense of the data during the analysis process, adopting this tool has allowed the process of grouping of the transcripts to occur strategically and

systematically, thus potentially yielding the research outcomes that can provide a more effective means to inform educational problems, which is the foundation of this study.

The grouping of transcripts was systematically organised according to the theme or context for the described ways of working which emerged during the data familiarisation stage 1.

Four different themes were identified. Each theme or context is representative of how participants described their ways of working. A common description was formulated for each theme: (A) protocol-based care; (B) disease-specific care; (C) emergent care; (D) emergency care. I have had to classify the transcripts according to their context and categorise them into their allocated places. According to Åkerlind (2005), grouping of transcripts involves physically grouping them into their allocated spaces. This method proved to be impossible in this study, as each interview contained more than one context or theme. The NVivo 12 software was used for this purpose since it allowed any transcript to be located in numerous different groups.

Ultimately, as the data analysis progressed, the distribution of different ways of understanding among the interviewees were explored. I determined how many interviews fell into each themed group. This helped to identify whether there was a gradual development to a broader understanding over a period of time between the investigated nurses.

Stage 3. Dimensions of variation

Dimensions of variation were searched for within these four categories.

Dimensions of variation are aspects of understanding that signify differences in awareness of the phenomenon, as well as the capability to understand the complexities of a specific aspect of the phenomenon (Åkerlind, 2008). While certain

dimensions define a more complex understanding, others define a merely simple experience with a partial understanding of an aspect of the phenomenon. The development of dimensions of variation emerged not only from one description located in a single transcript, but rather by using techniques that concurrently examine both experience in the transcript and within the rest of transcripts in the group.

The dimensions of variations have been developed in two phases:

Step a.

The process of developing the dimensions of variation began with analyzing every transcript and identifying and defining an aspect of early recognition of sepsis. It involved identifying *what* each nurse understands of as early recognition of sepsis. The primary focus here was not on the specific statements in themselves, but rather on the meaning of the statements in relationship to the other statements, as well as to the transcript as whole. This began the development of the dimension of variations as well as the formation of relationships in meaning and importance to other seemingly linked other transcripts.

Identifying *what* each nurse understands as early recognition of sepsis involved searching for the statements which seemed to define an additional expansion of the original experience. Any aspect of experience of early recognition of sepsis found in a single transcript was looked for in the same and in other transcripts. Once an aspect of experience of early recognition of sepsis found in a single transcript was found in the same and in other transcripts, then the practice of forming a shared meaning was ongoing throughout all transcripts on the themed group. A shared meaning happens to be the dimension of variation.

The next stage was to find statements which define an additional expansion or modifies the experience. It involved identifying *what* each nurse understands of as early recognition of sepsis in relation to *how* the nurse understands that work.

Step b.

In the following step, the dimensions developed in stage a that are similar in meaning were grouped together.

Stage 4. Themes

Organizing the dimensions of variation under themes

A theme characterizes an aspect of the phenomenon being examined. Themes represent areas in which early recognition of sepsis has been experienced. In the themes, which run through the transcripts as a whole, dimensions of variation were categorized in a meaningful and logical way for the purpose of demonstrating variation of awareness of a particular aspect of the phenomenon (Åkerlind, 2005).

In order for a theme to be accepted, it needed to be logically justified, meaning it had to provide a location in which a dimension could be allocated to demonstrate expanding awareness (Åkerlind, 2005). Also, it needed to be empirically justified, meaning that it ought to be meaningful in regard to the experiences explained in the transcripts.

Stage 5. The relationship among the dimensions of variations

The organization of the dimensions of variations in every theme demonstrate an increasing awareness of variation.

Themes are structural groups of dimensions of variation which demonstrate the relationships among dimensions (Åkerlind, 2005). The dimensions were organised in every theme based on complexity of contexts, processes, and learner-related aspects, (Åkerlind, 2005), which demonstrate increasing complexity in the understanding and increasing awareness of a specific aspect of the phenomenon (Åkerlind, 2008). The relationships between the categories were constituted, which involves organising the categories in a diagram called an outcome space.

Stage 6. Addition of the outstanding transcripts

Following the set of dimensions of variation developed in the earlier stage of the analysis, the outstanding transcripts were added into the analysis (Åkerlind, 2005).

This did not start the process again, and the tentative developments and the remaining transcripts were not treated as being individual but inclusive and in relation to each other.

Stage 7. Categories of description

Formation of categories of description of early recognition of sepsis

The Categories of description combine for every degree of complexity and all aspects of the phenomenon's experience into a single description. Every category is a description of a meaning assigned by nurses to experience of early recognition of sepsis at that particular degree of awareness. In order to provide a logical structure to the categories of descriptions, each category was built by combining dimensions of variations, and one of each of themes (Bowden and Green, 2005).

Stage 8. The outcome space

The last stage involved the development of an outcome space to develop a comprehensive image of the experience into one description. Combing all categories inclusively into relations with one another generate a picture of all contexts of experience and the degree of complexity of the phenomenon. The outcome space will demonstrate the comprehensive collection of prospective ways of experiencing the phenomenon (Åkerlind, 2005).

A combination of the logical and empirical method was used to create the outcome space (Walsh, 1994). The logical method aims to create the relationships among the categories, and thus provide well-defined logical meaning, while the empirical method

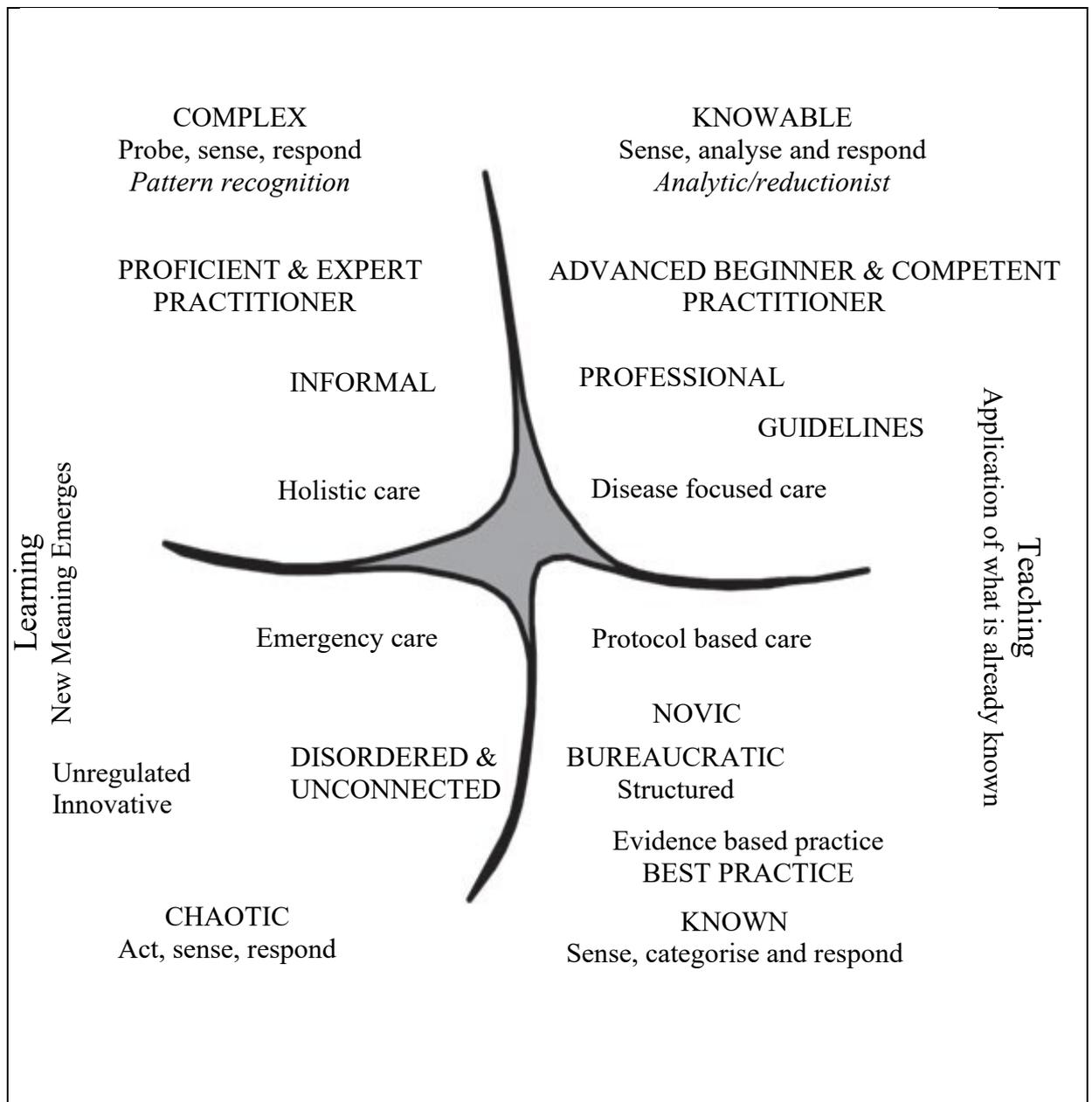
focuses on interpretation, or looking at the data itself. The combination of both were helped by the nature of the themes, as mentioned in the previous section.

Summary

Having conducted the data analysis, the following had been derived:

- Dimensions of variation.
- The dimensions of variation were combined into themes and organized into the increasing degree of the complexity of the phenomena.
- From every theme, a dimension at a particular degree of complexity was used to produce four categories of descriptions.
- Relationships between the categories of descriptions were determined to develop an outcome space.

Figure 2: Nursing knowledge in the Cynefin framework



The use of the Cynefin framework in the data analysis

As the data analysis progressed, it became clear that the framework which emerged from the field of knowledge management (Snowden, 2002) could prove useful in this study. The rationale for introducing the Cynefin framework in the data analysis relates

to the nature of the data of this study. In the Cynefin framework, which comprises of four domains, every domain makes use of reasoning pathways to generate knowledge and solve problems (Snowden and Boone, 2007). In this study, the series of qualitatively different reasoning pathways that nurses rely upon are highly related to the knowledge management system suggested by Snowden.

To exemplify this, the reasoning pathway in the complicated domain of the Cynefin framework is analytically based on hypothetical-deductive logic and makes use of explicit knowledge such as facts, rules and procedures (Corazza and Lenti, 2021). On the other hand, the reasoning pathway in the complex domain is more tacit knowledge based, and a form of knowledge which is often difficult to articulate. The reasoning pathway is driven by personal perceptions, intuition and beliefs, which are often result of a mixture of formal training and experience. Many of these characteristics of the framework resonate with the complexity of this study. This characteristic allowed for organizing knowledge explored in this study based on the reasoning pathways used by nurses, while still taking into account knowledge creation and its application in practice.

An additional characteristic that resonates with the nature of the findings is that knowledge explored in this study often resides only temporarily in one of the four domains (Snowden and Boone, 2007). There are circumstances when nurses operate predominantly in one domain when solving problems, known as the simple, best practice domain, as not all situations required the use of other reasoning strategies to solve problems. However, as time continues to pass in assessment without results, then other reasoning pathways are often used to increase the chances of successful outcomes. The nurses who simultaneously operate in other domains were generally thinking comprehensively about solving problems and used a combination of these four levels of reasoning pathways. Basically, the more complex the situation, the higher the likelihood that reasoning strategies seem to be required to solve it. Taken together, as

well as making sense of the data, the framework provided a strategic approach to the complexity of early recognition of sepsis.

3.5.4 Trustworthiness

In the traditions of qualitative research, the criterion for evaluating the trustworthiness of research includes credibility (validity), reliability and transferability (Sin, 2010).

“Validity is widely regarded as the extent to which a study is seen as investigating what it aimed to investigate, or the degree to which the research findings actually reflect the phenomenon being studied” (Åkerlind, 2005, p. 330). In phenomenography, validity is determined by the extent to which the study reflects “the human experience of phenomenon” (Åkerlind, 2005, p. 330). The two most frequently used types of validity checks among phenomenographic researchers are communicative validity checks and pragmatic validity (Åkerlind, 2005). Communicative validity checks depend on the extent to which the researcher ensures free-flowing communication of experience by the participant and provides a persuasive argument of a given interpretation (Sandbergh, 1997). Pragmatic validity depends on how meaningful research outcomes are to their proposed population of interest (Åkerlind, 2005). On the other hand, reliability addresses the question of the researcher’s neutrality during research process (Sandbergh, 1997). “From a qualitative research perspective, reliability may be seen as reflecting the use of appropriate methodological procedures for ensuring quality and consistency in data interpretations” (Åkerlind, 2005, p. 331). Lastly, transferability is concerned with how well findings can be used or applied in other contexts (Sin, 2010).

Communicative validity

In this study, communicative validity was addressed in three stages of the research process:

- interview phase
- data analysis phase

- discussion phase among researchers and relevant professionals

Interview phase

During the interview phase, the researcher strived to ensure communication of experience by the participant is free flowing in order to reduce the possibility that participants' responses be restricted and uncomfortable, and thus can truly reflect their experience. This was achieved by the following techniques:

- Open-ended, yet focused, interviewing technique to maintain a dialogue.
- Strategies to minimise, as much as possible, the researcher's influence during interviewing, such as using prompts but not introducing a new idea.
- At the commencement of every interview, the researcher reminded participants the subject of the interview and that they can select the direction of the dialogue. This technique supported establishing free-flowing communication of their experience.
- During interviews, the researcher used interview techniques such as asking additional probing question, asking for a concrete example from nursing practice, and encouraging a thorough expression of thoughts and experiences. This technique supported establishing fruitful and productive communication of their experience.

Data analysis phase

During the data analysis phase, the researcher strived to conduct data analysis in a way that treated every transcript as a whole, and not to take individual quotes out of context. In communitive validity, viewing the individual quotes out of context is considered as a serious invalidating risk.

Post-analysis phase

The third phase of communitive validity relates to post-analysis checks and includes seeking external feedback. The researcher assured communicative validity by seeking feedback on research outcomes from “other members of the population represented by the research sample” (Åkerlind, 2005, p. 330) and by obtaining external feedback from the “intended audience for the findings” (Åkerlind, 2005, p. 330). The researcher applied the communicative validity checks via seminar and conference presentations in which key findings were presented and verified by other researchers.

Pragmatic validity

With respect to pragmatic validity, the researcher strived to ensure that research outcomes were meaningful to their proposed population of interest. As such, the research outcomes that emerged from this study offered insights into learning and produced practical implications for learning and teaching in higher education.

Reliability

In this study, reliability was addressed through methodological procedures to ensure quality and consistency in the interpretations of data, which will be discussed in the following section. This included:

- A protocol used during interviews to ensure as much consistency as possible.
- Every interview began with the identical information and preliminary questions.
- Open-ended yet focused interviewing technique to allow the participants to focus on areas of the world that were significant to them, rather than areas that matched the preconceived ideas of the researcher.
- Strict adherence to the data within the interview transcripts to ensure an entire analysis was based on transcripts, which entailed continually returning to the whole transcript and reading participants’ accounts in context. This also entailed

recognising inconsistencies among transcripts instead of attempting to constrain data to claim consistency.

- Developing categories of descriptions in an iterative manner, in which the transcripts, that were not consistent, served as triggers for a distinct way of seeing the categories of descriptions.
- Reliability of the interpretations was assured by making the interpretative procedure clear to the reader and statements are offered to support the interpretations (Åkerlind, 2005).
- The researcher of this study adhered to appropriate compliance with the methodological process and the detailed descriptions of the outcomes.

Transferability

In order to improve transferability of findings, the researcher provided adequate information of contexts for users to draw a conclusion and be in a stronger place to make their own judgments of how well the findings can be used or applied in their contexts. In order to further strengthen transferability of findings, the researcher ensured adequate variation in terms of gender, education and the length of nursing experience to help achieving a heterogeneous sample (Green and Bowden, 2009). Therefore, this study employed a maximum variation strategy for achieving adequate variation (Åkerlind, 2005).

3.5.5 Ethical considerations

Three basic principles that are most pertinent to the ethics of research incorporating human participants include respect for human dignity, beneficence, and justice (Miracle, 2016). This study was also directed by the Code of Practice for Research defined by the UK Research Integrity Office (2009).

3.5.5.1 Researcher's stance

Costley et al. (2010) studied the role taken by the researcher, their stance and context in work-related projects. The authors reported that a study performed within a workplace tends to be shaped by the structure and culture of the work context of the researcher and shared understanding gained from working in the communities. Some may argue that this can potentially raise the issue of bias (Åkerlind, 2005), especially when the researcher has experience in the participants' setting. Costley et al. (2010) argue that this can place the researcher in the position that gives an advantage of dealing with the complexity of workplace contexts from an informed perspective.

With this approach in mind, the researcher's stance can potentially be regarded as benefitting from the insider knowledge derived from the role as a nurse, which has provided knowledge of the phenomenon under the study and is more than is possible to acquire from the literature. In addition, the researcher's interest in the concept of sepsis recognition is longstanding and of personal importance. This position had an impact on the study with respect to access to the participants, interpretations of participants' responses and placing these responses in context. In addition, the researcher's insight into work-based learning could have an impact on the development of relevant questions to fulfil the objectives of the study.

With respect to access to the participants, there was an advantage in that the researcher works for the Trust and has established partnership with potential stakeholders, which gave an insight into how things work within the organisation. It can be argued that the timely commencement of the data collection is partly a result of the researcher's involvement with other stakeholders and being in a position to escalate to relevant issues. Nevertheless, there are potential risks that need to be considered related to the insider position, among them taking things for granted during for interviews (Jangland et al., 2011). The way of addressing this issue is that the

researcher paid particular attention to this during the interviews and asked nurses for clarifications and concrete examples of their own experiences.

3.5.5.2 Human participants and ethics precautions

A range of precautions were taken to assure the privacy and protection of human participants in this research, which will be described in this section.

Consent

Informed consent processes obtained from participants ensured that participants were aware of the study's purpose. A written information sheet describing the project was distributed by the researcher who had appropriate access to staff details. Formal consent was taken by an appropriately trained researcher running the interviews. Consent was verbally checked at the interview. While conducting remote interviews, an electronic method was used for seeking, confirming and documenting informed consent for participation in this research by following the Health Research Authority guidance on an electronic method for seeking consent. Informed consent was documented using electronic signatures. A copy of the informed consent documentation (information sheet and signed consent form) was provided to the participant and a copy retained in the researcher site file.

Ethical and regulatory considerations

Participation in the study was entirely voluntary, on an opt-in basis, and participants were free to withdraw at any time without detriment to themselves, or any impact upon their current or future employment. The researcher has acknowledged that confidentiality and data protection are issues. These were mitigated by the anonymisation of all transcripts; allowing only research staff with appropriate experience and training to access the data, data being kept on University password-protected computers and servers; and adherence to GDPR principles.

The researcher has been conscious of the challenges associated with the impact of the COVID-19 pandemic on clinical services and for participants, meaning taking time to participate in this study could be challenging. Therefore, the interviews were arranged within or outside of their working hours, depending on the participant's circumstances. In keeping with social distancing measures, the interviews were undertaken remotely by telephone or by other University-approved electronic means, such as Microsoft Teams, depending on the participant's preference. While the interviews were undertaken remotely, the researcher still ensured that all necessary security arrangements were in place to ensure the confidentiality of collected data. Great care was taken to reiterate the voluntary nature of the project and avoid coercion or undue pressure.

In consideration of the research participants facing challenges associated with the recognition of sepsis in the COVID-19 pandemic, this research could be regarded as an asset to the participants rather than a burden. The act of participating in the study, such as having time to think and discuss the issues of sepsis and the appreciation that sepsis can be caused by a multitude of infections, including COVID-19, could itself have an impact on the nurses involved by raising their personal awareness of sepsis.

Assessment and management of risk

There is a possibility that, by discussing previous experiences of caring for a septic patient nurse have been engaged in, participation in this research may cause psychological distress or discomfort. To minimise the risk of distress, the interviews took place at times of day that suit participants. The researcher, who was conducting all interviews, is an experienced nurse working within her own respective codes of conduct and was vigilant to identify any such psychological or emotional distress. If any signs of such distress would be noticed at any time, the data collection would stop, and the participant would be given the opportunity to withdraw, and their action would not affect them in any way.

Measures taken to protect the confidentiality of personal data

To maintain the confidentiality of the participants, the following measures were taken. All data were stored as outlined above. To protect the identity of participants, personally identifiable data, such as textual or audio data, were anonymised as soon as possible after the data collection. The level of anonymity met the needs agreed during the informed consent. All participants were given an ID code and only the University research team had access to these codes. The key to these codes was stored in password-protected files on University computers linked to university servers, which were regularly backed up. University computers were used to analyse the data already in anonymised form.

Data maintenance

A variety of measures were taken to secure collected data of human participants in this study. The data was analysed by the PhD researcher of the study using a password-protected University computer linked to university servers which are regularly backed up. This process was supervised by two academic supervisors from Northumbria University.

To ensure the confidentiality of personal data, immediately after the interviews had taken place, all data from the interviews (audio and textual) was transferred by the researcher on password-protected University computers. Only the research team had access. As soon as the data had been transferred onto the university U-drive, the data on the digital recording device were deleted. All handwritten notes from the interviews were transferred by the researcher and stored in locked filing cabinets in locked offices on university premises. At the end of the project, identifying information will be deleted and the remaining data may be stored in an aggregated, anonymous form.

3.6 Summary

The first part of this chapter provided a detailed description of the phenomenographic approach. It outlined the rationale for using this approach to fulfil the aims of this study. It presented the reader with the ontological and epistemological standpoint of phenomenography to help them appreciate the methodology adopted in this study. It further discussed the knowledge and theory of phenomenography. It also discussed the development of phenomenography and its theoretical underpinnings.

The second part of the chapter described procedures adopted in this research. This section discussed the methods used in terms of how the participants were recruited, the ethical issues considered, and the data gathered and analysed. The following chapter describes the results of the research.

Chapter 4: Results

4.1 Introduction

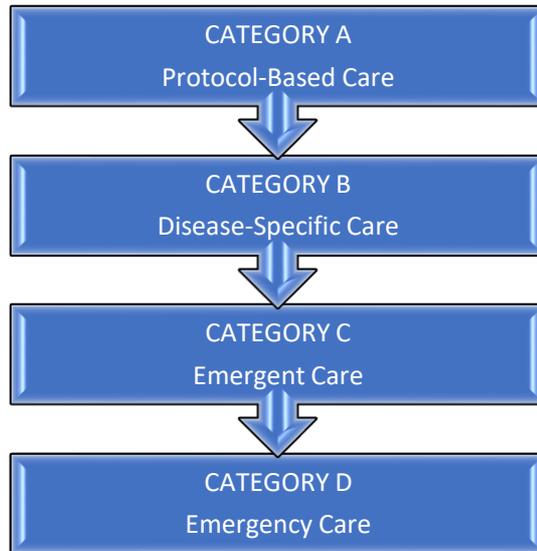
This chapter describes the findings of the study. It is composed of two main parts. The first describes the research results presented in the form of an outcome space, comprised of four categories of description which explore and illustrate the variation of understandings which emerged from the data analysis. The second describes the nature of every category of description placed within the outcome space. Each category and the dimensions of variation which differentiate them from each other are described and underpinned by excerpts from transcripts. This is followed by a section outlining the development of understanding, which deals with the flow and movement of understanding between categories.

4.2 The outcome space

The outcome space (Figure 3) emerging from this research is comprised of four categories of descriptions, arranged in a hierarchical manner from Category A through to Category D, in a logical order from the least to the most complex understanding of early recognition of sepsis:

- (A) Recognise sepsis by following protocol-based care.
- (B) Recognise sepsis by following disease-specific care.
- (C) Recognise sepsis according to emergent care.
- (D) Recognise sepsis according to emergency care.

Figure 3: The outcome space hierarchy



Although seemingly simplistic in their layout (due to the sequential nature of written text), the categories actually represent the multidimensional nature of early recognition of sepsis and the development of an increasingly complex understanding of early recognition of sepsis. The outcome space presents the research results through an exploration of the relationships among various reasoning strategies, representing early recognition of sepsis as a multi-stage process in which the various strategies communicate with each other via a circular flow of knowledge that is gradually produced and superseded by a new one. Every category is a distinctive adoption of practice to fit the context, rather than the nurses' characteristics and is defined as a one-way understanding of the phenomenon.

Themes

Data analysis identified several themes which help reveal qualitative differences among the different understandings of early recognition of sepsis: the availability of data, predictability, cause and effect relationships, type of practice, reasoning strategy, pattern of actions, and learner-related aspects. The themes not only help discern the different ways of understanding the phenomenon, but also provide structural

relationships between categories (Åkerlind, 2005). These themes contribute to larger components of the context, process and learner.

4.2.1 Data display

The Categories of description and their associated themes within the outcome space were arranged according to the structure and characteristics of the Cynefin framework detailed previously (Snowden and Boone, 2007). The categories of description and their associated themes are listed in Figure 4 below.

4.3 Categories and understanding of early recognition of sepsis

The upcoming section describes the nature of every category of description placed in the outcome space. The dimensions of variation which differentiate every category from others are described and underpinned by excerpts from transcripts. The research outcomes are supported by the structure of awareness framework. Every category of description consists of a referential aspect and a structural aspect. While the referential aspect relates to the meaning of the understanding, the structural aspect describes how the aspects of the understanding link to one another. The structural aspect encompasses an internal and external horizon.

The internal horizon was evident in every category and consists of themes: availability of data, predictability, cause and effect relationships, type of practice, reasoning strategy, pattern of actions and learner-related aspects. Themes contribute to the larger components of context, process and learner. The internal horizon also includes descriptions of dimensions of variations of the phenomenon. The external horizon explains the context within which participants experience early recognition of sepsis and early recognition of sepsis-related practice. The referential and structural aspects of the understanding in every category explain the critical variation among categories as well as the logical relationship between them.

Figure 4 comprises a diagram of the outcome space which represents the relationship between components of context, process and learner in every way of understanding early recognition of sepsis, and a group of aspects that contribute to every component. Distinctions notable in the complexities of aspects that comprise components are signified by the descriptions contained in the group of aspects in every component.

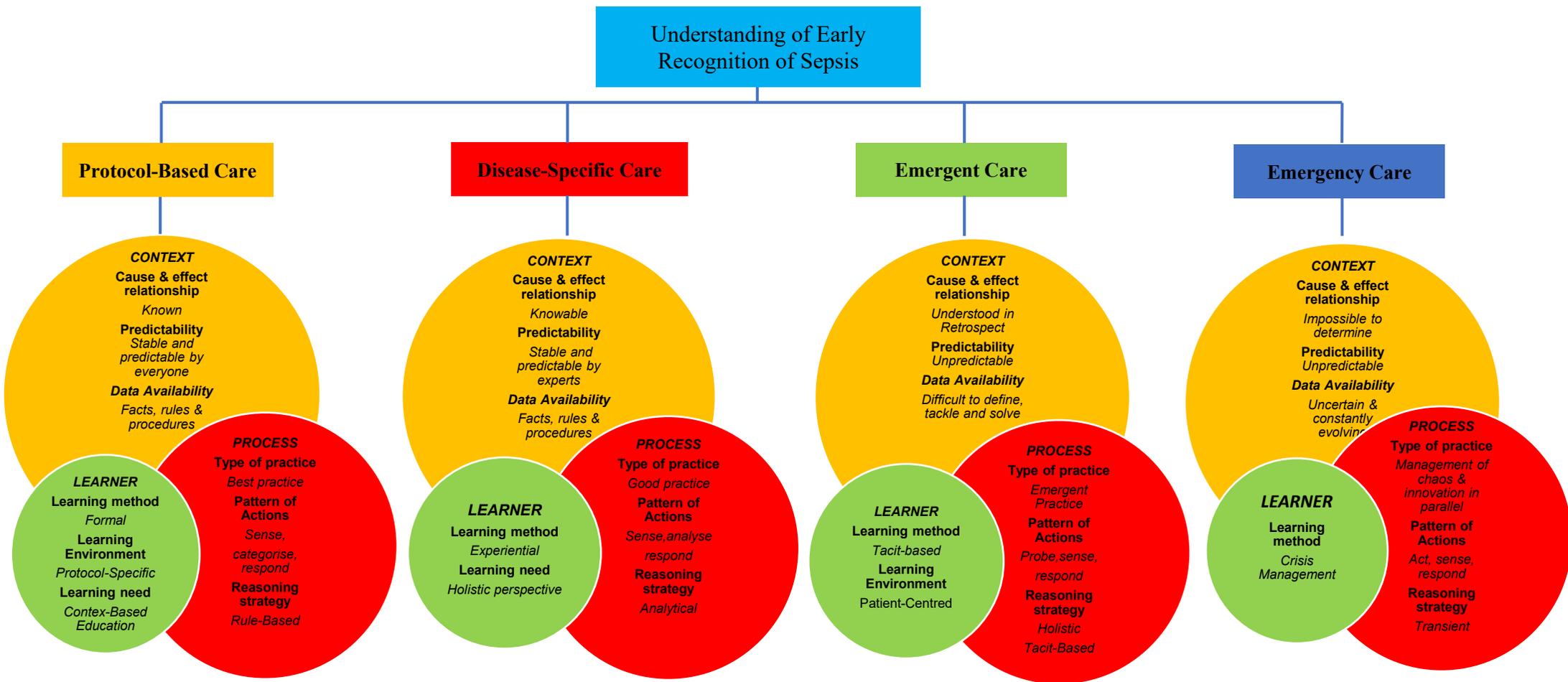


Figure 4: The diagram the outcome space

In Figure 4 circles illustrate how the components of context, process and learner in every way of understanding early recognition of sepsis are related.

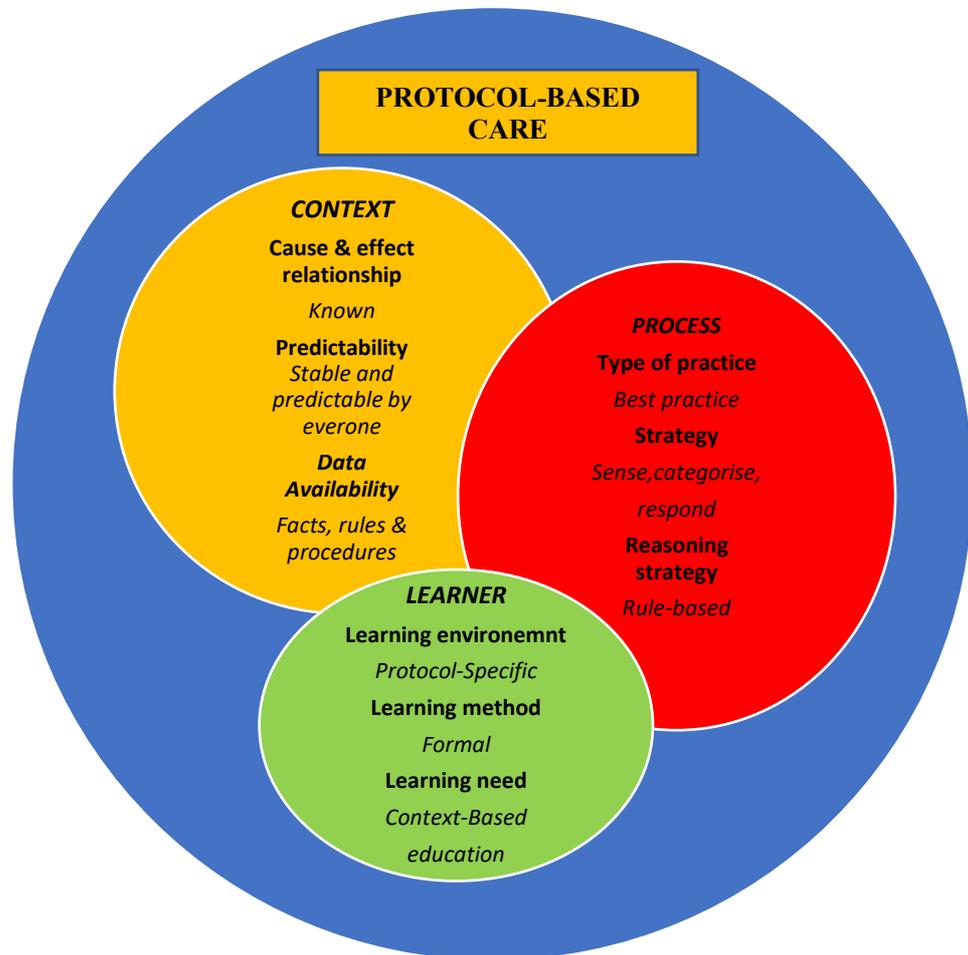
The following section describes every category of description placed within the outcome space in greater detail. The categories are presented in an ordered manner; however, they should not be considered as impermeable divisions. While different categories include different reasoning strategies, the strategies interconnect via the continuous flow of knowledge that is progressively constructed, reflecting a context-directed and adaptable approach to practice.

4.3.1 Category A: Protocol-based care

The first category of the outcome space is early recognition of sepsis as protocol-based care. The category opens with a figure depicting the analysis of the experience for protocol-based care. The rest of the section of this category will provide more detailed descriptions of where the figure came from and more detail around its constituent parts. Although this is the endpoint, the image is presented first to highlight the many aspects of the phenomenon before a more in-depth discussion of its emergence and the evidence from the transcripts are offered.

Figure 5 illustrates the analysis of the experience of early recognition of sepsis between the components of context, process and learner that contribute to the meaning of protocol-based care. The interrelated circles bonding various components demonstrate how context, process, and learner in the understanding of protocol-based care are related.

Figure 5: Understanding of early recognition of sepsis as protocol-based care



Within the protocol-based care category, there is an emphasis on a protocolized approach to disease. Here, the human body is viewed as an object against which existing pre-agreed criteria (normal and abnormal observation ranges as indicated in the protocol bundle) are compared. The following section will discuss the frequently occurring aspects within the components of context, process, and learner central to protocol-based care.

4.3.1.1 Context

Nurses ascribe protocol-based care to early recognition of sepsis based on aspects experienced as central to the context, including a clear cause and effect relationship, facts-based management and repeating patterns and consistent events.

Cause and effect relationship: Known

This conception of learning to recognise sepsis operates within the context of clear cause and effect relationships that can be comprehended in advance. The outcome is predictable by everyone. Cause and effect relationships can be recognised via validated protocols without the requirement of specialised knowledge and additional analytical or experimental approaches.

Interviewee 21 provided an example of a situation in which she/he clearly assigned the probability of sepsis to an outcome. The possibility of assigning probabilities to an outcome in advance allowed the option to automatically initiate a definite course of action for the presented problem.

Inter 21, lines 196-198

“Erm, I think if, if you were, you know on duty and you had a patient that you suspected, you know, might be septic. You have got something very clear, and it is not too detailed. You are not going to get confused by using it, it is just very, very clear.”

Interviewee 11 described two different contexts, of which one occurs in a clear cause and effect relationship.

Inter 11, lines 106-115

“...I think sometimes you can kind of identify that yes, maybe someone is having a response to an infection and then other times, especially on critical care, how many times do people have low blood pressure. How many times are people tachycardic and aren't necessarily septic. So, I think it's sometimes quite hard to establish what the cause of it is. I think sometimes it is obvious, you know, that someone has an infection somewhere and they are having a response to that, but I don't always think it is obvious.”
...Yeah, I guess it's... I guess kind of just looking out for the red flags, I suppose. Having more than one of the red flags to indicate that there possibly could be sepsis

Interviewee 06 and Interviewee 08 provided examples of this by discussing how assigning probabilities to outcomes using the protocol can be predictable by others.

Inter 06, lines 92-94

"Especially, I think in the hospital as well, it's important that you keep on top of the NEWS score, as you should, because then if you need to ring outreach of someone becoming a more unwell, then they can see that as well."

Inter 08, lines 81-83

"She was very, very septic and then we started the Septic Six pathway. So, she wasn't passing urine and then she was getting a canula in, so it was being comfortable to say to the doctors, I think she's septic."

Inter 08, lines 110-112

"Some of us actually have the little cards which clip into our badge ID holders which tell us what needs to be done within the hour and then within six hours, like the Sepsis Six pathway, so that's visible for everyone to see on the ward."

Predictability: Stable and predictable by everyone

Repeating patterns and consistent events

In the protocol-based care, nurses operate in the context of a certain level of predictability. Having a reproductive conception of learning, meaning they intend to replicate a fixed protocolized approach to other patients, assumes the occurrence of repeating patterns and consistent events. Examples of the intention to replicate the fixed approach to other patients were provided by Interviewee 11 and Interviewee 06, who assumed that if it enabled early recognition of sepsis on previous patients it will work again.

Inter 06, lines 312-314

"They always completing like full, full assessment of the patient using ABCD assessment and then managing the patients sort of the same way that I, that I always would, so using that NEWS score..."

Inter 06, lines 303-306

"...like what I said when patients get there to use a....get set of observations because it's good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it's what we use in the Trust."

Inter 11, lines 146-147, 150-152

"Erm... I think really if I am suspecting, if I am suspecting sepsis, I would always kind of follow the same, follow the same plan really."

"...so, I would pretty much always follow kind of the guidelines in the Sepsis Six, even if kind of... I'm not entirely sure what is causing it."

Inter 11, lines 134-141

“I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was. As a staff nurse, you don't really do all of that, do you.”

Predictive understanding of process

In the above excerpts, Interviewee 06 and Interviewee 11 described reasoning based on a predictive understanding of the process; starting with an outcome-based target and then progressing with a deterministic plan for how to go about it. They were making a decision in context of knowing/being certain exactly what they are going to achieve and what resources they need for it; thus, assuming that one cause produces one effect and events will be similar in the future.

Availability of data: Facts, rules and procedures

The knowledge emphasised in decision-making varies across conceptions depending on the category it occurs in. In each category, different information types had different likelihood of being considered worth paying attention to. In protocol-based care, nurses ascribe meaning to early recognition of sepsis based on factual information that matches the criteria in the protocol.

Interviewee 21 and Interviewee 06 provided examples in which recognition of sepsis did not depend on noticing all factual information about the patient, but instead depended on the nurses' ability to identify those that match the criteria in the protocol.

Inter 21, lines 80-85,

“So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis.”

Inter 21, lines 158-166

Interviewer: "May I please ask what made you feel that it was actually clear guidance?"

Participant 21: "Just the way that, because obviously the qSOFA document that we used at XXXX [name of hospital], it was just a two sided document and the front of the document, erm from what I remember, it would just sort of have a step by step guide how to... which included things like erm, you know, literally, quite literally, if the patient has two out of these three signs, like I say, resp, blood pressure and er conscious state of the patient, the mental state of the patient, you know, if you ticked two of those boxes it quite clearly would say, if you've ticked any of these boxes, it quite clearly would say, if this is the case go on to step two which was... and it was just very directed, directed as to what you needed to do next."

Inter 06, lines 303-306

"...like what I said when patients get there to use a....get set of observations because it's good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it's what we use in the Trust."

Inter 21, lines 116-119

"But I think because it was laid out very clearly. To ring the doctor to prescribe antibiotics, to give oxygen if it was required, to check lactate levels, all of those things. It was very clear. And I remember that. Erm... quite vividly erm and it just, it felt quite easy to use."

The extracts above demonstrate that nurses ascribe meaning to early recognition of sepsis based on knowledge that is known, explicit, easy to define and transfer and readily available. Thus, nurses ascribe meaning to early recognition of sepsis based on knowledge that is easy to tackle and solve. In the excerpts above, as well as in the following excerpts, the nurse simply makes progress by following the predetermined steps and goals from protocols with clearly stated objectives and requirements.

In the following excerpt, Interviewee 21 describes following the protocol as being straightforward, owing to the clearly stated, not-detailed objectives and requirements regarding what to give and take. It reduces information overload and effortful deliberation, requiring only negligibly mindful data processing. Interviewee 21 indicated this in the following examples:

Inter 21, lines 196-198

"Erm, I think if, if you were, you know on duty and you had a patient that you suspected, you know, might be septic. You have got something very clear, and it is not too detailed. You are not going to get confused by using it, it is just very, very clear."

Inter 21, lines 198-200

“Erm quite similar and they would literally just have, they literally have the Sepsis Six, so what you need to do, what you need to give and what you need to take, you know if it’s urine [0:15:37] or blood cultures from the patient. It’s quite clear.”

Inter 21, lines 187-193

“...the qSOFA document, it was just erm a little card just the size of a credit card. Erm er and I was given one of those that was created by XXXX [Hospital], but I have also got one now which was made by XXXX [name of hospital].”

Erm quite similar and they would literally just have, they literally have the sepsis six, so what you need to do, what you need to give and what you need to take, you know if it’s urine [0:15:37] or blood cultures from the patient. It’s quite clear. It’s just..., there’s a very small image of each thing, you know, it’s there aren’t many words on this card, it is just very basic.”

Inter 21, lines 395-397, 224-226

“I’m sure there was... I’m sure on the qSOFA document there was time limit as to how quickly you had to get these things done. Get the sepsis six done.”

“But both little cards that I have been provided are very clear. Erm and very basic and like I say, that is probably why it has stuck in my mind about... the sepsis six has just always stuck in my mind, ever since I was a student.”

Table 2: Summary of context-related aspects in protocol-based care

| Aspect | Meaning |
|----------------------|---|
| Cause and effect | “I think if, if you were, you know on duty and you had a patient that you suspected, you know, might be septic. You have got something very clear” (Interviewee 21). |
| Predictability | “...managing the patients sort of the same way that I, that I always would, so using that NEWS score...” (Interviewee 06). |
| Availability of data | “... get set of observations because it’s good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two” (Interviewee 06). |

4.3.1.2 Process

Nurses ascribe protocol-based care to early recognition of sepsis based on frequently occurring process-related aspects such as type of practice, reasoning strategy and strategy.

Types of practice: Best practice

Type of practice is one of the most frequently occurring aspects in the analysis and serves as an aspect critical to each conception. Type of practice occurs across all participants; however, the meaning associated with it differs depending on the category it occurs in. All nurses emphasised an overall practice of recognising sepsis. In this conception, where nurses based their decision on factual data, applying best practice from guidelines seemed possible. The predictive understanding of the process of early recognition of sepsis with a clear cause-and-effect relationship enabled the practice of adhering to guidelines, making this approach possible and practical.

What can be seen from the above and the following two excerpts is applying best practice from guidelines seemed possible in the context of decision-making based on factual information derived from the protocol. Interviewee 21 indicated this in the following examples:

Inter 21, lines 80-85,

“So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis.”

Inter 21, lines 196-198

“Erm, I think if, if you were, you know on duty and you had a patient that you suspected, you know, might be septic. You have got something very clear, and it is not too detailed. You are not going to get confused by using it, it is just very, very clear.”

Pattern of actions: Sense, categorise, respond

In protocol-based care, nurses ascribe meaning to early recognition of sepsis based on pattern of actions. Pattern of actions is one of the most frequently occurring aspects in data analysis and serves as an aspect critical to each conception. Pattern of actions is an aspect that occurs across all participants; however, the meaning associated with it

differs depending on the category it occurs in. In protocol-based care, pattern of actions relates to sensing, categorising, and responding.

In protocol-based care, nurses ascribe meaning to early recognition of sepsis based on a pattern of actions in which they organise and delimit the task of early recognition of sepsis in terms of several separate and unrelated stages. Nurses sense that something is wrong with their patient by assessing the factual information of the patient, categorise them according to protocol and then grounded their responses on established practice. Interviewee 21 captured this in the following examples:

Inter 21, lines 158-166

Interviewer: "May I please ask what made you feel that it was actually clear guidance?"

Participant 21: "Just the way that, because obviously the qSOFA document that we used at XXXX [hospital], it was just a two sided document and the front of the document, erm from what I remember, it would just sort of have a step by step guide how to... which included things like erm, you know, literally, quite literally, if the patient has two out of these three signs, like I say, resp, blood pressure and er conscious state of the patient, the mental state of the patient, you know, if you ticked two of those boxes it quite clearly would say, if you've ticked any of these boxes, it quite clearly would say, if this is the case go on to step two which was... and it was just very directed, directed as to what you needed to do next."

Inter 06, lines 266-275

"Yeah, so we had like a whole module that was really based around sepsis, so it went through the Sepsis Six, it told you sort of what to look out for. We used to break down each part of the NEWS score, the NEWS chart separately, so you know it would look at like oxygen levels and oxygen requirements and different things like that and you would like sort of breakdown each one separately, look at what the patient might be scoring, what you need to be doing in sepsis if that was the case. It told you sort of about the bottom of the NEWS chart when I asked about nursing concern and how if you are concerned about the patient like what to do, what to sort of do in that instance. Hmm, then the exam sort of give you a patient and describe what was happening with the patient and then you have to decide what was wrong with them, like if it was sepsis or, and then what you would do from like from then on to sort of from management of that."

In the next excerpts, evidence of these claims is elaborated on and discussed in more detail. Interviewee 21 and Interviewee 06 organised and delimited the task of early recognition of sepsis in terms of several separate and unrelated stages.

Inter 21, lines 80-85

"So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I

think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis.

Inter 06, lines 85-88

“...when they first enter the unit, and if the patient is scoring a high NEWS, then we hope obviously is to get on top of that and manage all of those things, so you know, if the patients Sat's were low, making sure that you're going to give them oxygen. If their blood pressure was low, make sure that you're going to do fluid challenge.”

This strategy, as revealed by Interviewee 21 and Interviewee 06 themselves in the previous excerpts and confirmed by Interviewee 02 in the following excerpt, indicated that the nurses' frame of mind is mindlessly directed only on particular tasks, keeping everything simple and safe, with limited attention being paid to what is occurring outside of that particular task or routine (around them).

Inter 02, lines 138-143

“... when you, hmm, you know, newly qualified, if I think back to newly qualified, you really just that you saw anxious just to get everything right, at first, you're not thinking of the bigger picture, are you, you just trying to get through the day, get through your tasks, look after the patient safely, but when you get more experienced, you develop this tacit knowledge, you know, and I think when you link up with education, you can read it in a book, but you don't always see it, it doesn't always link in, you need real life experiences.

Deliberate exploration of specific data

Within the strategy, knowledge of recognition of sepsis appeared to be a product of deliberate exploration of data. For example, Interviewee 06, while getting a set of observations, was gathering data in the form of deliberate experience, which is evident from fulfilling an already objectively predetermined plans, such as looking at the numbers. As a consequence, gathering data in the form of a reactive experience by perceiving aspects that stands out was largely seen as absent.

Inter 06, lines 303-306

“...like what I said when patients get there to use a....get set of observations because it's good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it's what we use in the Trust.

Inter 04, lines 185-192, 258-260

Interviewer:” Can you please give me an example of anything you have done for example at workplace to help you to find some information about that would help you to spot maybe sepsis or help you recognise sepsis?”

“And we have like a uh, I have like a thing in the back of my ID badge with like a little picture of the Sepsis Six on it, like a kind of cartoon thingy. Hmm, I had a ped’s one and adult one and I’ve used that quite a bit and to (pause) to like, because it’s got hmm these symptoms on one side and like red flags and what you do about it on the other side, which is really handy it’s just like a little ID badge size card that I carry everywhere.”

Participant 04:” ...,it’s just really good for like prompting yourself to think about it. It is kind of sits in my ID badge, so you see it all the time as well, you’re kind of drummed into what you’re looking for, I think.”

Reasoning: Rule-based reasoning

Furthermore, a reasoning strategy is another frequently occurring aspect in the data analysis and serves as an aspect critical to each category. This reasoning strategy occurs across all participants; however, the meaning associated with the strategy differs depending on the conception it occurs in.

All nurses emphasised an overall reasoning strategy. In this category, nurses’ reasoning involves identifying a deviation of physiological values from some expected norm, through matching them against the predetermined criteria of a protocol. Nurses had a list of predetermined criteria from which to select and implement actions. Interviewee 21 captured this in the following example:

Inter 21, lines 80-85

“So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis.”

The same form of rule-based reasoning was applied to the timescale within which interventions needed to be delivered. As seen in the following excerpt, the nurses were given a predetermined rule and an objectively determined timescale of actions, indicated by the protocol. It was within these rules and timescales that they had to act.

Inter 21, lines 387-388

"I'm sure there was... I'm sure on the qSOFA document there was time limit as to how quickly you had to get these things done."

Inter 06, lines 127-131

Interviewer: "...you trying to do it quickly could you tell me why do you do it that way?"

Participant: "Because you've sort off, the rule is sort of an hour from door to needle, so we would hope that within that time of identifying somebody with sepsis, and especially if they're neutropenic as well, and give them antibiotics in that time,..."

Inter 21, lines 395-397, 224-226

"I'm sure there was... I'm sure on the qSOFA document there was time limit as to how quickly you had to get these things done. Get the sepsis six done."

"But both little cards that I have been provided are very clear. Erm and very basic and like I say, that is probably why it has stuck in my mind about... the sepsis six has just always stuck in my mind, ever since I was a student."

Inter 06, lines 115-117

"We continue to sort of monitor the obs in our guideline with the NEWS chart, so every 15 minutes, depending on the score that they were, or every hour..."

Knowledge

Knowledge was expressed by all nurses as essential to early recognition of sepsis. However, the meaning of the above attribute differed depending on the category it occurs in. Within rule-based reasoning, knowledge of the early recognition of sepsis means an understanding how the patient's physiological values match the predetermined criteria from a protocol.

Interviewee 21 indicated in the following examples that recognition of sepsis did not depend on noticing factual information about the patient, but instead success was reliant on the nurses' ability to identify those that match the criteria from the protocol.

Inter 21, lines 80-85

"So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis."

Inter 21, lines 158-166

Interviewer: "May I please ask what made you feel that it was actually clear guidance?"

Participant 21: “Just the way that, because obviously the qSOFA document that we used at XXXX [hospital], it was just a two sided document and the front of the document, erm from what I remember, it would just sort of have a step by step guide how to... which included things like erm, you know, literally, quite literally, if the patient has two out of these three signs, like I say, resp, blood pressure and er conscious state of the patient, the mental state of the patient, you know, if you ticked two of those boxes it quite clearly would say, if you’ve ticked any of these boxes, it quite clearly would say, if this is the case go on to step two which was... and it was just very directed, directed as to what you needed to do next.”

Inter 21, lines 198-200.

“Erm quite similar and they would literally just have, they literally have the Sepsis Six, so what you need to do, what you need to give and what you need to take, you know if it’s urine [0:15:37] or blood cultures from the patient. It’s quite clear.”

Inter 06, lines 266-275

“Yeah, so we had like a whole module that was really based around sepsis, so it went through the Sepsis Six, it told you sort of what to look out for. We used to break down each part of the NEWS score, the NEWS chart separately, so you know it would look at like oxygen levels and oxygen requirements and different things like that and you would like sort of breakdown each one separately, look at what the patient might be scoring, what you need to be doing in sepsis if that was the case. It told you sort of about the bottom of the NEWS chart when I asked about nursing concern and how if you are concerned about the patient like what to do, what to sort of do in that instance. Hmm, then the exam sort of give you a patient and describe what was happening with the patient and then you have to decide what was wrong with them, like if it was sepsis or, and then what you would do from like from then on to sort of from management of that.”

Inter11, lines 87-94

Interviewer: “What helped you to kind of realise that patient could be septic as part of the symptoms that you describe?”

Participant: “I mean, obviously the whole kind of Sepsis Six that came out a few years back and the warning signs to look out for, ...”

“...I think since the, you know, the Sepsis Six card that I think even you gave out with the red flags on one side. And then the treatments on the other. I think that certainly helped to recognise the signs, definitely.”

Inter 06, lines 85-88

“...when they first enter the unit, and if the patient is scoring a high NEWS, then we hope obviously is to get on top of that and manage all of those things, so you know, if the patients Sat's were low, making sure that you're going to give them oxygen. If their blood pressure was low, make sure that you're going to do fluid challenge.”

Success of early recognition of sepsis

Within rule-based reasoning, the success of early recognition of sepsis seemed to be a control over the patient via the maintenance of patient symptoms. The following extracts demonstrate that success in early recognition of sepsis is dependent on the removal or maintenance of the patient’s symptoms.

The key to this process was the evaluation of an anticipated protocolised plan, which lacked anticipations of changing circumstances while implementing a course of action. For Interviewee 04, success is seen as a judgment if the performance based on the protocol yielded the results expected for it. During the execution of their protocol-based plan, there was no sign of stopping and thinking about the problem.

Inter 04, lines 263-268

Interviewer: "And just one question please, how do you decide that something that you have done to early recognise sepsis has been successful?"

Participant: "I think when they start the Sepsis Six (pause), and then, like you know, like when you start the Sepsis 6 and then a couple of hours later with the patient looking a little bit better, like when they had a dose of antibiotics. And like I think that's like you feel like oh yeah, I did the right thing like it's been successful, we're getting there."

Inter 07, lines 129-134

"...with given fluids and tachycardia and I know this because I know we've talked about it before and actually just having that conversation with you made it more kind of openminded with that. And I've seen instances where you know the patient has been tachycardic and given them that a bit of fluid, if brought them down to kind of a normal heart rate you're getting below a hundred, you know, things like that. So, seeing that patient's response, you know, it's valuable and kind of can guide you on the right track, you know, are you doing the right thing?"

Inter 07, lines 114-117

"Yeah, so like, for instance, fluid, that's quite a good one, so if the patient is septic, then fluid would be a good response to that. Another thing would, could be antibiotics as well, so, you know, if the patient's been given antibiotics and then their temperature comes down after the...after a dose or two, then you know that you're on the right track to... kind of treating sepsis."

Table 3: Summary of process-related aspects of protocol-based care

| Aspect | Meaning |
|--------------------|---|
| Type of practice | "...managing the patients sort of the same way that I, that I always would, so using that NEWS score..." (Interviewee 06). |
| Pattern of actions | "She was very, very septic and then we started the Septic Six pathway" (Interviewee 08). |
| Reasoning strategy | "...it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. I think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis" (Interviewee 21). |
| Success | "when you start the Sepsis 6 and then a couple of hours later with the patient looking a little bit better, like when they had a |

dose of antibiotics. And like I think that's like you feel like oh yeah, I did the right thing like it's been successful, we're getting there"(Interviewee 04).

4.3.1.3 Learner

In protocol-based care, learner-related aspects predisposed nurses towards adopting this approach, such as learning environment, learning method, and learning needs.

Learning environment: Protocol-specific learning environment

There were aspects of the learner's environment that predisposed nurses towards adopting protocol-based care for early recognition of sepsis. When trying to seek information about how to recognise sepsis in this type of environment the nurse would find it easily. Clinical departments and universities are full of the evidence of information related to Protocol-Based Care. There are posters on the walls, and information in the media, conferences, universities and publications. These all combine to confirm their beliefs that following information from protocols is the way to recognise sepsis. As a result, nurses in this environment were therefore unlikely to search for contradictory information.

Interviewee 04, Interviewee 08 and Interviewee 06 capture this in the following excerpts.

Inter 08, lines 349-352

"Just officially, I've only been qualified in the past two years and I don't remember, also the pandemic hasn't helped, but I don't remember doing anything wholeheartedly based around sepsis recognition and treatment. There's just what you get told by other nurses or there's the Sepsis Six pathway that's laminated on the nurse's station."

Inter 06, lines 303-306

"...like what I said when patients get there to use a....get set of observations because it's good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it's what we use in the Trust."

Inter 04, lines 185-192, 258-260

Interviewer:" Can you please give me an example of anything you have done for example at workplace to help you to find some information about that would help you to spot maybe sepsis or help you recognise sepsis?"

“And we have like a uh, I have like a thing in the back of my ID badge with like a little picture of the Sepsis Six on it, like a kind of cartoon thingy. Hmm, I had a ped’s one and adult one and I’ve used that quite a bit and to (pause) to like, because it’s got hmm these symptoms on one side and like red flags and what you do about it on the other side, which is really handy it’s just like a little ID badge size card that I carry everywhere.”

“...it’s just really good for like prompting yourself to think about it. It is kind of sits in my ID badge, so you see it all the time as well, you’re kind of drummed into what you’re looking for, I think.”

What can be seen from the above excerpts is that while the learning environment predisposed nurses towards adopting a protocol-base care approach to early recognition of sepsis, equally it predisposed them to what they perceived and how they judged the importance of a perceived content of observations.

Learning method: Formal training

There were aspects from the learning method’s side that also predisposed nurses towards adopting protocol-based care to early recognition of sepsis and which oriented them to apply it in practice. As illustrated in the following extracts, the use of protocol-based care is a result of formal training and driven by fulfilling obligations and expectations of the Trust and the university.

Inter 06, lines 303-306

“...like what I said when patients get there to use a....get set of observations because it’s good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it’s what we use in the Trust.”

Inter 21, lines 578-580

“It’s just, it’s stuck with me and I’ve remembered it and it was always, you know, I was always taught that it is something that isn’t recognised as often as it should be, and obviously it is something that needs to be recognised and dealt with quickly.”

Inter 21, lines 386-388

“So probably just education. Erm it was just always, you know, drilled in that you have to use the qSOFA, if you suspect it, then use the sepsis six.”

Inter 08, lines 284-287

“Yeah, I think that it should start in University. For example, you know we had that patient in our OSCE. It was, it was a septic patient. I just think there should be sepsis recognition and sepsis treatment. I mean that’s why it’s been missed so many times. That’s why we’ve had the Sepsis Six pathway instilled.”

Objective and subjective features

In formal learning, nurses received rules for drawing conclusions or for determining actions based upon objective facts, and subjective features of the situation that are assumed to be recognizable without experience in the field. With these elements, regardless of their form, the nurse is reasonably expected to follow procedures based on a protocol.

Inter 06, lines 266-275

“Yeah, so we had like a whole module that was really based around sepsis, so it went through the Sepsis Six, it told you sort of what to look out for. We used to break down each part of the NEWS score, the NEWS chart separately, so you know it would look at like oxygen levels and oxygen requirements and different things like that and you would like sort of breakdown each one separately, look at what the patient might be scoring, what you need to be doing in sepsis if that was the case. It told you sort of about the bottom of the NEWS chart when I asked about nursing concern and how if you are concerned about the patient like what to do, what to sort of do in that instance. Hmm, then the exam sort of give you a patient and describe what was happening with the patient and then you have to decide what was wrong with them, like if it was sepsis or, and then what you would do from like from then on to sort of from management of that.”

Inter 06, lines 303-306

“...like what I said when patients get there to use a....get set of observations because it's good to sort of look at the numbers, make sure that that you sort of identify any potential risk to the patient and get a baseline for their numbers and always using the NEWS 2 score two because it's what we use in the Trust.”

Learner needs: Context-based education

Learner needs relates to indications or descriptions of educational needs. Learner needs occurred across all transcripts. However, within each conception of learning, learners indicated varying educational needs which contributed to the meaning they ascribed to learning to recognise sepsis. Within protocol-based care learning, descriptions of educational needs relate to the type of education. Learners demand education where there is a greater emphasis on context-based components of learning to recognise sepsis. Interviewee 21 captured this need in the following excerpt:

Inter 21, lines 619-625

“And I... because I haven't had specific training, you know, education around sepsis in critical care. I would maybe doubt myself a little bit. Erm, so I think like I keep saying, more education... if education around sepsis was specific to your department, your area, because like I say it is quite different from a ward. Then

that would just give you the confidence to not doubt yourself and that's literally, that's what I think.

The need for context-based education is related to the perceived difficulties of applying the best practices to complex clinical contexts, given the context-free feature of the best practice knowledge.

In the following excerpts, Interviewee 11 and Interviewee 21 described a broader spectrum of clinical contexts than protocol-based care can permit, such as a patient presentation that has multiple interacting causes leading to contradictory assumptions, evidence and ideas of patient symptoms, all of which suggest different solutions. The nurses recognised that theoretical knowledge of standardised management that adheres to guidelines does not match the knowledge required for personalizing management based on patient individual circumstance. Although the nurses described the understanding of the different contexts within which they are working, they did not describe a change in the clinical behaviors and decisions to match that context.

In their excerpts, there is a clear effort to acquire insight into the specific features of a patient, but also perceived difficulties of following rules for determining actions and conclusions on the basis of context-free features and without considering any differences in context. As a direct result of this, an evaluation of difficulties had no functional view and appeared an obstructive component of working. The nurses' understanding of the different contexts within which they are working occur without a corresponding ability to change the clinical behaviors and decisions to match that context.

Inter 21, lines 258-167

Interviewer: "Why do you think, you know, following this guidance from the sepsis six card...Why do you think it is harder on ITU? ..."

Participant: Erm, I think because obviously patients on intensive care are sicker than patients on a ward, but things like lactate levels, I know from the qSOFA, if the lactate level is above 2, that is sort of one of the alarm bells.

Whereas, I have frequently had a patient on ITU with a lactate above 2. Erm and I... if I've reported it to a doctor, it might just be that, often they're dehydrated and need fluid.

Inter11, lines 106-115

“...I think sometimes you can kind of identify that yes, maybe someone is having a response to an infection and then other times, especially on critical care, how many times do people have low blood pressure. How many times are people tachycardic and aren’t necessarily septic. So, I think it’s sometimes quite hard to establish what the cause of it is. I think sometimes it is obvious, you know, that someone has an infection somewhere and they are having a response to that, but I don’t always think it is obvious.”

...Yeah, I guess it’s... I guess kind of just looking out for the red flags, I suppose. Having more than one of the red flags to indicate that there possibly could be sepsis

Inter11, lines 146-147, 150-152

“Erm... I think really if I am suspecting, if I am suspecting sepsis, I would always kind of follow the same, follow the same plan really.”

“...so, I would pretty much always follow kind of the guidelines in the Sepsis Six, even if kind of... I’m not entirely sure what is causing it.”

Table 4: Summary of learner related aspects in protocol-based care

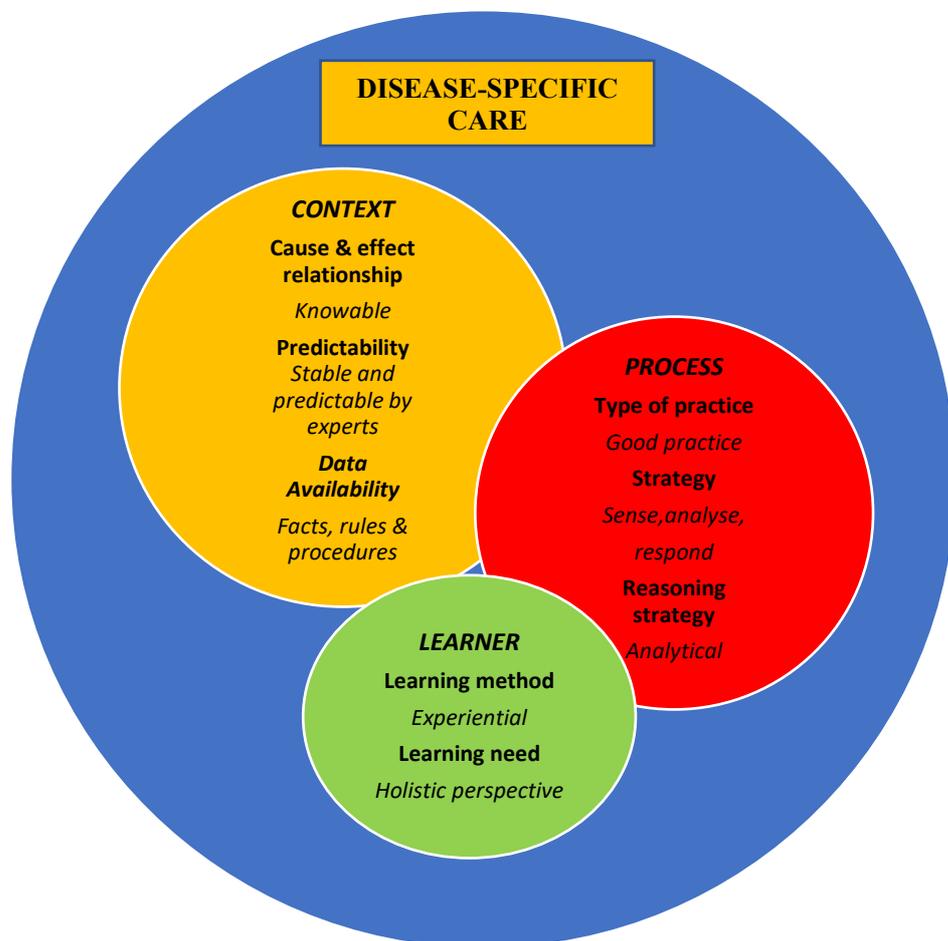
| Aspect | Meaning |
|----------------------|---|
| Learning environment | “It is kind of sits in my ID badge, so you see it all the time as well, you’re kind of drummed into what you’re looking for...” (Interviewee 04). |
| Learner needs | “... if education around sepsis was specific to your department, your area, because like I say it is quite different from a ward. Then that would just give you the confidence to not doubt yourself...” (Interviewee 21). |

4.3.2 Category B: Disease-specific care

The second category of the outcome space in early recognition of sepsis is disease-specific care. This category opens with a figure depicting the analysis of the experience for disease-specific care. The rest of the section of this category will provide more detailed descriptions of where the figure came from and go into more detail around its constituent parts. Although this is the endpoint, the image is presented first to highlight the many aspects of the phenomenon before a more in-depth discussion of its emergence and the evidence from the transcripts are offered.

Figure 6 illustrates analysis of understanding of early recognition of sepsis between the components of context, process and learner that contribute to the meaning of disease-specific care. The interrelating circles bonding various components demonstrate how context, process and learner are interconnected in the understanding of disease-specific care.

Figure 6: Understanding of early recognition of sepsis as disease-specific care



Within this category, the primary focus of attention has shifted from a protocolized to a reductionist approach to disease, where a reduction of symptoms and patient stability of condition is seen as key to early recognition of sepsis. The human body is viewed as the sum of distinct parts, which can develop isolated diseases. A disease is then

considered to be the result of a malfunction of its parts, with a well-defined label that demands a professional judgment. Efforts are concentrated on breaking down a patient's signs and symptoms into single divisions and to define with a great accuracy and precision the intervention that is needed to be performed for every malfunction, as seen in the following excerpts.

The following section will discuss the frequently occurring aspects within the components of context, process and learner central to disease-specific care.

4.3.2.1 Context

Nurses ascribe disease-specific care to early recognition of sepsis based on aspects experienced as central to the context, such as knowledge of cause-and-effect relationships, predictability of the outcome and fact-based management. The following section presents these aspects.

Cause-and-effect relationship: Knowable

As noted in the previous category, a cause-and-effect relationship is a frequently occurring aspect and serves as central to every category. Cause-and-effect relationships vary across categories, depending on the category it occurs in. Within these approaches, nurses ascribe disease-specific care to early recognition of sepsis based on a cause-and-effect relationship that is knowable, as opposed to the known cause-and-effect relationships observed in protocol-based care.

In protocol-based care, nurses operate with one causal factor for the clinical problem. Here, they might operate with multiple causal factors for the clinical problem, which are linear and synergistically compatible with symptoms, and through which there is a clear relationship between cause and effect. The evidence of these claims is captured in the following excerpts.

For example, Interviewee 11 described a context with an unclear relationship between cause and effect due to the multiple causal factors for the clinical problem. However, there is a little elaboration of what these might include.

Inter11, lines 106-115

“...I think sometimes you can kind of identify that yes, maybe someone is having a response to an infection and then other times, especially on critical care, how many times do people have low blood pressure. How many times are people tachycardic and aren't necessarily septic. So, I think it's sometimes quite hard to establish what the cause of it is. I think sometimes it is obvious, you know, that someone has an infection somewhere and they are having a response to that, but I don't always think it is obvious.”

...Yeah, I guess it's... I guess kind of just looking out for the red flags, I suppose. Having more than one of the red flags to indicate that there possibly could be sepsis

Interview 12 provided a more detailed description of the unclear relationship between cause and effect due to the multiple causal factors for the clinical problem. What can be seen in this excerpt is that where there are multiple causal factors for the clinical problem, there is a possibility of forming a list of probable hypotheses compatible with the symptoms. What else can be seen here is the process of forming hypotheses is still rational and expressed in an explicit manner with clearly stated objectives.

Inter 12, lines 284-292

“So, in my examination, I would identify definitely areas of concern definitely. So, say you know like if somebody when I examined, if somebody is chesty, so obviously I would focus on their chest. I would, you know if they were complaining of urinary symptoms, I would obviously think, you know, my second observation would be, you know, they've got urinary symptoms. If they had abdominal pain, abdominal distention. Nausea, vomiting anything like that, obviously I would focus more on abdominal causes.”

“So, you know, like even though I've come to a conclusion it could be urinary sepsis, but I would still have all the other options in my mind.”

Inter 11, lines 318-323

“I suppose. So, if you are suspecting sepsis and you're starting a fluid bolus, are they responding to that? Erm.. kind of the bloods that you are taking, the antibiotics that you are administering, the oxygen that you are giving. Are all of these things working?

Do you see that there is an improvement in the patient? If not, you kind of need to look at other options, but you kind of do one thing at a time and see if you are noticing a difference.”

Regarding the predictability of the outcome, comparable to the descriptions of predictability of outcomes in protocol-based care, descriptions within disease-specific care also highlight a high level of predictability. However, here, where there are multiple casual factors for the clinical problem, the outcomes are not predictable by everyone, but are predictable by an expert and via the inclusion of and contribution from a team of experts across relevant disciplines. The experts have the right expertise and can analyze the problem. This approach is more difficult and needs experts with the ability to analyse the problem and understand its consequences at multiple levels.

The following excerpts demonstrate that nurses have a certain level of comprehension of the patient's clinical problem, but an analysis of the problem demands the inclusion of and contribution from a team of experts across relevant disciplines.

Inter 10, lines 438-447

"If you don't understand, you might feel like your only responsibility is to inform the doctor." "Because you don't understand. So [0:32:28] from the doctor because the number is not by the book. And they say okay and then you just go back and be sad, but when you fully understand the situation, you have more confidence to say to the doctor that it is either junior or whatever, no that's not alright. Normally in this situation we would do this and that."

Inter 06, lines 192-194

"... I think it's just really important that you're discussing as a nurse everything you are doing in that instance with the doctor and make sure that you are identifying the right thing and that you are sort of doing everything that you should be doing."

Inter 04, lines 96-101

"I think it comes well, sometimes it comes with kind of experience and with like senior nurses' guidance as well like if you're ask your nurse in charge what... what do I do with my patient? Does not look quite well or what do you think of this? And like other nurses around you as well like your colleagues, you say what do you think of this? And I think you kind of get confidence from your colleagues to go and ask about it like if they agree you kind of think oh two of us now agree that this patient looks rubbish, I'm gonna go and get a doctor."

Inter 08, lines 212-216

"But then also having the doctors on board with you and coming up with a plan among ourselves, like I'll do this and you'll do this, it's very much [pause], but I don't think it's just a nurse responsibility. Yes, it could be the nurse's responsibility to identify it, then because you've got to escalate higher, it's a multi-disciplinary team [pause] approach that you've got to take [inaudible sounds] in a very septic patient."

Inter 06, lines 187-194

“ So, I suppose it's really important when the patient gets there, to sort of discuss it with your colleagues, discuss it with the doctor first of all, don't sort of just make a decision straight away. And I think it's important, especially because a lot of our patients report that they had, they might have had temperatures at home, just make sure that you sort of bring them in, check the temperature first, asking if they had any paracetamol in the last 4 to 6 hours.

Hmm... I think it's just really important that you're discussing as a nurse everything you are doing in that instance with the doctor and make sure that you are identifying the right thing and that you are sort of doing everything that you should be doing.”

Inter 17, lines 425-427

“...you can just advocate for... like if... go to the medical staff, if you like think it's sepsis”

Inter 08, lines 235-238

“I think sometimes, sometimes you don't necessarily 100% know because it's an investigative, investigatory type of process [pause] at the beginning, but then I mean, as nurses, we can't say this patient had sepsis. Yes, we can alert to the doctor and outreach that we suspect it, but it's very much trusting the people that we work with.”

Inter 17, lines 164-166

“Erm... probably like multiple options and just like keep the, whoever, like the doctor whoever is... if anything is like deteriorating or anything like that, just keep them informed. So, they can like come and have a look and see if they need to do anything.”

Inter 17, lines 173-179

“...sometimes you have to keep going like to the medical staff and saying, there is something not right, kind of thing, you think there is something... else going on. You might have to keep going, like raising awareness to them that something is not right. And like... need to do something about it.”

Inter 05, lines 89-92

“I feel like it's more the doctors who would be like right take some bloods, I'll do some blood cultures and then they would prescribe the antibiotics, so I don't feel like we really get too much of a say in it. Whereas when I was on the wards even as a student, I felt like it was a lot more ran by me because obviously you got your septic six, three in and three out.”

Predictability: Stable and predictable by experts

As noted in the previous category, predictability is a frequently occurring aspect and serves as an aspect central to every category. Predictability varies across categories, depending on the category it occurs in. Within disease-specific care, nurses continue to ascribe this to early recognition of sepsis based on a predictable view of the world. Yet, similar to nurses in protocol-based care, nurses in disease-specific care also have a

reproductive conception of learning, meaning they intend to replicate a fixed approach with other patients, assuming the occurrence of repeating patterns and consistent events.

Nevertheless, while they intend to replicate a fixed approach to other patients based on protocols, here they also intend to replicate a fixed approach to other patients based on their professional experience, assuming that if it enabled early recognition of sepsis on a previous patient it will work again.

Inter 17, lines 376-379

“Erm, like probably just like from patient to patient. If you have looked after somebody and something has happened like to a previous patient, it maybe just sticks in your mind and if it happens to the patient that you are looking after next, you just think what did we do to improve like that and...”

There are several concepts related to the nurses' views of the predictable world.

These are the key concepts of predictability found in this category.

- 1) Predictive understanding of the nature of patient presentation:

Inter 11, lines 81-84

“So, I guess the main thing that the nursing staff kind of pick up on is usually the temperature. They are pretty good to come and inform you if someone has a spike in temperature. Or if someone's tachycardic or hypotensive or not as alert, or respiratory rate is up. Just kind of all the classic signs of sepsis.”

Inter 17, lines 73-75

“Erm... probably just when like if a patient, like when they initially come in, if they start like deteriorating and just look out for certain things like, I don't know... erm, like in the gases, like the lactate and things.”

- 2) The predictability of future state:

Inter 20, lines 227-228

“So maybe next time when you've got a patient who is quite similar to a one that you have had before, you will remember what you did last time.”

- 3) Predictability arising from the applicability of scientific data:

Inter 11, lines 134-141

“I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine

measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was. As a staff nurse, you don't really do all of that, do you."

"You would kind of do someone's observations and then they would report it back to whichever doctor was on the ward and you would expect them to then follow on from it."

4) Predictability about a course of actions for a particular patient:

Inter 17, lines 376-379

"Erm, like probably just like from patient to patient. If you have looked after somebody and something has happened like to a previous patient, it maybe just sticks in your mind and if it happens to the patient that you are looking after next, you just think what did we do to improve like that and..."

Availability of data: facts, rules and procedures

As noted in the previous category, nurses ascribe meaning to early recognition of sepsis based on the type of information. The type of information emphasised in decision-making varies depending on the category it occurs in. Within disease-specific care, nurses still ascribe this to early recognition of sepsis based on factual information. Comparable to the descriptions of the type of information in protocol-based care, descriptions of information types within disease-specific care also highlight factual information.

However, while in protocol-based care nurses emphasize factual information in accordance with a protocol, in disease-specific care, nurses also emphasize factual information according to common rules or classifications according to the type of ward, type of assessment and type of disease.

The views expressed in the excerpts reflect the nurses' receptiveness to this sort of information:

Inter 05, lines 73-78

"So, it's quite different in our unit, which I don't know if you would agree, because I have been on the ward before and obviously the first thing would be if they had a temperature, if they had raised white blood cells and need of oxygen requirement, but obviously that's just if it was like a respiratory type of assessment, trying to think of what else, confusion. We get a lot of patients because I did my final placement when I was a student was actually on a

dementia ward and a lot of the patients had sepsis then, and one of our main things was recognizing them was from the smell of the urine.”

Inter 11, lines 81-84

“So, I guess the main thing that the nursing staff kind of pick up on is usually the temperature. They are pretty good to come and inform you if someone has a spike in temperature. Or if someone’s tachycardic or hypotensive or not as alert, or respiratory rate is up. Just kind of all the classic signs of sepsis.”

The use of this form of knowledge is noticeable in decision-making areas, such as the judgement for drawing conclusions and for determining actions.

Inter 11, lines 134-141

“I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was. As a staff nurse, you don’t really do all of that, do you.”

You would kind of do someone’s observations and then they would report it back to whichever doctor was on the ward and you would expect them to then follow on from it.”

Inter 17, lines 73-75

“Erm... probably just when like if a patient, like when they initially come in, if they start like deteriorating and just look out for certain things like, I don’t know... erm, like in the gases, like the lactate and things.”

The extracts above demonstrate that nurses ascribe meaning to early recognition of sepsis based on knowledge that is discoverable and definable, even if that might not be obvious at first glance.

Decontextulised knowledge

Furthermore, nurses described a natural tendency to prioritise information at the level of physiology during the decision-making, thus paying a little attention to contextual factors and not aiming to gain cumulative interpretation of the patient’s physiological condition.

Inter 16, lines 355-362

“And I think that was just because I knew what the triggers were. Had I been maybe a more junior member of staff or somebody who hadn’t had the experience or the exposure to sepsis with other cases, then, you know, I probably wouldn’t have put the two and two together and I probably would have

gone, okay they've got a temperature and yeah, okay, they have not passed urine, but there would be other reasons why that would happen, like I say, for example, the patient had been into theatre, so, they often don't pass urine for a bit of time afterwards and that sometimes is, you know, that is just the way that it goes, especially with the lumbar decompression, anaesthetics, etc."

Inter 05, lines 98-105

"I think it's because our patients are already so poorly and I mean we work in a neuro intensive care where patients are confused, patients get delirious of the dexamethasone, patients get delirious of, you know, a CAM-ICU and general ICU area, so it's not something we could look at from someone being really well within themselves and then suddenly becoming confused, like wetting themselves being incontinent because I think straight away, we would look at it being a neuro aspect.

And even sometimes with pyrexial temperatures we would sometimes look at that being a neuro aspect, because of obviously like bleeding in the brain and then obviously we got to tell the doctors and then they would do the bloods."

Inter 23, lines 352-355

"So, whereas if you've got somebody on inotropes and you're constantly going up on the inotropes, you don't always think, oh actually could there be something else dropping the blood pressure and the inotropes aren't working as well, because we are not dealing with whatever that is, and that could be a sepsis thing and it could be a fluid thing."

Table 5: Summary of aspects related to context in disease-specific care

| Aspect | Meaning |
|----------------------|--|
| Cause and effect | "I think it's sometimes quite hard to establish what the cause of it is..." (Interviewee 11). |
| Predictability | "If you have looked after somebody and something has happened like to a previous patient, it maybe just sticks in your mind and if it happens to the patient that you are looking after next, you just think what did we do to improve like that and..." (Interviewee 17). |
| Availability of data | "...just look out for certain things like, I don't know... erm, like in the gases, like the lactate and things" (Interviewee 17). |

4.3.2.2 Process

Nurses ascribe disease-specific care to early recognition of sepsis based on frequently occurring process-related aspects such as type of practice, reasoning strategy and strategy.

Types of practice: Good practice

As noted in protocol-based care, type of practice is one of the most frequently occurring aspects in data analysis and serves as critical to each conception. Type of practice occurs across all participants; however, the meaning associated with strategy differs depending on which category it occurs in. Yet, like descriptions of the type of practice in protocol-based care, descriptions of the type of practice within disease-specific care also emphasise best practice. However, best practice assumes single pathways, and in the disease-specific care there is much more diversity than implied by best practice.

Therefore, disease-specific care resembles rule-based solutions, however in a significantly expanded form. While still adhering to guideline-determined practice defined by formal procedures, here practice is relaxed to enable variations based on expertise. Thus, best practice is then replaced by good practice that encompasses a range of investigations, clinical decision rules, laboratory tests and clinical signs. The evidence for these claims is presented in the following Interviewee 11 excerpt. Best practice is still viewed as a viable option, but it is expanded by additional practice of clinical decision rules, investigations and laboratory tests, but there is a little elaboration of what the additional practice might include.

Inter 11, lines 134-141

“I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was.”

You would kind of do someone’s observations and then they would report it back to whichever doctor was on the ward and you would expect them to then follow on from it.”

As the discussion progressed, Interviewee 11 went on to identify interventions that he/she viewed as viable. Fluid therapy is viewed as the first viable intervention here,

before moving onto practice of blood investigations. However, another practice of an oxygen administration was then considered as valuable.

Inter 11, lines 318-323

"I suppose. So, if you are suspecting sepsis and you're starting a fluid bolus, are they responding to that? Erm.. kind of the bloods that you are taking, the antibiotics that you are administering, the oxygen that you are giving. Are all of these things working? Do you see that there is an improvement in the patient? If not, you kind of need to look at other options, but you kind of do one thing at a time and see if you are noticing a difference."

Pattern of actions: Sense, analyse, respond

As noted in protocol-based care, pattern of actions is one of the most frequently occurring aspects in analysis and serves as an aspect critical to each conception.

Pattern of actions occurs across all participants; however, the meaning associated with pattern of actions differs depending on which category it occurs in. Within disease-specific care, nurses' decision making emphasises the type of information that is completely definable, observable and discoverable, even if that might not be obvious at first glance. In this context, a certain level of comprehension of a clinical problem and assignment probabilities to the outcome are possible, if not required, to proceed with action. Equally, an automatic commencement of the definite course of action for the presented problem is possible.

Therefore, here, once nurses reach a certain level of comprehension of the underlying causality, they then automatically turn to an expert with the right kind of expertise to solve or analyse the clinical problems. Thus, they are using the experts' pattern of actions of sense, then analyse and respond. In disease-specific care, pattern of actions include:

- 1) Using **sense to detect** a problem with the patient
- 2) **Analyzing** how to maximize the outcomes or calling an expert who has expertise in that domain
- 3) Examining the results and **responding** to them.

The evidence for these claims is presented in the following excerpts.

In the following extract, Interviewee 12 described the initial stage of the strategy of assigning probabilities to outcomes, but there was little elaboration on what follows.

Inter 08, lines 201-203

"I just think you should always consider every route and then if you go no that's not that, then at least you've ticked it off the list of potentials and then you can plan from there. As long as you got an idea in your head of what it could be, then you know what to then go and do."

Inter 12, lines 284-292

"So, in my examination, I would identify definitely areas of concern definitely. So, say you know like if somebody when I examined, if somebody is chesty, so obviously I would focus on their chest. I would, you know if they were complaining of urinary symptoms, I would obviously think, you know, my second observation would be, you know, they've got urinary symptoms. If they had abdominal pain, abdominal distention. Nausea, vomiting anything like that, obviously I would focus more on abdominal causes. "

"So, you know, like even though I've come to a conclusion it could be urinary sepsis, but I would still have all the other options in my mind."

Further elaboration of the strategy is seen in the following extract. Again, partial recognition of sepsis is considered achievable. The possibility of recognition allowed the option to automatically initiate a definite course of action for the presented problem, and perform analysis and take it to a doctor to recognise the problem.

Inter 11, lines 134-141

"I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was."

You would kind of do someone's observations and then they would report it back to whichever doctor was on the ward and you would expect them to then follow on from it."

Inter 11, lines 318-323

"I suppose. So, if you are suspecting sepsis and you're starting a fluid bolus, are they responding to that? Erm.. kind of the bloods that you are taking, the antibiotics that you are administering, the oxygen that you are giving. Are all of these things working?

Do you see that there is an improvement in the patient? If not, you kind of need to look at other options, but you kind of do one thing at a time and see if you are noticing a difference."

What can be seen from the above extracts is that, within this category, partial or complete recognition of sepsis is considered achievable with an end point to the process, although this endpoint is not well defined, since it varies from person to person. Also evident from these excerpts is that there is a notable similarity in how learning about the patient is viewed. Nurses' learning is still a staged process; nurses explain separate phases of learning where they delimited and organised knowing and doing into separate steps, resulting in knowing being a product of a staged process.

The nurses who adopted this conception of learning believed that recognising sepsis requires just getting through the leaning tasks that seemingly are not related to one another. Nurses even reported experiences that followed the same structure, which is evident from their attempts to reproduce a series of separate stages which are disconnected from each other to complete tasks.

Reasoning strategy: Analytical reasoning

As noted in protocol-based care, a reasoning strategy is another frequently occurring aspect in the analysis of the data and serves as critical to each category. All nurses emphasised an overall a reasoning strategy; however, the meaning associated with a reasoning strategy differs depending on the category it occurs in.

Within disease-specific care, reasoning still occurs in the context where casual factors for the clinical problem are linear and synergistically compatible with symptoms. However, while rule-based reasoning assumes a single causal factor, in disease-specific care there is much more diversity than implied by the reasoning. Therefore, the meaning associated with the reasoning strategy differs in disease-specific care. In this category, the reasoning strategy is a partially logical process based on implicit yet deliberate knowledge. It is composed of several stages.

The hypotheses are formed to explain a patient's problem in the context of the signs and symptoms, which are considered as more usual and relevant, rather than from the clinical picture of the patient as a whole in his context. In the formation of a set of hypotheses, the signs and symptoms of the patient are matched against previous experience, thus relying on the repertoire of knowledge and clinical experience. In the formation of a set of hypotheses, probabilities are assigned to the clinical problem which are linear and synergistically compatible with symptoms (if A, then B, and thus next C). The set of hypotheses is ruled out or ruled in by reasoning analytically about them, breaking down their elements into pieces and separately analysing them. The hypotheses are refined by the analytical approach, relying on a conscious and deliberate application of evidence-based procedures and decision-making aids.

Inter 11, lines 81-84

"So, I guess the main thing that the nursing staff kind of pick up on is usually the temperature. They are pretty good to come and inform you if someone has a spike in temperature. Or if someone's tachycardic or hypotensive or not as alert, or respiratory rate is up. Just kind of all the classic signs of sepsis."

Inter 08, lines 78-93

"Yes, so we had a lady who had an esophagectomy. She was discharged and then she came back in because abdomen and around her juj side was very inflamed and very sore, and she's just about shocking all that two days and it was when she came in and we did the observations we queried if it was a leak that she's had. She was very, very septic and then we started the Septic Six pathway. So, she wasn't passing urine and then she was getting a canula in, so it was being comfortable to say to the doctors, I think she's septic. The doctor then needing to, I can, like [pause] kind of trust the nurses as well because she then needed to be cannulated for fluids, bloods would need to be taken. Then working really, really quickly with the doctor to get the blood culture steps, maybe get the urine sample, catheter in her. Oh yeah, I can see quite a lot of that in my ward, mostly post-op patients."

Inter 08, lines 201-203

"I just think you should always consider every route and then if you go no that's not that, then at least you've ticked it off the list of potentials and then you can plan from there. As long as you got an idea in your head of what it could be, then you know what to then go and do."

Interviewer: "OK, yeah, so what sort of things would you normally do or what did you do in that situation?"

Participant 08: "So, I got the fluids up for her, I helped the doctors get all the blood culture sets together. We also organized chest and abdomen X-Rays and possible CT. She was on half hourly observations, IV drugs, especially for her temperature that she was having, and we moved her into a bay that was the

cubicle that was closer to the nurses' station, just because she fell quite poorly quite quickly.”

Inter 11, lines 318-323

“I suppose. So, if you are suspecting sepsis and you're starting a fluid bolus, are they responding to that? Erm.. kind of the bloods that you are taking, the antibiotics that you are administering, the oxygen that you are giving. Are all of these things working?

Do you see that there is an improvement in the patient? If not, you kind of need to look at other options, but you kind of do one thing at a time and see if you are noticing a difference.”

Inter 23, lines 219-221

“I think it was by ruling things out, because by the time you've started sending things that weren't coming back with anything, like the urine was sent and that came back with nothing in it, you were kind of ticking off all of the list of things it could potentially be. “

Success of early recognition of sepsis

As noted in protocol-based care, the success of early recognition of sepsis is another frequently occurring theme in the study. All nurses described an overall judgment if the performance yielded the results expected for it; however, the meaning associated with it differs depending on the category in which it occurs in. In protocol-based care, judging the performance means being able to evaluate the practice specific to a protocol. Here, it means being able to evaluate practice specific to a disease. It still resembles protocol-based practice, however in a significantly expanded form. While still adhering to protocol-determined practice defined by formal procedures, here practice is relaxed to enable for variations based on expertise.

The key to the evaluation process was understanding how the patient's physiological variables react to the therapeutic interventions. This kind of understanding is developed by nurses so that they can judge in the future which values of vital signs should change, and by how much, in order to reach the demand in the future. This knowledge is closely connected to understanding which treatment intervention has an influence on a specific parameter and how they do so. Together, these two areas of knowledge form a basis which allows the nurses to evaluate the results from the

interventions so that the optimum values of the parameters can be reached in the future.

Evaluating single parameters

Furthermore, for these nurses, the primary aim was to evaluate a single parameter, without considering how it interacted with the remaining parameters to ultimately produce a cumulative interpretation of the values. It is through the knowledge of evaluating single parameters of a patient that these nurses were able to judge the degree of success of the outcome of sepsis recognition. These claims are supported by the excerpts that follow, which describe evaluating whether the patient's vital signs react to the therapeutic interventions. However, the evaluation of unexpected results and whether nurses took the opportunity for knowledge creation at that stage is not elaborated.

Inter 22, lines 263-267, 272-275

"I think it's when you see someone to respond to like the treatment that is being implemented by the medical staff. So, when they do like a full septic screen. Blood cultures, sputum sample, urine sample, possibly like a wound swab or even if they've got like an EVD drain into the skull you could, you know, do the CSS fluid."

"...you might clinically see changes in their observations. The heart rate may become more stable. The temperatures have dropped, they are more stable, more lower grade pyrexia rather than on the high side."

Inter 19, lines 311, 313-319

"If the treatment ends up working, then you know you are on the right track, I guess. You give them fluid and their lactate is coming down. ... urine output is improving. Erm... and things like that then you might think it's probably sepsis and it is working to treat it."

Inter 08, lines 257-261

"I could just see that the observations weren't getting any better, even though, you know, they were having IV paracetamol, they were having antibiotics, they had IV fluids, do you know what I mean, but I could just see their urine output wasn't getting better, they still had a temperature that was borderline fever."

Inter 18, lines 360-363

Inter 18 "You know what, yeah so you will find out from the blood results and everything when it comes back. So, we will know, isn't it [0:28:16] and find out what caused sepsis."

Interviewer: "So once you have kind of results from er from the test then you kind of determine that patient is septic?"

Inter 18: "Um hum"

Inter 20, lines 190-193

"If the blood gases were improving, you would know that what you are... that the treatments that you are giving in terms of the amount of oxygen and fluid"

because your lactate would improve, your CO2 would improve. So that would probably be able to determine that what you are doing is working.”

Inter 19, lines 311, 313-319

If the treatment ends up working, then you know you are on the right track, I guess. You give them fluid and their lactate is coming down. ... urine output is improving. Erm... and things like that then you might think it's probably sepsis and it is working to treat it.

Inter 17, lines 240-242

Interviewer: How do you know that something that you do to spot sepsis has been then the right thing to do or has been successful?

Participant: I think just like a slight improvement in the patient or even if they... just like a slight improvement in the patient or even if they are just like stabilising...”

...“Just monitoring like everything really. Just like all the vital signs and the gases and like sending bloods off to the lab and stuff like that.”

Inter 11, lines 164-171

“So, kind of blood pressure being low, being tachycardic, respiratory rate going up, like a need for oxygen or kind of observation side of things.

Erm, obviously if anyone had kind of developed a rash, or anything like that, or even just keeping a check on bloods. I mean, we're responsible for checking the bloods every day. So, if I see someone's white blood cell count or CRP climbing, you kind of think, oh we are heading in that direction. So just like a variety of things, of different things really and then just seeing how the patient is in themselves. Are they kind of deteriorating? Are they any different from how they are on a daily basis? Is there anything that has changed with how the patient is?”

A further illustration of what happens if the person's performance yields unexpected results is described by Interviewee 11 in the following extract. Upon realisation of failed predictions, the hypothesis was abandoned and the reasons for it were not explored. Furthermore, while not able to complete their insight into the patient's problem, discriminative observations of the patient's responses and constructing an interpretation of their meaning were not considered. Learning from the patient was not considered, making the professional judgement unquestionable.

Despite the failed predictions, the goal was to replicate the same approach with the same form of reasoning, thus, to make a new prediction of the patient's problem and see if it was working.

Inter 11, lines 318-323

"I suppose. So, if you are suspecting sepsis and you're starting a fluid bolus, are they responding to that? Erm.. kind of the bloods that you are taking, the antibiotics that you are administering, the oxygen that you are giving. Are all of these things working?"

Do you see that there is an improvement in the patient? If not, you kind of need to look at other options, but you kind of do one thing at a time and see if you are noticing a difference."

Table 6: Summary of aspects related to the process in disease-specific care

| Aspect | Meaning |
|--------------------|---|
| Type of Practice | <i>"...if I suspect that someone has sepsis, I would go through my Sepsis Six." "And then kind of like urine sample or chest x-ray depending on what I thought the source was" (Interviewee 11).</i> |
| Pattern of Actions | <i>"As long as you got an idea in your head of what it could be, then you know what to then go and do". "I just think you should always consider every route and then if you go no that's not that, then at least you've ticked it off the list of potentials and then you can plan from there" (Interviewee 08).</i> |
| Reasoning strategy | <i>"...we queried if it was a leak that she's had. She was very, very septic and then we started the Septic Six pathway". "The doctor then needing to, I can, like [pause] kind of trust the nurses as well because she then needed to be cannulated for fluids, bloods would need to be taken. Then working really, really quickly with the doctor to get the blood culture steps, maybe get the urine sample, catheter in her. Oh yeah, I can see quite a lot of that in my ward, mostly post-op patient" (Interviewee 08).</i> |
| Success | <i>"If the blood gases were improving, you would know that what you are... that the treatments that you are giving in terms of the amount of oxygen and fluid because your lactate would improve, your CO2 would improve. So that would probably be able to determine that what you are doing is working" (Interviewee 20).</i> |

4.3.2.3 Learner

In disease-specific care, frequently occurring learner-related aspects predisposed nurses towards adopting this approach, such as learning method and learning needs.

Learning method: Experiential learning

There were aspects in terms of learning methods that predisposed nurses towards adopting disease-specific care to early recognition of sepsis and which oriented them to apply it in practice. Much of the power of disease-specific care rests on the ability to detect the patients who are comparable to the previous experience. Much of the basis of this power is the ability to observe information related to the patient observation and then compare them to personal or collective experience of the environment in which nurses work. Knowledge gained is then applied to future solutions in similar contexts, even without sufficient evaluation of their viability. The evidence of this can be seen in the following excerpts. Here, information related to the patient observation is collated and compared to previous experience with similar patients, allowing the application and replicability of the same rules for drawing conclusions or for determining actions.

Inter 20, lines 227-228

“So maybe next time when you’ve got a patient who is quite similar to a one that you have had before, you will remember what you did last time.”

Inter17, lines 376-379

“Erm, like probably just like from patient to patient. If you have looked after somebody and something has happened like to a previous patient, it maybe just sticks in your mind and if it happens to the patient that you are looking after next, you just think what did we do to improve like that and...”

Inter 24, lines 310-311

“Then using that experience of seeing a patient who’s deteriorated and applying that and seeing that and so when you come across a different patient.”

Inter 23, lines 189-191

“Because I bet by the nightshift she probably had started to drop her blood pressure, became tachycardic, all of the normal signs that you would be looking for probably would have happened, but I think that at the point we had her it was more intuition and things you’d seen before.”

Inter 10, lines 438-447

“If you don’t understand, you might feel like your only responsibility is to inform the doctor.” “Because you don’t understand. So [0:32:28] from the doctor because the number is not by the book. And they say okay and then you just go back and be sad, but when you fully understand the situation, you have more confidence to say to the doctor that it is either junior or whatever, no that’s not alright. Normally in this situation we would do this and that.”

According to the majority of nurses working in the disease-specific care, the experience is mainly defined by common and well-established rules and procedures. Adopting this

sort of experience entails practicing recognition of sepsis within well-known procedures and formulas. Restrained by this quest for well-established procedures, the nurses' attitude fostered a natural inclination to enter the interpretation of a situation within rational decision making on the basis of well-known and well-established procedures and classifications for determining actions and forming conclusions.

Inter 11, lines 81-84

"So, I guess the main thing that the nursing staff kind of pick up on is usually the temperature. They are pretty good to come and inform you if someone has a spike in temperature. Or if someone's tachycardic or hypotensive or not as alert, or respiratory rate is up. Just kind of all the classic signs of sepsis."

Inter 11, lines 146-147, 150-152

"Erm... I think really if I am suspecting, if I am suspecting sepsis, I would always kind of follow the same, follow the same plan really."

"...so, I would pretty much always follow kind of the guidelines in the Sepsis Six, even if kind of... I'm not entirely sure what is causing it."

Inter 11, lines 134-141

"I mean, now if I suspect that someone has sepsis, I would go through my Sepsis Six. So, oxygen, if it was required, blood cultures before starting antibiotics, administering antibiotics before an hour, fluids, lactate, bloods, and urine measurement. I would kind of do all of that as standard really, if I was suspecting sepsis for someone. And then kind of [0:09:34] like urine sample or chest x-ray depending on what I thought the source was. As a staff nurse, you don't really do all of that, do you."

You would kind of do someone's observations and then they would report it back to whichever doctor was on the ward and you would expect them to then follow on from it."

Inter 11, lines 114-115, 119-120

...Yeah, I guess it's... I guess kind of just looking out for the red flags, I suppose. Having more than one of the red flags to indicate that there possibly could be sepsis."

"Where did I learn? Just kind of working on the wards."

What can be drawn from the concept of learning is the practice of learning being enacted by a top-down approach. The nurses or doctors place themselves as experts, considering themselves to have better knowledge and insight into the patient's problem, with a superior understanding of the required interventions. The knowledge acquired from patients is assumed to be inferior to the professional knowledge of the nurse, thus paying negligible attention to the option of learning from the individual patient.

These assertions are supported by the excerpts listed below:

Inter 08, lines 201-203

"I just think you should always consider every route and then if you go no that's not that, then at least you've ticked it off the list of potentials and then you can plan from there. As long as you got an idea in your head of what it could be, then you know what to then go and do."

Inter 22, lines 263-267, 272-275

"I think it's when you see someone to respond to like the treatment that is being implemented by the medical staff. So, when they do like a full septic screen. Blood cultures, sputum sample, urine sample, possibly like a wound swab or even if they've got like an EVD drain into the skull you could, you know, do the CSS fluid."

"...you might clinically see changes in their observations. The heart rate may become more stable. The temperatures have dropped, they are more stable, more lower grade pyrexia rather than on the high side."

Inter 18, lines 360-363

Participant 18: "You know what, yeah so you will find out from the blood results and everything when it comes back. So, we will know, isn't it [0:28:16] and find out what caused sepsis."

Interviewer: "So once you have kind of results from er from the test then you kind of determine that patient is septic?"

Participant 18: "Um hum"

Learning method: Theoretical and biomedical examination of patient

Furthermore, disease-specific care relies to a great extent on the theoretical and biomedical examination of patients, as opposed to verbal or physical examination, with an emphasis on the application of technical knowledge. While this method promotes the application of technical knowledge, it barely stimulates additional cognitive processes. These assertions are supported by the following excerpts:

Inter 22, lines 265-267, 272-275

"...they do like a full septic screen. Blood cultures, sputum sample, urine sample, possibly like a wound swab or even if they've got like an EVD drain into the skull you could, you know, do the CSS fluid."

"...you might clinically see changes in their observations. The heart rate may become more stable. The temperatures have dropped, they are more stable, more lower grade pyrexia rather than on the high side."

Inter 17, lines 73-75

"Erm... probably just when like if a patient, like when they initially come in, if they start like deteriorating and just look out for certain things like, I don't know... erm, like in the gases, like the lactate and things."

Inter 20, lines 190-193

“If the blood gases were improving, you would know that what you are... that the treatments that you are giving in terms of the amount of oxygen and fluid because your lactate would improve, your CO2 would improve. So that would probably be able to determine that what you are doing is working.”

Learner need: Holistic perspective

Learner needs occurred across all transcripts. However, within each category, learners indicated varying learning needs depending on the category they occur in. In disease-specific care, learning needs related to acquiring the capability to think beyond the confines of the familiar in order to recognise subtle signals indicative of sepsis. The need is related to the nurses' perceived difficulties in changing from a common frame of reference for determining actions and drawing conclusions to a more holistic frame of reference for interpreting events, particularly in novel and unexpected situations. In novel, unexpected situations, nurses experienced a tendency to fall back on the familiar, well-established problem-solving techniques.

This tendency is depicted as a trained response according to what is familiar based on the viewpoints obtained from recent experience, thus preventing them from appreciating subtle signals indicative of sepsis. The perceived implication of the trained response is a reduced ability to think beyond the confines of what is familiar and recognise subtle signals that could indicate sepsis. The following excerpts provide evidence to support these claims. As revealed by the nurses, their minds are automatically directed solely to the familiar practices, keeping everything within the confines of what is familiar and preventing them from thinking about and noticing what is occurring in the outside world.

Inter 23, lines 352-355

“So, whereas if you've got somebody on inotropes and you're constantly going up on the inotropes, you don't always think, oh actually could there be something else dropping the blood pressure and the inotropes aren't working as well, because we are not dealing with whatever that is, and that could be a sepsis thing and it could be a fluid thing.”

Inter 21, lines 281-284

“Erm... I suppose when you are checking somebody’s CGS and you’re checking what, you’re assessing what their mental state... I am probably in the mindset, I am focusing on that that’s probably due to their neurological condition and why they are actually on the unit, as opposed to thinking that it is sepsis.”

Inter 03, lines 208-214,219-223

“...if you are in specialist ward like kidney or transplant ward or ophthalmology ward, your mind probably almost focused on that specialty, but uh, for me, what I see is that people should I mean, nurses or healthcare professionals who is working in that specific area, should be able to use their knowledge more widely rather than just focusing on one specialty, so they should be able to, I mean, if they had given this educational session, so, for example, about the session which I attended then, then they will be able to look at the person as a whole...”

“...that is something when I said as a whole, don’t just think about ophthalmology ward, just think of eye or ophthalmology problem just think a bit more in broad sense. Maybe in medical ward, that is a bit more possible because you would be thinking about heart rate, respiratory rate or anything even more than that, specialty maybe, I may be wrong, but that’s my assumption.”

Inter 09, lines 113-119

“I think what made it so memorable was because she had gone in for a fairly straight forward surgical procedure and we weren’t really expecting her... we were just expecting her to recover and then get downgraded back to the ward and I think because she was quite young and we attributed some of her elevated respiratory rate due to anxiety and her mum was with her at the time and I think her mum was creating quite a lot of anxiety for her by being present, and because her mum was quite anxious, and I think in hindsight I would probably have removed myself away from the emotive issue of her being anxious to more of a clinical picture of her...”

Inter 05, lines 98-105

“I think it’s because our patients are already so poorly and I mean we work in a neuro intensive care where patients are confused, patients get delirious of the dexamethasone, patients get delirious of, you know, a CAM-ICU and general ICU area, so it’s not something we could look at from someone being really well within themselves and then suddenly becoming confused, like wetting themselves being incontinent because I think straight away, we would look at it being a neuro aspect.

And even sometimes with pyrexial temperatures we would sometimes look at that being a neuro aspect, because of obviously like bleeding in the brain and then obviously we got to tell the doctors and then they would do the bloods.”

Inter 02, lines 128-129

“They may be looking at the condition what they came in with liver or I don’t know gastrointestinal failure, they’re not really thinking about sepsis...”

Table 7: Summary of aspects related to the learner in disease-specific care

| Aspect | Meaning |
|--------------------|---|
| Learning resources | “...you just think what did we do to improve like that and...” (Interviewee 17). |
| Learning method | “If the blood gases were improving, you would know that what you are... that the treatments that you are giving in terms of the amount of oxygen and fluid because your lactate would improve, your CO2 would |

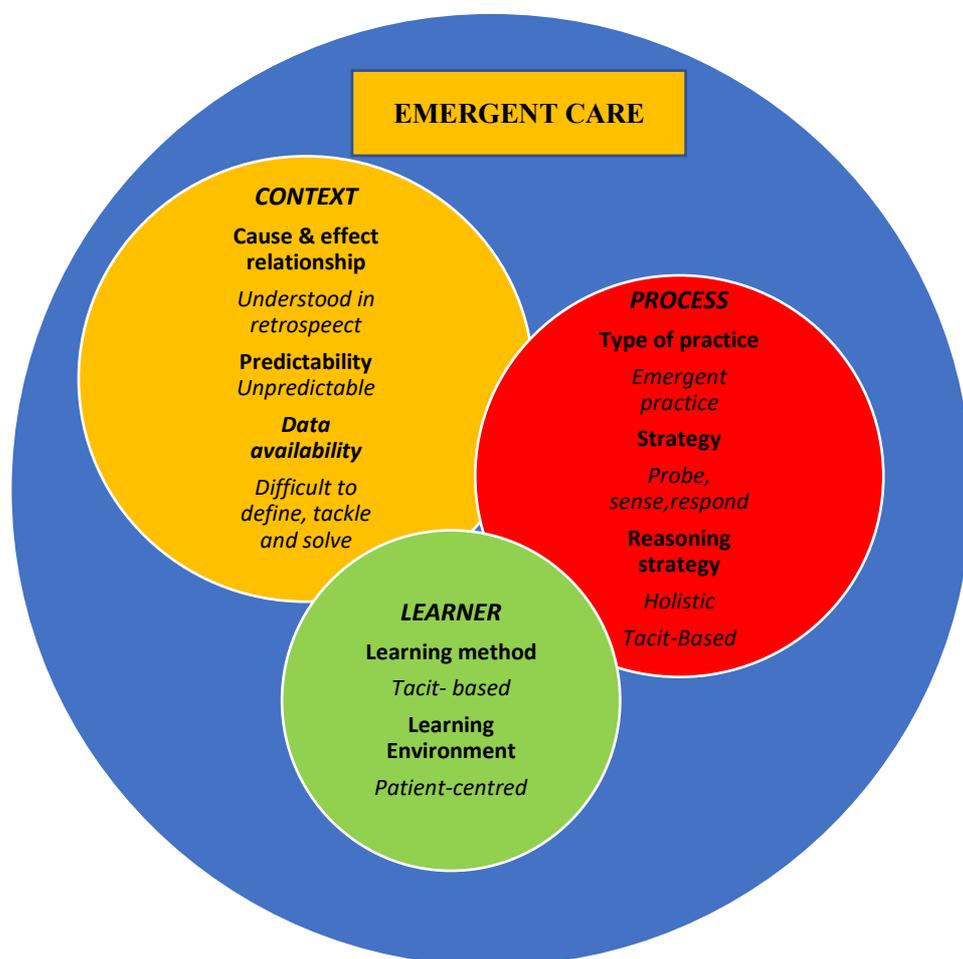
| | |
|-----------------------|---|
| | <i>improve. So that would probably be able to determine that what you are doing is working” (Interviewee 20).</i> |
| <i>Learning needs</i> | <i>“...nurses or healthcare professionals who is working in that specific area, should be able to use their knowledge more widely rather than just focusing on one specialty, ...” (Interviewee 3).</i> |

4.3.3 Category C: Emergent care

The third category of the outcome space is early recognition of sepsis as emergent care. This category opens with a figure depicting the analysis of the experience for emergent care. The rest of the section of this category will provide more detailed descriptions of where the figure came from and go into more detail around its constituent parts. Although this is the endpoint, the image is presented first to highlight the many aspects of the phenomenon before a more in-depth discussion of its emergence and the evidence from the transcripts are offered.

Figure 7 illustrates analysis of understanding of early recognition of sepsis between the components of context, process and learner that contribute to the meaning of emergent care. The interrelating circles bonding various components demonstrate how context, process and learner in the understanding of emergent care are interrelated.

Figure 7: Understanding of early recognition of sepsis as emergent care



In this category, the primary focus of attention has shifted from the individual disease to the individual patient, where a patient is considered to have a disease which might manifest in a unique and unpredictable manner. Furthermore, the focus of attention has shifted from a highly-protocolized to an emergent approach, where the recognition of nonlinear and frequently unseen connections between variables is highlighted as the key to early recognition of sepsis. Early recognition of sepsis is perceived as more complex in this category because it entails unique and adaptive responses to novel stimuli from an external environment.

The following section will discuss the frequently occurring aspects within the components of context, process, and learner central to emergent care. The process section is outlined in a sequential manner and divided into sections, processes, and stages. However, in the real world of practice it is an intertwined and iterative process. In order to provide an explanation of each aspect and facilitate comprehension, the process is presented in a linear format. Based on the researcher's experience and the interviews and illustrations and examples the nurses provided, it appears that this is a very intuitive, implicit process rather than a linear, stage-by-stage and step-by-steps one. It is difficult to divide it into aspects because it is intertwined, but the researcher has explained aspects in the sections and puts it into text to aid the reader's comprehension.

4.3.3.1 Context

Experiences of context in emergent care differ greatly from those in protocol-based care and disease-specific care. In emergent care, nurses portray the context as uncertain, complex and unpredictable.

Cause-and-effect relationship: Understood in retrospect

As noted in the previous category, a cause-and-effect relationship is a frequently occurring aspect and serves as central to every category. Cause-and-effect relationships vary across categories, depending on the category they occur in. Within emergent care, nurses ascribe this approach to early recognition of sepsis based on the cause-and-effect relationship that is not predictable or discernible in advance of an action, because in emergent care important characteristics of patient observation are not observable, instead, they are latent and emergent.

The latent and emergent nature of clinical information renders the option of assigning a probability to an outcome in advance neither conceivable nor practical. This inability to

assign probability to outcomes hindered the option of clearly stating objectives and resource requirements. Equally, the possibility to automatically initiate a definite course of action for the presented problem was disabled. In emergent care, cause-and-effect relationships could be understood only in retrospect after nurses have sought to solve the problem.

Inter 22, lines 100-104

“...sometimes I think in the initial stages you’re trying to work out... If they’re like speaking then you can kind of ask them, but sometimes you’re... it’s like a bit of a guessing game to work out what you think it could be. Sometimes like medications can make people a bit confused. Sometimes it can cause them... that they don’t just react properly.”

Inter 03, lines 55-69

“Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it’s very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better.”

Interviewer: “...You mentioned ventilator. Why do you think when patients are on a ventilator, it could be difficult? What’s your experience like?”

Participant 03: “I think because sometimes if they are on a control mode, that you will be like, you know, let’s say for example, like one of the symptoms we see first thing will be the respiratory rate, so sometimes you are, if you are on a control mode, you know, on ventilation, I don’t know probably I may be wrong, but those symptoms will be ignored or may not be identified at the very first of the symptoms, but in other than that if the patient is in a ward situation, you would probably be able to identify them with the NEWS score and things like that, you know, easily identifiable.”

Predictability: Unpredictable

As noted in the previous category, predictability is a frequently occurring aspect and serves as central to every category. Predictability varies across categories, depending on the category it occurs in. Within emergent care, nurses ascribe this approach to early recognition of sepsis when the same solution cannot be expected to work in every instance, because in emergent care the right solutions are not predictable, but instead latent and emergent.

Inter 22, lines 100-104

"...sometimes I think in the initial stages you're trying to work out... If they're like speaking then you can kind of ask them, but sometimes you're... it's like a bit of a guessing game to work out what you think it could be. Sometimes like medications can make people a bit confused. Sometimes it can cause them... that they don't just react properly."

Availability of data: Difficult to define, tackle and solve

The information pertinent to the clinical problem emphasised in decision making varies across categories depending on the category it occurs in. In each category, various types of information had varying probabilities of being deemed worthy of consideration. Nurses in the previous category emphasised the objective information of patients, relating to the disease itself, expressed in an explicit form and presented as factual information. These were usually acquired using external tools, such as monitors and computers. This form of information was easy to define and was solvable through the application of a standard procedure or best practice. This sort of clinical information stands in contrast to the type of information emphasised by nurses in this category which was often difficult to define, tackle and solve through the application of a standard procedure or best practice.

This sort of clinical information was often expressed in more of an implicit form and was presented as tacit understandings. These were usually acquired using the nurse's own sense, as reflected in the interviews via comments regarding interaction with patient.

Inter 24, lines 293-297

"Just, just it's like, it's hard to explain in terms of just looking at the patient, it's... I mean that looks just like, so for example, [0:15:45] they look different, you know. Their colour might be slightly different. Or say if it is a ventilated patient, you know, so they are sedated. It might be that actually they are needing more inotropic support."

Nurses described multiple sources of complexity pertinent to clinical information. The following are the key concepts and sources of complexity associated with this clinical data:

1) Incompleteness of information.

Inter 12, lines 97-99, 101-102, 104, 109-118

"...it was a patient who actually didn't like trigger, like you know a lot of like the vital signs haven't changed or anything, but the patient, when we looked at the patient on like a review..." "I reviewed a patient, or I was talking to a patient, the patient like obviously looked a bit sleepy, wasn't feeling right in themselves."

"They said, oh I don't feel great"

"...it was like, it took a good 3 hours before the patient started high temperature, started going tachycardic, like was not passing urine. So, so that was a good example, but like you know, initially, the 3 hours prior to all the symptoms started, the patient had no symptoms other than just feeling tired. So that could be easily like missed, if, you know, if we don't, you know, identify those little things, you know, where sometimes... you know, sometimes you don't just have to look at the... It's not just the numbers. In front of you. So, like, you know, I feel like you don't... it's not... numbers always don't give you everything, you have to look at your patient first."

Inter 12, lines 138-142

"So, because I met the patient before the weekend. I know how the patient was like more alert. The patient was sitting in their chair and that morning when I reviewed the patient, the patient was like not out of bed. The patient was lying in bed. Looked a bit pale. Erm... you know, was conversing, but patient could not tell me what was wrong. All she could tell me was, oh, I just feel tired. I haven't slept."

2) Paucity of scientific data

Inter 24, lines 301-306

"And it's just, that's just looking at them, you know, sometimes you can look at a patient and just go... They look like there is something underlying what's driving this. And they might not be showing all the signs. Sorry, might not be showing you the classic signs or might not be hitting in the numbers like sepsis six, like the identification."

3) The presence of interacting symptoms leading to contradictory assumptions, evidence and ideas which suggest different solutions. Something that contradicted the nurse's own original beliefs.

Inter 11, lines 106-109

"Yeah, I think sometimes you can kind of identify that yes, maybe someone is having a response to an infection and then other times, especially on critical care, how many times do people have low blood pressure. How many times are people tachycardic and aren't necessarily septic. So, I think it's sometimes quite hard to establish what the cause of it is."

Inter 22, lines 177-179

"Because a lot of these signs and symptoms can be related to, you know say people have taken drugs in the community or they could have fallen and just banged their head. So, some of the things all overlap."

Inter 16, lines 355-362, 366-367

"And I think that was just because I knew what the triggers were. Had I been maybe a more junior member of staff or somebody who hadn't had the experience or the exposure to sepsis with other cases, then, you know, I

probably wouldn't have put the two and two together and I probably would have gone, okay they've got a temperature and yeah, okay, they have not passed urine, but there would be other reasons why that would happen, like I say, for example, the patient had been into theatre, so, they often don't pass urine for a bit of time afterwards and that sometimes is, you know, that is just the way that it goes, especially with the lumbar decompression, anaesthetics, etc.”
“So again, you know, you could explain what had happened with various different answers to the question.”

4) Randomness of information occurrence

An ill-defined problem pertinent to clinical practice was often not anticipated or accounted for at the time when the nursing plan was put together.

Inter 24, lines 312-319

“Even for example if, you know, you're walking along when you are on the ward, and you are going to help a positional change.

Participant 24: You are literally helping a different member of staff... sorry, so I work on one side of the unit, I have come down to help a member of staff to turn their patient and you can look at them and go, well actually... you ask the story. And then, you can then contribute and say well actually is there infection here because they just don't look quite right or is there something else going on? I might not always jump to the conclusion that there is definitely infection going on.”

5) Uncertainty in patient's story

Inter 12, lines 105-108

“So basically, what it was, was like the persons catheter was taken out the day before, been up all night, so hence the patient thought that they didn't sleep well, that's why they feel tired, because they have been up to toilet several times but what it was, was like because the catheter got taken out, the patient was starting to like develop an infection. Didn't feel right.”

Inter 12, lines 149-153

“What was wrong. But yeah... but patient herself said, I don't know. There's something not right, but obviously they can't tell you all the time because to them, okay I am in hospital I am tired because I didn't sleep. That is probably their main concern, because they haven't had a good night's sleep is their main concern.”

6) Uncertainty about best course of actions for a particular patient

Tacit Knowledge

There were a number of indications suggesting that much of what nurses do in practice relies on tacit knowledge. Nurses often referred to the things that they knew but could not easily explain. It appeared as if they were trying to find the ways to explain what they know. For instance, nurses found it much easier to explain what they do than all

the elements involved in the performance (why do you do it this way). In another instance, nurses found much easier to articulate objective clues than tacit unspecifiable ones.

Inter 13, lines 142-152

Interviewer: "Was there anything else what maybe has given you a clue that how to progress in that situation?"

Participant 13: "Erm, er what do you mean? You mean what other kind of symptoms and...?"

Interviewer: "Anything what you can think of... anything."

Participant 13: "So, tachycardia, you know, increased heart rate. Respiratory rate was up as well. The lactate was high. And inflammatory markers were up, temperature."

Table 8: Summary of aspects related to context in emergent care

| Aspect | Meaning |
|--------------------------|--|
| <i>Data availability</i> | <i>"...sometimes you can look at a patient and just go...They look like there is something underlying what's driving this. And they might not be showing all the signs. Sorry, might not be showing you the classic signs or might not be hitting in the numbers like sepsis six..." (Interviewee 24).</i> |
| <i>Cause and effect</i> | <i>"...my experience, sometimes it's very hard to identify sepsis...". "... those symptoms will be ignored or may not be identified at the very first of the symptoms..." (Interviewee 03).</i> |
| <i>Predictability</i> | <i>"...sometimes you're... it's like a bit of a guessing game to work out what you think it could be". "...sometimes I think in the initial stages you're trying to work out... If they're like speaking then you can kind of ask them..." (Interviewee 22).</i> |

4.3.3.2 Process

Nurses ascribe emergent care to early recognition of sepsis based on frequently occurring process-related aspects such as type of practice, reasoning strategy and strategy.

Type of practice: Emergent practice

Type of practice serves as a critical aspect in all categories of descriptions. Within this category, practice takes on a different meaning to that in protocol-based care and disease-specific care. Rather than emphasizing best practice from guidelines, within emergent care nurses adopt emergent practice characterised by a belief of an unpredictable world in which nurses patiently allow the path to emerge itself.

In this context, where nurses had to base their decision on incomplete data, imposing best practice knowledge from guidelines seemed ineffective. Guidelines could not ensure timely recognition of those patients with a non-specific presentation and who provide nurses with incomplete data. Also, every presenting nonspecific problem could not be investigated with blood investigations, so analytical reasoning was not used in this context. In addition, solutions derived from a former experience of dealing with similar problems were of a limited value, since this form of ill-defined problems was unique and there was no right solution that could be applied to all patients.

Inter 22, lines 107-112

"...then most people who do come from post op, erm from theatres can have a slight spike in temperature and the doctors don't overly go and do blood cultures straight away, they just monitor because usually within 24 hours most patients probably would spike a temperature post operatively. So, it is trying to get sepsis caught quick enough but also just monitoring that it could just be a response from being in theatre."

Inter 03, lines 55-69

"Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it's very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better."

Interviewer: "...You mentioned ventilator. Why do you think when patients are on a ventilator, it could be difficult? What's your experience like?"

Participant 03: "I think because sometimes if they are on a control mode, that you will be like, you know, let's say for example, like one of the symptoms we see first thing will be the respiratory rate, so sometimes you are, if you are on a control mode, you know, on ventilation, I don't know probably I may be wrong, but those symptoms will be ignored or may not be identified at the very first of the symptoms, but in other than that if the patient is in a ward situation, you would

probably be able to identify them with the NEWS score and things like that, you know, easily identifiable.”

What can be seen in the above excerpts is that neither best practice algorithms nor their procedures are considered likely to be appropriate for that kind of problem. Such clinical problems, while not amendable to best practice, could be understood by adopting emergent practice, distinctive from the other ways of recognising sepsis. Within this practice, clinical problems are not addressed but rather comprehended via experimentation and learning from experience. In order to accomplish this, it requires the interruption of perceived wisdom and instead allowing the wisdom to itself emerge from the interaction with a patient.

Inter 22, lines 139-140

“So, they might just need like a bit of medication to help and just constant like orientation and keep reminding of who they are and where they are and see if they gradually can try and remember.”

This practice was characterised by a belief in an unpredictable world. Therefore, the process started with a sense of direction rather than a defined destination, and thus involved making non-hypothesis-based decisions.

Inter 01, lines 140-143

“Well, I suppose, if you stop deteriorating and you reverse the process. And if you ideally can identify the root cause of this, that’s the big help, but that doesn’t always happen, but I suppose as long as we get some antibiotics and fluids and usual stuff, that’s what you are aiming for.”

Within this sort of practice, the pursuit of insight is seen as a continual accomplishment and is gradually framed and reframed as nurses physically engaged in the everyday practices. This attribute contrasts with the conception seen in the previous categories that implies that understanding of a clinical problem is embedded in practice, awaiting to be discovered, and is accomplished by a fixed capability or stable disposition. This is evident from the following excerpts, as an emerging understanding of a clinical problem appears to be a product of an ongoing process that is dispersed in the environment and inherently undetermined.

Inter 01, lines 291-293

"You're always looking for things like it was your part of that basic run through on every shift. Checking the skin, looking for a cut, rashes anything that might give you a clue where there might be some sort of infection."

Inter 01, lines 277-278

"Well, you get them to prescribe some paracetamol, get some antibiotic, should try."

For some nurses, learning about the problem involved using different methods to explore some of the properties of the temperature and its relationship to causality.

Inter 01, lines 224-231, 234-237

"I suppose when I worked there, but we used to be obsessed with temperatures and literally like when I first started in general, all we did was wash them down with tempered water, because their temperature was so spectacular, whether that be for their sepsis or for their head their neuro problem, so we were always dead thrilled for somebody's temperature down, because they used to have such high ones, that was, you would think oh well, the temperatures down so you get back on an even keel, which I know isn't the biggest indicator but when they have very high temperatures, I think it is."

"I learnt all this of (name of nurse) XXXX. Get the temperatures down, put the fan on, open windows, washing them down, take their blankets off, do anything you can for cooling them down (laugh), old-fashioned nurses."

Inter 22, lines 130-134

"Say you're taking a temperature and it is really high and then the patient is asking you for more blankets and they're like shivering and shaking. It's usually that they are spiking a temperature, it could be a possible infection, so it is just trying to give them... so paracetamol, try to put a fan on them, try and remove blankets, just to bring that temperature down naturally. For, you know, extreme pain, try to get the pain relief on board as quick as possible."

Inter 22, lines 180-183

"So, it is just trying to do the basics first before you speak to someone more senior and they would ask you, well have you done this, this and this? Have you given pain relief? Have you took the blankets off? Have you given them a fan? Just before they start maybe taking blood cultures or prescribing stronger pain relief."

What can be seen from the nurses' enactment of actions above is that they demonstrate to be knowledgeable in a unique way. The nurses did not know what they need to know, and their knowing appeared to be a by-product of moving forward with nursing care. This form of knowing was inseparable from action, since it emerged from action.

A key concept that underpinned emergent practice is the mutual composition of doing and knowing. Within this type of practice, the nurses did not delimit and organise knowing and doing into separate steps but saw it as several interacting steps in which knowing was a product of an intertwined process, although they were not always aware of it.

Inter 01, lines 194-195, 200-204

Interviewer: "Can you remember of any example when you have realized that you have gain new knowledge and skills?"

Participant 01: "I think, I started to learn a lot more about it and to look out for it. I mean, I think, you know, we were always very obviously on any ITU before apart from sepsis, is it always looking to see if you know, well enough hydrated or you know you're looking at those things anyhow on a daily basis, all the time..."

Inter 01, lines 291-293

"You're always looking for things like it was your part of that basic run through on every shift. Checking the skin, looking for a cut, rashes anything that might give you a clue where there might be some sort of infection."

Inter 12, lines 101-103

"I was talking to a patient, the patient like obviously looked a bit sleepy, wasn't feeling right in themselves. So, like and obviously on your usual chat you check with the patient you know how they are doing."

Reasoning strategy: Holistic tacit-based reasoning

As noted in the previous categories, a reasoning strategy is another frequently occurring aspect in the data analysis and serves as critical to each category. All nurses emphasised an overall reasoning strategy; however, a reasoning strategy differs depending on the category it occurs in. In contrast to the descriptions of reasoning strategy in the preceding categories, which emphasize a reductionist approach to understanding patient illness, here, nurses' descriptions promote a holistic, multidimensional approach that entails an understanding of a whole person embedded in their context.

It involves paying attention to the presence of interconnections that constitute the essence of solvable problems, which would be abandoned by a reductionist approach.

This type of reasoning is more complex and tacit based, requiring a variety of cognitive powers detailed in the learner section, such as perception, attention, and intuition. The holistic, multidimensional approach relies on a broader interpretation of the disease. In the process of reasoning, an isolated single piece of information on its own did not play a significant role. Instead, a cumulative interpretation of information regarding the patient's condition played a significant role. In this thought process, every observation or cue was interpreted in the context of and alongside each other, as information that potentially contributes to a fundamental whole.

The evidence of these claims can be seen in the following excerpts. Interviewee 24 described how he/she merged information to draw a meaningful conclusion of the patient's condition. Upon detecting concrete visual cues distributed in the environment, the nurse displayed the ability to synthesise the information to draw a probable hypothesis. This went beyond the descriptive/literal content of situation based on their experience and the knowledge about the world around them. Seeking the holistic, integrated view of reality gave rise to seeing beyond the visibly obvious.

Inter 24, lines 310-311, 315-320,

"Then using that experience of seeing a patient who's deteriorated and applying that and seeing that and so when you come across a different patient."

"I have come down to help a member of staff to turn their patient and you can look at them and go, well actually... you ask the story.

And then, you can then contribute and say well actually is there infection here because they just don't look quite right or is there something else going on?

I might not always jump to the conclusion that there is definitely infection going on. But that there's something else, an infection potentially being one of the reasons."

Inter 22, lines 227-230

Interviewer: "... what has given you a clue how to kind of progress in that situation and you know kind of help you to determine, oh yeah, patient is definitely septic?"

Participant 22: "I think it is when you get a pool of the signs and symptoms all mixed together."

Inter 22, lines 168-173

Interviewer: "So, when you are doing all of this, how does it kind of help you to maybe realise that patient could be septic, you know or...?"

Participant 22: "I think [break in audio] to begin with, like if they came in with like an operation or if they came in with like quite bad wounds that they have had. So, if you try to look at the bigger picture first to see what they come in with [break in

audio] symptoms they are presenting with, then you can kind of make a little diagnosis..."

Inter 10, lines 849-866

Participant 10: "I think it means that you fully understand the patients conditions and history and that what is the dynamic of... what is the dynamic of presentation. Not only the presentation but the dynamic of the situation."

Interviewer: Okay. "What do you mean by this dynamic?"

Participant 10: So you don't just see er... that this patient had a blood pressure of this and that, you just see when did she start to deteriorate, what is the speed of deterioration.

Because if it is going down since two days, well this might not be sepsis, yeah.

So what is the dynamic of this presentation. If you have a clear understanding.

What's the patients background? What's the situation now but what was the dynamic as well of this situation? Er... you could understand potentials, potential for septic symptoms without them being as obvious."

Connections that constitute the essence of solvable problems

Seeking a holistic, integrated view of reality relies on the ability to construct a diversified network of links between clinical features. The connections between elements are nonlinear, emerging from seemingly unrelated observation. Furthermore, the connections between elements are not always visible or known. Nurses could see the impact of the connections but could not always see why they were happening. Despite this, nurses were paying attention to the presence of interconnections as they constituted the essence of solvable problems.

The evidence of these claims can be seen in the following excerpts. Upon detecting concrete visual cues distributed through the environment, nurses displayed the ability to construct a diversified network of links between clinical features which constitute the essence of solvable problems. Through the network of links, the nurses could draw probable hypotheses that go beyond the descriptive/literal content of the situation. Interviewee 03 observed the connection between the mechanism of ventilator and detection of sepsis signs, and as a result recognised sepsis. Meanwhile, interviewee 24 suspected sepsis after developing an analogy between the mechanism of inotropes and detection of sepsis signs. As the connections were unpredictable and non-linear,

some would probably ignore the connections, yet those nurses realised the significance and used their understanding of the patient's problem.

Inter 03, lines 55-69

“Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it's very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better.”

Interviewer: “...You mentioned ventilator. Why do you think when patients are on a ventilator, it could be difficult? What's your experience like?”

Participant 03: “I think because sometimes if they are on a control mode, that you will be like, you know, let's say for example, like one of the symptoms we see first thing will be the respiratory rate, so sometimes you are, if you are on a control mode, you know, on ventilation, I don't know probably I may be wrong, but those symptoms will be ignored or may not be identified at the very first of the symptoms, but in other than that if the patient is in a ward situation, you would probably be able to identify them with the NEWS score and things like that, you know, easily identifiable.”

Inter 24, lines 293-297

“Just, just it's like, it's hard to explain in terms of just looking at the patient, it's... I mean that looks just like, so for example, [0:15:45] they look different, you know. Their colour might be slightly different. Or say if it is a ventilated patient, you know, so they are sedated. It might be that actually they are needing more inotropic support.”

Meaning embedded in physical context

Part of the holistic, integrated view of reality was always embedded in the context in which care was delivered. The process of developing the conception of reality appeared as entering the physical world and engaging with the patient. This exposure elaborated the processes of a creative thought.

Inter 12, lines 284-292

“So, in my examination, I would identify definitely areas of concern definitely. So, say you know like if somebody when I examined, if somebody is chesty, so obviously I would focus on their chest. I would, you know if they were complaining of urinary symptoms, I would obviously think, you know, my second observation would be, you know, they've got urinary symptoms. If they had abdominal pain, abdominal distention. Nausea, vomiting anything like that, obviously I would focus more on abdominal causes. “

“So, you know, like even though I've come to a conclusion it could be urinary sepsis, but I would still have all the other options in my mind.”

The need for entering the physical world and engaging with the patient appeared as an instinct-driven process. The nurse implicitly understood that the problem is situated and therefore asked for the rest of the information before committing her/himself to an interpretation of the problem. Then the context, as well as a patient's sleep pattern, supported the interpretation of the problem.

Inter 01, lines 169-174

"And there is lot of people who are doing their obs. don't always understand the implications of the obs. When you where on ITU or HDU, you're constantly looking at a patient. You literally, you can see them they are in front of you, but I think if you were in big 40 bed ward you might not see those patients, so those figures the NEWS scores did not really make sense unless you actually looking at the patient.

Inter 16, lines 355-362

"And I think that was just because I knew what the triggers were. Had I been maybe a more junior member of staff or somebody who hadn't had the experience or the exposure to sepsis with other cases, then, you know, I probably wouldn't have put the two and two together and I probably would have gone, okay they've got a temperature and yeah, okay, they have not passed urine, but there would be other reasons why that would happen, like I say, for example, the patient had been into theatre, so, they often don't pass urine for a bit of time afterwards and that sometimes is, you know, that is just the way that it goes, especially with the lumbar decompression, anaesthetics, etc."

Broader awareness of different perspectives of practice

Part of the holistic, integrated view of reality was always embedded in the broader awareness of different perspectives of practice and deeper understanding of the individual's own theoretical bases. Interviewee 03 demonstrated the context of linking tacit with propositional knowledge. They realised, upon reflection, that tacit knowledge developed by personally seeing events and stored them in memory as, over time, when combined with factual knowledge, they construct the knowledge that allows for a holistic perspective.

Inter 03, lines 214-221

"...look at their respiratory rate, heart rate, the blood pressure, or you know early warning times like less urinary output, things like that when they see the patient is not responsive, maybe they find that patient very cold and clammy, you sometimes will not thinking about sepsis at that point, but if you have knowledge of these symptoms that your patient may be experiencing and then it could be fatal if you know the seriousness of that situation, then you would be able to act promptly and maybe to alert promptly, so that is something when I said as a

whole, don't just think about ophthalmology ward, just think of eye or ophthalmology problem just think a bit more in broad sense.

Inter 09, lines 113-119

"I think what made it so memorable was because she had gone in for a fairly straight forward surgical procedure and we weren't really expecting her... we were just expecting her to recover and then get downgraded back to the ward and I think because she was quite young and we attributed some of her elevated respiratory rate due to anxiety and her mum was with her at the time and I think her mum was creating quite a lot of anxiety for her by being present, and because her mum was quite anxious, and I think in hindsight I would probably have removed myself away from the emotive issue of her being anxious to more of a clinical picture of her..."

Nurses who used knowledge in a specific activity developed an increasingly rich understanding both of the knowledge itself and of the world in which they apply that knowledge. Their understanding, which was originally narrow, was gradually expanded through use. Seeking the holistic, integrated view of reality seemingly did not take a second. The nurses took a time to look at multiple aspects and out of these she/he constructed a picture of the patient as a whole.

Inter 12, lines 161-166

"So, like I think in my role, you know like, because I'm in that role I look at, you know, everything as a whole. You know, I wouldn't just like look at like you know a patient's sleep pattern and just like, you know, not sleeping, just feeling tired. I look at the causes, what could be causing them to be tired. So, and erm... my instinct always if somebody is not feeling right or not looking right you need to find out what is the cause."

Inter 12, lines 196-200

"...if I found somebody unwell, I would look at everything, definitely, you know like what could it be from head to toe, but then if you definitely know, okay, this is what happened like I know, as I said, the catheter was taken out, so it is something you could think of, okay have they got a urinary tract infection because they had like a catheter in for a week or so."

Inter 10, lines 460-463

"So, by the first situation he might be like, yeah, yeah let's keep an eye, but you have been keeping an eye on this situation since 2 hours and you know it's going down here, it is not just the first minute that it is going down here. It is a bigger picture, you see all the time at the bed space."

The practice of learning enacted by a bottom-up approach

Despite the fact that part of the holistic, integrated view of reality was always embedded in the broader awareness of different perspectives of practice or a deeper

understanding of their own theoretical bases, nurses position themselves as having inferior knowledge and insight into the patient's problem, with an inferior understanding of the required interventions. The knowledge acquired from the patient is assumed to be superior to the professional knowledge of the nurse, thus encouraging mainly engaging/interacting with the patient.

Inter 01, lines 303-305

"I literally believe in that patient at the center of everything you do, well, if you start from there, the more you learn the better you will be able to do it."

Nurses' reasoning in terms of interconnected systems embraces learning of surprises and the unpredictability of each individual patient. From this perspective, pure knowledge of disease and the attainment of particular skills, although an essential prerequisite, are not adequate to deal with complex problems detailed in this category. The holistic care was acquired through the practice of understanding the interconnectedness of systems and elements, and the personalisation of interventions on a patient-centered basis.

Inter 24, lines 310-311, 315-320,

"Then using that experience of seeing a patient who's deteriorated and applying that and seeing that and so when you come across a different patient."

"I have come down to help a member of staff to turn their patient and you can look at them and go, well actually... you ask the story.

And then, you can then contribute and say well actually is there infection here because they just don't look quite right or is there something else going on?

I might not always jump to the conclusion that there is definitely infection going on. But that there's something else, an infection potentially being one of the reasons."

Pattern of actions: Probe, sense and respond

In emergent care, pattern of actions differs from protocol-based care and disease-specific care, mainly because the important features of a situation are not observable, but rather latent and emergent. Therefore, action is viewed as essential prior to any level of comprehension. As such, the appropriate pattern of action involves probe-sense-respond. This pattern of actions involved probing the environment, using a sense and evaluating the impact and demand of the intervention. If there is an

inadequate improvement, then something different needs to be tried. In this pattern of actions, nevertheless, action always proceeded a certain level of comprehension.

How nurses acted in emergent care:

- 1) Nurses **probed** the environment.
- 2) Nurses used their **sense** and evaluated the outcome of intervention.
- 3) Nurses **responded** to that result and decided if it was required to probe something else.

In this pattern of actions, a tacit understanding of the clinical problem emerged after the exposure to the environment, and then this is confirmed and broadened on the base of experience by verification, trial-error and by reflecting on gained lessons. Within this pattern of actions, reflection in action constituted an integral part of this form of expertise. Reflection in action served as an essential point of elaborative cognitive processes, leading to moments of insights. This was evident when nurses probed the environment, as they sensed the outcome by reflecting on the spot, and the results of their reflection were imminently applied in practice. In turn, this led to an ongoing and spontaneous interplay between knowing and doing, during which conceptions of a patient's problem were formulated, verified, and revised.

Inter 03, lines 195-204

Interviewer: "...can you remember any example when you have realized that you've gained new knowledge and skills to recognise sepsis?"

Participant 03: "Hmm, I have to really think about it because my knowledge whatever I gained I've always tried to put it into practice, so when I look after a patient, I always think broadly if there's anything, say for example, that if I work in neuro ITU, although I just mainly focusing on neuro patient, we do get several patients out of hours like coming from different department, so those times it's like it making you think more widely just not just to focus on one you know specific area, so I always use my knowledge then, although this is not like you know, concrete deep, whatever knowledge I knew then, I had then, I've always used them to look after my patients, that's what I was thinking when I think back."

Inter 24, lines 310-311, 315-320,

"Then using that experience of seeing a patient who's deteriorated and applying that and seeing that and so when you come across a different patient."

"I have come down to help a member of staff to turn their patient and you can look at them and go, well actually... you ask the story.

And then, you can then contribute and say well actually is there infection here because they just don't look quite right or is there something else going on?

I might not always jump to the conclusion that there is definitely infection going on. But that there's something else, an infection potentially being one of the reasons."

Inter 01, lines 277-278

"Well, you get them to prescribe some paracetamol, get some antibiotic, should try."

For some nurses, learning about the problem involved using different methods to explore some of the properties of the temperature and its relationship to causality.

Inter 01, lines 224-231,234-237

"I suppose when I worked there, but we used to be obsessed with temperatures and literally like when I first started in general, all we did was wash them down with tempered water, because their temperature was so spectacular, whether that be for their sepsis or for their head their neuro problem, so we were always dead thrilled for somebody's temperature down, because they used to have such high ones, that was, you would think oh well, the temperatures down so you get back on an even keel, which I know isn't the biggest indicator but when they have very high temperatures, I think it is."

"I learnt all this of (name of nurse) XXXX. Get the temperatures down, put the fan on, open windows, washing them down, take their blankets off, do anything you can for cooling them down (laugh), old-fashioned nurses."

Inter 12, lines 107-109

"...the patient was starting to like develop an infection. Didn't feel right. So, we did like erm... bloods and gave the patient some fluids, all that..."

Inter 22, lines 130-134

"Say you're taking a temperature and it is really high and then the patient is asking you for more blankets and they're like shivering and shaking. It's usually that they are spiking a temperature, it could be a possible infection, so it is just trying to give them... so paracetamol, try to put a fan on them, try and remove blankets, just to bring that temperature down naturally. For, you know, extreme pain, try to get the pain relief on board as quick as possible."

Inter 22, lines 139-140

"So, they might just need like a bit of medication to help and just constant like orientation and keep reminding of who they are and where they are and see if they gradually can try and remember."

Inter 22, lines 180-183

"So, it is just trying to do the basics first before you speak to someone more senior and they would ask you, well have you done this, this and this? Have you given pain relief? Have you took the blankets off? Have you given them a fan? Just before they start maybe taking blood cultures or prescribing stronger pain relief."

Rather than implementing specific practice to specific problems, the pattern of action provided a more general structure applicable for a range of problems, and this required an essential flexibility in the face of unanticipated events.

Inter 01, lines 224-231, 234-237

“I suppose when I worked there, but we used to be obsessed with temperatures and literally like when I first started in general, all we did was wash them down with tempered water, because their temperature was so spectacular, whether that be for their sepsis or for their head their neuro problem, so we were always dead thrilled for somebody’s temperature down, because they used to have such high ones, that was, you would think oh well, the temperatures down so you get back on an even keel, which I know isn’t the biggest indicator but when they have very high temperatures, I think it is.”

“I learnt all this of (name of nurse) XXXX. Get the temperatures down, put the fan on, open windows, washing them down, take their blankets off, do anything you can for cooling them down (laugh), old-fashioned nurses.”

While nurses were conducting trial-and-error experiments, they were monitoring what was emerging and responding to an emergent causality. In case of a failure, they discovered what is possible. This process of evaluating the effects of theories served as an essential aspect to demonstrate a demand and impact to find out what action/intervention to keep and which to exclude. If the outcome was positive, nurses did more of that. If undesirable outcomes were arising, they abandoned the procedure and tried something else.

In the process of evaluating the effects of theories, identifying the definite cause was not what nurses were aiming for, since it was not essential for action. Rather, they were evaluating the effects of interventions and using the information of symptom progression and intervention responses as supplementary knowledge to construct and reconstruct their understanding. For some nurses, learning about the patient’s problem involved evaluating the impact of fluid therapy on the heart rate to explore some signs of the patient’s tachycardia and its relationship to fluid depletion.

Inter 9, lines 138-148

“...if I felt they were fluid depleted, I would want to know if they had any fluid replacement, what their fluid [0:10:05] status was. If they responded to that, if they had any tachycardia that didn’t respond to fluid.”

Inter 22, lines 134-136

“For, you know, extreme pain, try to get the pain relief on board as quick as possible. Types of analgesia, not all patients respond well to say morphine, to fentanyl other people might respond well to just basic paracetamol.”

Inter 12 lines 127-131

“So that was a very good example. Patient didn’t need to go to intensive care or anything, because obviously we’ve sent the bloods, we’ve identified that the CRP was high. So, we did urine dipstick and we started fluids. So, before the patient got sick, you know, like we started antibiotics after sending the urine sample, so straight away. So, the patient didn’t get very sick.”

Having evaluated the effects of theories, the next stage involved adapting management strategies depending on the way a patient’s presentation progressed under their care, all while being willing to revise their beliefs in the light of new evidence. In a number of cases, information of the patient’s responses to an intervention elaborated the processes of creative thought. The variety of ideas/knowledge about the possibilities was endless, ranging from maintaining ideas to adapting or revising them, depending on the individual response of each patient.

Instructive patterns that emerged from a specific situation influenced outcomes in completely new and unpredictable ways. Nurses gradually built on emergent understanding of the clinical problem. Nurses used the responses to interventions to develop an understanding of patient’s problems. Depending on the response and whether or not the pre-set goal of that intervention has been achieved, nurses were deciding to maintain or alter the intervention accordingly. For instance, an effective dose of a fluids affirmed one nurse’s hypotheses that a tachycardia was from sepsis. In contrast, an infective dose of fluids was unlikely to cause long-lasting harm and helped to think of a different cause of the issue.

Altering the intervention

Inter 22, lines 137-138

“Bring the heart rate down. Sometimes it could be a response to pain or temperature. It could be they might need an anti erm hypotensive drugs because their blood pressure has gone up as well.”

Maintaining the Intervention

Inter 12, lines 120-126

“So, I mean alright that was a good experience. So, we have started saying like now if any patient has had a catheter out, you know, in the past 24 hours, if they’re not feeling well... Obviously, we will definitely like monitor their intake and output, but we encourage patients to drink as well, but we always say if they show any symptoms. If they are tired, they’re unwell, they don’t want to do things, they’re lying in bed longer than they would want to, get a urine sample straight away and that is the first thing we have started doing and I think most of our health care assistants are like very good at doing things like that now.”

Inter 01, lines 300-302

“The more you, the more you know, the better able you are going to be to help patients. So that yeah, that would always be my reason to learn something. So that I can do better the next thing.”

Success: Judging success and evaluating the effects of informal theory

As noted in previous categories, the success of early recognition of sepsis is another frequently occurring theme in the study. All nurses described the success of early recognition of sepsis; however, the meaning associated with it differed depending on the category in which it occurs in. However, similar to description of success within the previous categories, descriptions of success within emergent care were also seen as an overall judgment of whether the performance yielded the results expected for it, but in much broader terms.

In previous categories, judging the performance simply meant evaluating if the performance yielded the predicted results. Here, it also meant evaluating the performance that yielded unexpected results. The evidence of these claims can be seen in the following excerpts which demonstrate how nurses executed judgment of the performance that led to unexpected outcome.

Inter 22, lines 137-138

“Bring the heart rate down. Sometimes it could be a response to pain or temperature. It could be they might need an anti erm hypotensive drugs because their blood pressure has gone up as well.”

Inter 12, lines 97-99, 101-102, 104, 109-118

“...it was a patient who actually didn’t like trigger, like you know a lot of like the vital signs haven’t changed or anything, but the patient, when we looked at the patient on like a review...” “I reviewed a patient, or I was talking to a patient, the patient like obviously looked a bit sleepy, wasn’t feeling right in themselves.”
“They said, oh I don’t feel great”

“...it was like, it took a good 3 hours before the patient started high temperature, started going tachycardic, like was not passing urine. So, so that was a good example, but like you know, initially, the 3 hours prior to all the symptoms started, the patient had no symptoms other than just feeling tired. So that could be easily like missed, if, you know, if we don't, you know, identify those little things, you know, where sometimes... you know, sometimes you don't just have to look at the... It's not just the numbers. In front of you. So, like, you know, I feel like you don't... it's not... numbers always don't give you everything, you have to look at your patient first.”

Inter 24, lines 301-306

“And it's just, that's just looking at them, you know, sometimes you can look at a patient and just go... They look like there is something underlying what's driving this. And they might not be showing all the signs. Sorry, might not be showing you the classic signs or might not be hitting in the numbers like sepsis six, like the identification.”

Inter 12, lines 406-411

“You know we can never, we can never assume ourselves, you know, that it is the right track. So, we definitely, you know like, you look at your patient first and clinically how they're doing and then the remaining investigations help you with that.

So, you know, the investigations we do like chest x-rays, you know obviously when I am doing the bloods, I would be doing blood cultures or you know, if there is any organism, you know any growth in there, any bacteria, you know like reasons, you know like you would look at that....”

While some nurses executed the judgement to the performance that led to unexpected outcomes, others also highlighted the importance of learning from the unexpected outcome. If the performance led to unexpected outcome, nurses explored the meaning of the unexpected outcome, rather than simply applying it and replicating another course of action that worked before, thus assuming if it worked before it might work again.

Inter 18, lines 205-214

Participant: “It was just, you know, it's just the patient wasn't stable. Even though we did all these, the patient wasn't settling down and you know the heart rate came down a little bit, but the temperature was spiking. She was still in pain, not comfortable. So, it was like, I was like really just continuing [0:16:38] you know, to get this down, you know pain settled down, even when we gave her the pain killers, she was still uncomfortable, couldn't move herself.

So, it's like we need to do a scan to find out what is wrong, so we can take it from there.”

Interviewer: “Okay, so you were kind of trying different things if er... and see what will come up.”

Participant: “Yes yeah, I did.”

Evaluating parameters

Furthermore, for some nurses, the primary aim was to evaluate all parameters as a whole, particularly considering how each interacted with the remaining parameters to ultimately produce a cumulative interpretation of value. It is through the knowledge of evaluating parameters of a patient as a whole that these nurses were able to judge the degree of success of an outcome of sepsis recognition.

Inter 09, lines 221-230

Interviewer: "Can I please ask how do you kind of know that you are on the right track or you know, you are doing the right thing when you are trying to spot sepsis or you know...?"

Participant 9: Erm... well hopefully the patient will improve if the... I think if the patient is going to improve then something's got to be right in the mechanism what we're treating the patient with.

Erm... and it's just constant assessment of whatever we're instituting. Whether it be entropic support, or fluids, or bringing a patient's temperature down or constant just assessment of the patient, you know the lactate, blood gases. How the patient looks in themselves. The saturations are improving. If they are requiring less oxygen and their blood pressure is improving. If they are, you know, I think it is all just piecing a bit... like the patient as a whole and breaking it down into the systems and see if they are responding appropriate to what you are giving them."

Table 9: Summary of aspects relating to process in emergent care

| Aspect | Meaning |
|--------------------|---|
| Type of practice | "... keep reminding of who they are and where they are and see if they gradually can try and remember "(Interviewee 22). |
| Strategy | "Bring the heart rate down. Sometimes it could be a response to pain or temperature. It could be they might need an anti erm hypotensive drugs because their blood pressure has gone up as well" (Interviewee 22). |
| Reasoning strategy | "...I look at, you know, everything as a whole. You know, I wouldn't just like look at like you know a patient's sleep pattern and just like, you know, not sleeping, just feeling tired..." (Interviewee 12). |
| Success | "...it was a patient who actually didn't like trigger, like you know a lot of like the vital signs haven't changed or anything..." "...the patient had no symptoms other than just feeling tired. So that could be easily like missed..." (Interviewee 12). |

4.3.3.3 Learner

In emergent care, there were learner-related aspects that predisposed them towards adopting this approach to early recognition of sepsis. These aspects will be discussed in the following section.

Learning method: Tacit-based learning

There were aspects within learning methods that also predisposed nurses towards adopting emergent care to early recognition of sepsis, such as cognitive powers which oriented nurses to this approach. The method of learning emphasised across categories varies, depending on the category it occurs in. In disease-specific care, much of the power of this approach rests on the ability to detect the patients who are comparable to previous experience or match the expectation of reality. Much of the basis of this power is the ability to identify information related to the patient observation and then compare them to personal or collective experience of the environment in which the nurses work. Knowledge gained is then applied to future solutions and methods in similar contexts. This form of expertise implies that if nurses are exposed to the right information, and if the nurses have the right abilities, training and experience, then they will make the right decision leading to early recognition of sepsis.

Inter 23, lines 189-191

“Because I bet by the nightshift she probably had started to drop her blood pressure, became tachycardic, all of the normal signs that you would be looking for probably would have happened, but I think that at the point we had her it was more intuition and things you’d seen before.”

This method of processing is of a limited value in emergent care because whether nurses even notice data in the first place is in question, even if it is right front of them. The data encountered in emergent care may not match nurses’ expectations of reality. Even if nurses perceive it, whether they pay attention to it is in question. Similarly, even if the nurses pay attention, whether they act upon it also is in question. The evidence of these claims is supported by the following excerpts:

Inter 03, lines 55-69

"Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it's very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better."

Interviewer: "...You mentioned ventilator. Why do you think when patients are on a ventilator, it could be difficult? What's your experience like?"

Participant 03: "I think because sometimes if they are on a control mode, that you will be like, you know, let's say for example, like one of the symptoms we see first thing will be the respiratory rate, so sometimes you are, if you are on a control mode, you know, on ventilation, I don't know probably I may be wrong, but those symptoms will be ignored or may not be identified at the very first of the symptoms, but in other than that if the patient is in a ward situation, you would probably be able to identify them with the NEWS score and things like that, you know, easily identifiable."

This indicates that, as confirmed by Interviewee 03, much of the power of emergent care rests on the ability to process information that would often be ignored, go unnoticed or fail to be critically evaluated. The participation in this learning process relies less on what nurses think, and more on the way they think. In this respect, knowledge itself is not, by any means, highly advantageous in the realms of their clinical behavior. Instead, much broader cognitive powers than any objectivist conception of knowledge might be of considerable importance. This implies that the study should not be limited to the study of knowledge.

These cognitive powers did not emerge in all transcripts and did not contribute to each way of experiencing early recognition of sepsis. However, it did relate to the resources which enabled early recognition of sepsis in emergent care and helps explain why nurses in emergent care process information clues that would often be ignored, go unnoticed or fail to be critically evaluated. These cognitive powers appeared to be a complex entity traceable to several distinct areas that will be discussed in further below.

Awareness of complexity and uncertainty

The awareness of uncertainty and complexity pertinent to a clinical problem constituted an integral part in nurses' reasoning about tacit unspecifiable clues. It was a demanding awareness of uncertainty and complexity associated with physiological variability that caused uncertainty and a certain level of outcome unpredictability. However, awareness of complexity was no reason for complacency. On the contrary, awareness of complexity framed the orientation of the nurses' role perspective, moving them towards a more complexity-informed approach. Furthermore, awareness of complexity also shaped the orientation of nurses' thinking, prompting them to interrupt their perceived wisdom and consider new possibilities that might emerge.

In the following excerpts, Interviewee 22, rather than denying uncertainty, embraced it as a trigger for considering alternative possibilities that might emerge. Recognising uncertainty protects both the nurse and the patient from an ineffective pursuit of certainty, and encourages the application of personal experience rather than general scientific principles to the specific circumstance of the individual patient.

Inter 22, lines 100-104

"...sometimes I think in the initial stages you're trying to work out... If they're like speaking then you can kind of ask them, but sometimes you're... it's like a bit of a guessing game to work out what you think it could be. Sometimes like medications can make people a bit confused. Sometimes it can cause them... that they don't just react properly."

This form of perceiving the world appeared to be distinct from the rest of the team. Most of the team members were inclined to stop thinking once they had a rational idea and they abandoned any ideas that appeared excessively problematic or impractical. However, the nurses' thought processes were distinct. They did not stop at early ideas but instead kept seeking diverse ways of arriving at a solution. Some nurses used these unmeasurable pieces of evidence to discover their understanding of the patient's problem.

Inter 22, lines 107-112

“...then most people who do come from post op, erm from theatres can have a slight spike in temperature and the doctors don't overly go and do blood cultures straight away, they just monitor because usually within 24 hours most patients probably would spike a temperature post operatively. So, it is trying to get sepsis caught quick enough but also just monitoring that it could just be a response from being in theatre.”

Nurses' recognition of uncertainty and the risks linked with the unpredictability of patient responses were not considered to be connected to inherent uncertainty, as success in early recognition of sepsis appeared to be a reflection of nurses' attributes.

Perception

Perception was constituted as an integral part of nurses' expertise. Perceptions were commonly starting points of elaborative cognitive processes leading to creative moments of insight. By drawing upon their own perception of a tacit unspecifiable clue, they could experience moments of a creative inspiration leading to an insight. The perceptual advantages that emerged of considerable importance are noticeable in several areas.

A perceptual advantage that emerged of considerable importance is perceiving a tacit unspecifiable clue that would be often ignored, taken for granted, not noticed or critically evaluated.

Inter 03, lines 55-69

“Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it's very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better.”
Interviewer: “...You mentioned ventilator. Why do you think when patients are on a ventilator, it could be difficult? What's your experience like?”

Participant 03: “I think because sometimes if they are on a control mode, that you will be like, you know, let's say for example, like one of the symptoms we see first thing will be the respiratory rate, so sometimes you are, if you are on a control mode, you know, on ventilation, I don't know probably I may be wrong, but those symptoms will be ignored or may not be identified at the very first of the

symptoms, but in other than that if the patient is in a ward situation, you would probably be able to identify them with the NEWS score and things like that, you know, easily identifiable.”

Open-minded to novel experience

How did nurses see what others do not? This stemmed from the practice of being attentive and open minded to a novel experience. Being very open minded seems to overcome difficulties of recognising an unexpected (new) stimulus. In protocol-based care and disease-specific care, nurses' self-sufficiency in perceiving and interpreting clinical signs of a problem was restricted to pre-specified well-established knowledge from their past experience or guidelines. However, in the context of uncertainty, experiential learning required a stance of an open-minded and responsive learner, rather than a stance of learner capably applying well-established knowledge in a predetermined, clear context.

The evidence of these claims can be seen in the previous and following extracts, where openness and responsiveness are the key requirements of a perceptual acuity in recognizing subtleties.

Inter 15, lines 248-252

“So, like 2009, I think we went to a bit more of a standardised track and trigger. So, I definitely think that helped me in my role, but then it was really sort of identifying per se what is the issue.

So, I think initially when I was sort of a staff nurse, I don't think sepsis was at the forefront of your brain. I think it was deterioration, so you were thinking of everything.”

Attention

The cognitive powers allowed for more than a process of facilitating the details to input into their visual field (perceiving). It seems that it allowed for knowing *what* and *how* to pay attention to (selecting) and guide the attention appropriately. Learning how to control your own attention during multitasking and prioritising between demanding workloads was observed to be essential in order to perceive a tacit unspecifiable clue. A number of dimensions of attention were observed, including

vigilance and readiness to respond to anticipated needs/stimuli, selecting certain clues as relevant, ignoring other clues and executive attention.

Vigilance and readiness to respond to unanticipated needs/stimuli

Vigilance and readiness to respond to unanticipated needs/stimuli are not or have rarely been situated in other categories and, here, they are the key prerequisites for nurses' adaptive responses to novel stimuli from an external environment. This was manifested in making deliberate and general preparations to be alert for clues that indicate sepsis. These preparations are exemplified in constant scanning and monitoring the external environment and their own internal state.

This was practiced in a set of observational habits that nurses seemed to cultivate on a daily basis. Nurses were paying close attention from the start. This set of habits stemmed from years of experience of preparing their mind for potential threats to their patient. As direct result of this, they have made that active process of scanning the environment the mind's default setting.

Inter 01, lines 194-195,200-204

Interviewer: "Can you remember of any example when you have realized that you have gain new knowledge and skills?"

Participant 01: "I think. I started to learn a lot more about it and to look out for it. I mean, I think, you know, we were always very obviously on any ITU before apart from sepsis, is it always looking to see if you know, well enough hydrated or you know you're looking at those things anyhow on a daily basis, all the time..."

Inter 01, lines 291-293

"You're always looking for things like it was your part of that basic run through on every shift. Checking the skin, looking for a cut, rashes anything that might give you a clue where there might be some sort of infection."

Inter 12, lines 101-103

"I was talking to a patient, the patient like obviously looked a bit sleepy, wasn't feeling right in themselves. So, like and obviously on your usual chat you check with the patient you know how they are doing."

Inter 09, lines 263-244

"I think you are just constantly assessing, constantly comparing and that should be the way that you should work in that environment..."

Knowing as by-product of activity

What can be seen from the extracts above is that nurses demonstrated being knowledgeable in a unique way. The nurses did not know what they need to know, and often the nurses' knowing appeared as a by-product of moving forward with nursing care. This form of knowing was inseparable from action since it emerged from engagement with their patients.

While they were moving forward with implementing their daily plan, they always had a sense of seeking, despite not looking for a particular piece of information. In this sense, nurses were gathering data in the form of reactive experience by perceiving aspects that stand out while progressing with nursing care. Within this strategy, the nurses did not delimit and organise knowing/understanding and doing into separate steps, but saw it as several interacting steps in which knowing was a product of an intertwined process. However, they were not always aware of this. While some nurses' learning occurred a linear sequential step-by-step process, sources of uncertainty (incomplete information) disabled the possibility of a structured plan to follow. The occurrence of clues was unpredictable, and made the possibility of forming a plan difficult due to randomly-occurring information which still required to be recognised and acted upon. Nurses reported experiences that did not follow the same structure. Their learning was not a staged process, as they did not explain separate phases of learning but rather an intertwined process of doing and knowing.

Forming novel connections

The nurses were looking at the world as everyone else does but seeing something very distinct by constantly forming novel connections. This mode of cognition was not or has rarely been situated in other categories. They were always scanning the environment for ways to connect ideas in unique ways. They were making connections/relationships between seemingly unrelated things in order to find solutions to the problems at hand.

The ideas and thoughts they were connecting were not new, but they were not connected in this way before. The creative process relied on a certain level of expertise within the domain, since the expertise was crucial in delivering a body of knowledge that can be brought together in novel ways.

In the following example, a measure of noticing connections among seemingly unrelated tasks was a creative approach to problem solving. This was particularly evident when nurses were performing seemingly unrelated tasks and perceived inconsistencies. For example, a nurse observed the comparison between the mechanism of the ventilator and detection of sepsis signs, and as a result recognised sepsis. In another example, nurses suspected sepsis after developing an analogy between the mechanism of inotropes and the detection of sepsis signs.

Inter 03, lines 55-69

“Participant 03: From my own experience, like, working in a ward situation, is difficult sometimes to recognise sepsis if you are not actually looking forward to diagnose something like sepsis, but you have to be very open minded to, hmm, get to know what the symptoms of sepsis are to identify it early enough. So, my experience, sometimes it's very hard to identify sepsis, because some of, most of my patients will be on ventilator, so those times it used to be very difficult, but once they come out of the ventilator and they start experiencing any of the symptoms of sepsis, then I found it easier to identify the symptoms better.”

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Inter 24, lines 293-297

“Just, just it's like, it's hard to explain in terms of just looking at the patient, it's... I mean that looks just like, so for example, [0:15:45] they look different, you know. Their colour might be slightly different. Or say if it is a ventilated patient, you know, so they are sedated. It might be that actually they are needing more inotropic support.”

Inter 10, lines 486-494

“... with sepsis time is crucial. So, he will be lying for a few hours before someone pick on the fact that. So, the last 7 hours you've been going consequently on [0:35:56] and we don't know why. Nobody looked into why. So yeah, they said there is quite a deterioration, but you are hitting the targets. So,

patient's quite a... you are masking the symptoms by symptom management, but nobody stood there and analysed why we are, why he is quite, so quietly he's deteriorating."

Knowing what to observe: Selecting certain clues as relevant and ignore other clues

The insight into a patient's problem did not depend on simply paying attention to all information, but instead paying attention to all that matters to the purpose at hand. Success depended on the ability to allocate attention strategically. This involved selecting a certain type of clues as relevant and ignoring others. Different information types had different likelihoods of being worth attention. Thus, the key question was what dictated salience for hypothetical conclusions?

The key part of what nurses perceived and how they judged the importance of perceived content of observations was the ability to draw (receptiveness) upon previous experience. The experience was a starting point of how they think, how their preferences form, and how they make decisions about them.

Exposure to intensive care environment

Here, an experience within intensive care emerged as of considerable importance. Nurses from all sorts of environments perceived tacit unspecified clues, yet not all paid attention to them. In contrast, the experience in intensive care settings was linked to paying a lot more attention to less obvious indicators. Nurses working in ward settings were less receptive to such clues (did not mean much to them), but they were still very interested to learn about objective deterioration in patients.

Inter 01, lines 266-269

"I think, and also you pay a lot of attention to respiration and everything on ITU and HDU, which probably don't do so much on the ward. So, we were more used to look at those hmm less obvious indicator if you like.

Pattern matching and making predictions

How did nurses know which of the range of information of a patient's appearance were essential? This judgment was driven by the power of intuition. The nurses experienced different patient behaviours in the past and developed a representative schema in their mind that shaped their judgments and evaluation of probabilities. They were looking to gauge how representative this situation was. This was achieved by recognition of a situation by drawing upon a former experience. It appeared as though their memory contained knowledge of a higher level of abstraction and generality, rather than a specific range of cases that the nurses experienced. To account for this type of knowledge, it occurred with ease when looking at patients and bringing to mind pre-existing knowledge of exposure to the same and similar patients.

When the nurses arrive at the scene and look at the patient, they appear to be able to recall rapidly and automatically the similarity of the current patient by the mechanism of an inherent long-term working memory. The significance that emerged of considerable importance is the representative schema acquired from previous experience, which was not taken for granted, but rather critically evaluated. The experience base allowed appreciation of what the clues meant for the patient both imminently and in the immediate future. In the following example, based on past experience, the nurse made a deliberate decision that the information about the patient mattered. Interviewee 03 indicated gut feeling prompted by an initial hidden cue changed the course of their reasoning process. It served as an early warning sign and prompted her/him to explore the clinical issue. What can be observed from this account is that rather than rejecting a gut feeling, he/she utilized it as a convincing prompt for a comprehensive assessment. At the completion of the assessment, Interviewee 03 recognised and acted upon the gut feeling.

Inter 03, lines 242-249

“Looking after the patient, yes. Yeah, if your patient experienced any problem, uh, say for example, you will see, you will have an insight of your patient whole, you look at the patient, how the patient is going to be for that shift, so basically when you are going into shift and you can you see that the patient is not the way he or she was in the previous day when you look back at to the patient. Or even when you see the new patient you know from your experience that this person is not going to do well. So, basically at that point you are going to be act on, acting on to say what you can do to make that situation possibly make better before it goes worse, so you will be acting on, hmm, to find out if there is anything wrong”

Confidence in own perceptions

Although nurses did not have knowledge with clearly stated objectives, they had the perceptual ability of confidence in their own perceptions of an ill-defined problem.

Often, this was profound enough to assess the probability of an event that had not yet occurred. The perceptual ability was linked to prior experiences of reading the situation correctly, where the first hypothesis based on intuition matched the final diagnosis.

Inter 12, lines 104

“They said, oh I don’t feel great and like within, like 2-3 hours patient like double up like urosepsis. “

Low probability, high-impact events and the ability to identify their implications

Gaining insight into a patient’s problem did not depend on simply noticing a contradiction or inconsistency, but their success also depended on the nurses’ ability to identify those that might have important implications, even when not yet being aware of what the implications are. More specifically, the insight into a patient’s problem depended on the ability to identify the events that might have a high impact on the patient’s outcome, even when they are not yet aware of what this impact is.

Imagination

This judgment was driven by the power of imagination of what the situation in front of the nurse could mean for the patient’s immediate and long-term future. Imagining the implication shaped the judgement of significance. The conception that shaped the

thought processes was based on the grounds that the probability of serious illness might be low, however an implication of not treating a specific disease could be high.

Inter 03, lines 214-221

“...look at their respiratory rate, heart rate, the blood pressure, or you know early warning times like less urinary output, things like that when they see the patient is not responsive, maybe they find that patient very cold and clammy, you sometimes will not thinking about sepsis at that point, but if you have knowledge of these symptoms that your patient may be experiencing and then it could be fatal if you know the seriousness of that situation, then you would be able to act promptly and maybe to alert promptly, so that is something when I said as a whole, don't just think about ophthalmology ward, just think of eye or ophthalmology problem just think a bit more in broad sense.”

Tendency to focus on hypothetical outcomes

Although nurses expressed a tendency to focus on hypothetical outcomes in terms of ‘what if’, they did not focus on all hypothetical outcomes, but only those that they judged significant. They engaged in a creative process by purely imagining applicable and plausible threats to patients. This expertise was crucial in recognising the significance of threats. The following excerpts demonstrate the nurses with the background and expertise to judge that a contradiction or inconsistency might be important. The nurses’ sense of what was usual allowed them to recognise something that may have meaningful impact.

Inter 16, lines 413-417

“I think, it's a personal, internal, that you have done everything and, as I say you've covered your back with, you know, that even if it never developed into sepsis at least you have done all the right steps. So that if it was sepsis, you can diagnose it as early... or the doctors can diagnose it as early as possible, rather than waiting and then for it to develop.”

Inter 9, lines 375-376

“... if you can intervene before it becomes a shock and issue for the patient, then it's... from a nursing perspective, it is going to make you feel as if you are doing your job properly.”

Inter 22, lines 145-146

“If you try and catch it early enough you are preventing something more severe happening.”

Inter 12, lines 150-157

“But yeah... but patient herself said, I don't know. There's something not right, but obviously they can't tell you all the time because to them, okay I am in hospital I am tired because I didn't sleep. That is probably their main concern, because they haven't had a good night's sleep is their main concern.”

But I think if we left it, it could be worse, you know, especially on a weekend, you know, you haven't got any facilities. You are not reviewing the patients frequently. You know, you've got a reduced amount of medical staff. So, it is difficult because sometimes you wouldn't identify that deterioration until like Monday maybe.

Inter 03, lines 123-125

"...most of the time the patients will be on like CVVH or something to restore the function, so that can be prevented, if we are able to identify these symptoms in time, and treat it..."

Inter 22, lines 141-142, 146-155

"So, it is trying to just do the basic things first before you ask the doctor to do more advanced treatments or interventions."

"If you try and catch it early enough you are preventing something more severe happening. So, you don't... like sepsis is like a type of you know septicaemia, blood poisoning. So, you don't want it to start having a really bad adverse reaction on the organs."

So, if you can try and treat it as quick as possible then you could be preventing like heart failure and kidney failure, which could mean a patient needs to go on like dialysis machines, which means another line being put into the body which is another infection risk of having to put an invasive line into the groin or into the neck."

Also, if you need to have like Noradrenalin, you would have to have another line put into your neck just for the route of that to be given."

Knowing how to guide the attention appropriately

How did nurses know how to guide their attention in an appropriate and timely manner? This stemmed from the nurses' memory of the experiences of how the disease evolves. In particular, memories derived from former exposure to an advanced stage of the disease presented with multiple abnormal physiological parameters, and its link to poor outcomes and prognosis, guided their attention accordingly. Thus, this enabled them to get ahead of the progression of the illness. It guided their attention towards predicting how the disease might evolve and how long they have to respond. This ability served as an early warning system of potential danger to their patients that guided their attention towards probable sources of critical information. As a result, they had to pay attention to some types of information and ignore or restrain others. The memory was a starting point of how they think, how their preferences form, and how they make decisions about them. In

the following example, based on her memory of recent or long-term experience, the nurse deliberately chose which information to hold onto.

Inter 01, lines 78-81

“... you would be looking at, it would be their temperature, the heart rate, the resp. rate and the blood pressure and the look of them, how they looked. You know because it comes on quite quick and sometimes, their obs. don't catch up with them”

Inter 09, lines 180-183, 188-190

“I always remember a consultant saying to me once someone's blood pressure has dropped, you're sort of you're compensating, your patient is compensating quite dramatically by then. So, I always think if you can pick up more subtle signs before the blood pressure drops you are going to get a better outcome for the patient.”

“So, I always think if you can quickly... intervene more quickly, your outcome will be better because I always think once you have reached your compensatory mechanism you're... it's a bit further down, it is a bit further down the course of the sepsis.”

Executive/Functional attention management

Nurses from all sorts of environments perceived tacit unspecified clues, yet not all expressed an interest to probe them in greater depth. However, an insight into a problem was of limited value if it did not translate into actions. Many nurses explicated the ability of gaining an insight into a problem, but only in a few nurses did it translate into actions. For those who it did, this explicated a construct known as functional attention management (Klein et al., 2011). This mark of expertise went beyond what nurses pay attention to or how they think about it, but instead facilitated how they respond to it.

As demonstrated in the quotes below, nurses did not only notice the content of the message, but also interpreted the message regarding what information and actions they could begin. From the nurses' comments, many of their descriptions showed instant responses upon considering probable information, such as recognition that the information is a probable source of critical information which allowed them to conceptualise the low probability of a high-impact event.

Inter 03, lines 284-290

“...there is something not right, so if you are able to act on what is needed then, uh, for example if I say, this patient is not looking good, he may need fluid or something that he's not eating properly, he will need an NG tube, make a decision early that at least to put NG tube or catheterise the patient or put canula in straightaway rather than you wait for the whole vein to collapse and then you try and act then there's no point of you doing anything you won't be able to gain, you won't be able to find a proper vein by that point, you know, things like that.”

Inter 03, lines 257-247

“...basically at that point you are going to be act on, acting on to say what you can do to make that situation possibly make better before it goes worse, so you will be acting on, hmm, to find out if there is anything wrong, let's say for example, is any medication to be changed or if there is anything fluid management that we need to do, or is there something that we need this patient to be, say, on respiratory support before it could even get worse or do they need some other management some physio input or maybe the chest physio management, so things like that you brought things widely to make that situation get better rather than making it, let's say for example, look after the patient for 10 hours and final hour you are going to be losing your patient. Saying that recognising it early and acting on is very important, there are several, several times I had to do it, like receiving a patient like you know, not doing really well and then acting immediately at the beginning of the shift, to make this patient feel better and then make the situation improved better.”

The need to let go of the need to know the definite cause

The nurses set themselves apart from other nurses via the frame of mind of 'letting go of the need-to-know' a definite cause of the issue. In the absence of an experience of the management plan, nurses expressed the need to enact while remaining consciously indecisive of a definite cause of problem, This is because they believed in the suitability of specific management determined by knowing the yet-unknown strategy. Directing the management plan towards a more probable cause of the issue, was carried out while still continuing to be vigilant to changes in the patient's condition that could indicate the need to think more seriously of probable causes of the issue.

Faced with inherent uncertainty, nurses exhibited in their comments a lack of confidence in their own capacity/knowledge to manage a given situation or have predictive understanding of the problem.

Inter 03, lines 248-249

“...you will be acting on, hmm, to find out if there is anything wrong...”

Inter 22, lines 101-102

“... it’s like a bit of a guessing game to work out what you think it could be.”

Inter 01, lines 91-93

“...you look at their obs. because you'd be looking for deterioration in a patient, so that you can do something about it before it becomes a bigger problem.”

Mindfulness

Knowing/gaining an insight into the patient’s problem was not only about the presence of attention, but also the presence of mindfulness. While nurses in previous domains instantly passed judgment on others, or made a quick judgment themselves, the nurses in this domain took a moment to reflect. This raised the question of how the nurses managed to disengage themselves from instantaneous, preattentive judgment.

Reflection in action - Self-dialogue

The key to this process was looking at the world around them with a real thought. As such, an initial judgment of a problem was not limited to the cognitive process of perceiving, but also included consciously engaging in a reflective dialogue with their situation. Before their minds leapt into judgment, the nurses engaged in a reflective dialogue with the situation they found themselves in. In addition to making the initial judgment constructed by the reflection in action, they also probed it in greater depth.

The key advantage of this process is a mindful interaction with the world, as opposed to mindless, passive processing of data.

Inter 24, lines 301-303

“And it’s just, that’s just looking at them, you know, sometimes you can look at a patient and just go...They look like there is something underlying what’s driving this.”

Inter 09, lines 229-231, 239-247, 253-256

“I think, you know, I think what helps me is when they put it on the prompt boards, you know the white boards and they have like, I don’t know the theme of

the month and I think anything like that helps and talking to yourself helps, because you help cement the knowledge that's already there."

Interviewer: "You mentioned something very interesting, you said you'd, you're kind of talking to yourself. Could you please tell me what do you mean by it?"

Participant 9: So erm... well I like breaking down what I think.

So, when I come on shift, as well as getting a hand over, I always try and assess my patient from top to toe and make sure that I understand what is going on with a patient from a clinical point of view. So, I will always like do a top to toe assessment. Look at what they've come in with. Look at their past medical history. Look at their drugs, what drugs they're on and look at what their blood results are... and then obviously just wait for the ward round to come round. Assess the patient, see if I have missed anything or and then just what the 24 hours plan of care is.

"It, for me, it just erm... I have, er... I know the baseline level of the patient and I think if you... So, I look, knowing the history of the patient, what's brought them in and I like doing my baseline. So, I know what my baseline is for that patient from the start of the shift. So that if anything else changes throughout that day, you know, I've got a comparative."

Tendency to hold onto assumptions and having a curious mindset

The nurses differed in the way they fixated on scenes and objects. Despite not dealing with any objective measurable pieces of evidence, nurses were holding onto their own assumptions and got fixated on these, as opposed to others who had the same information and discarded their beliefs and used unmeasurable pieces of evidence to discover their understanding of the patient's problem.

Use of curiosity

This began when a single piece of observation provoked curiosity-driven investigations (put them on the road of discovery). A single piece of observation aroused the reaction of questions about observations, which prompted further diagnostic processes, and ultimately enabled putting all pieces of the observations together. In the following example, a nurse stumbled upon sepsis-related properties. A single observation sparked a curiosity that led to a curiosity-driven investigation. The nurse noticed the sleep pattern affecting the patient. The nurses did not expect anything unusual, it just occurred while having a "usual chat", but when she/he spotted the unordinary pattern in the patient's look, this prompted the response of asking questions and investigating the problem further. In the following scenarios, uncertainty had a favourable effect on the

clinical reasoning of nurses by prompting a reassessment of the clinical problem and provoking questions, which led to the trigger of possible situations. This reflection on the situation, or learning by experience, triggered the nurses' curiosity to learn more about the problem.

Inter 12, lines 101-103

"I was talking to a patient, the patient like obviously looked a bit sleepy, wasn't feeling right in themselves. So, like and obviously on your usual chat you check with the patient you know how they are doing."

Inter 12, lines 140-147

"The patient was lying in bed. Looked a bit pale. Erm... you know, was conversing, but patient could not tell me what was wrong. All she could tell me was, oh, I just feel tired. I haven't slept. When we asked more, that's when she said, oh... I said, why did you not sleep. Are you worried? She said, no I was up for the toilet too many times. So those are the things like triggered to me, to like you know get some bloods done, give her some fluids and you know, get the urine dip stick and all that."

Inter 01, lines 281-285,

"I remember as nurses if it did have an infection, where was it coming from, if it wasn't obvious. You know you look at the patient in detail where you work somewhere like ITU, so every time you turn them or whatever you might be looking for possible source of infection."

Inter 15, lines 892-894

"So you thought about it a little bit differently, but it didn't initially set off with sepsis? I think you just always thought, when I look back, deterioration. Oh they're really sick. What is going on with them?"

Inter 10, lines 534-553

"There is a reason why she is losing the blood pressure. Either she is dehydrated or there's, or she's got early signs of sepsis, blah, blah. If you don't understand by just going by the goal.

Well then there is nothing to report to the doctor. If I hit the button up on [0:39:00] I will achieve the goal and I can sit and do that for the whole shift.

And I will have mapped [0:39:07] so there is nothing to report to the doctor, but if you understand and analyse the process and like, hmm, okay I've been going up on [0:39:16] since a few hours. I've still achieved the target because they told me to have map above 17. I achieve the target by [0:39:26] but I will tell them, hey this patient has been going up, I'm going up on inotropes for a while now.

Plus, you know, by the look of this and that, this as well is kind of occurring.

Which is like a mild kind of something, but together with her blood going up on [0:39:48] all the time. Hey, I think that she is starting with something. But yeah, if you don't understand, you will be happy sitting there because you've got map achieved, by what the doctor said on the ward round. You have to kind of see the bigger picture and how the patient has acted over, you know, few last hours, not just by the number, yeah. So, I think that you learn to be more confident with a, a bigger understanding of picture, not just by following commands."

Implicit learning in a social context

Having described many nurses' cognitive powers critical to practice in emergent care, this section discusses the learning method through which those marks of expertise were developed. In the emergent care category, nurses reported a method of learning that is considerably distinctive from that described across other categories. In the previous categories, learning was mainly experienced as a deliberate activity directed towards the accomplishment of specific, explicit learning outcomes. This mode of learning is distinct from the previous categories where learning is experienced as a deliberate activity directed towards the accomplishment of specific, explicit learning outcomes.

In this category, nurses described learning methods, including their activities which seemed to have domains in a social dimension of tacit knowledge. The learning method generally involved collective and co-produced actions and shared experiences: the corresponding characteristics of learning involve uncertain and ambiguous learning outcomes, an implicit and ambiguous teaching content and a mode of discourse via activities rather than words. Other distinct characteristics include a nondeliberate and indirect nature of knowledge question, and a non-standardized method of learning not directed towards explicit learning outcomes. As such, instructions provided a mere guide; it was a case of 'indicating rather than telling'.

To refer to nonspecific instructions, nurses used the language of *"you were alerted of", "it wasn't so sepsis specific", "might be some sort of infection", "just looking for general deterioration",* and *"anything that might give you a clue"*. These profound uncertainties in the language seemed a crucial step towards resolving them. This reflects the need for a teaching approach of prompting reflection, encouraging nurses to imagine or deduce what was meant and, in some instances, even addressing the indescribable or mystical aspects of their subject matter. This facilitated directing nurses towards a self-

expressive, exploratory and experimental approach to learning. This mode of learning seems far distinct from learning seen in the previous categories, which was governed by constrained and standardised approaches based on instructions along a specific path of reasoning to a definite conclusion. The evidence of these claims is supported by the following excerpt. Interviewee 01 provided examples of learning about patient problem indicators that was situated in a social context. Collective and co-produced actions and shared experiences facilitated learning in these situations.

Inter 01, lines 283-287

“And they are all from all other nurses I worked with as well, you know, all the nurses I worked with over the years you know they were good. You're always looking for things like it was your part of that basic run through on every shift. Checking the skin, looking for a cut, rashes anything that might give you a clue where there might be some sort of infection.”

Inter 01, lines 224-231, 234-237

“I suppose when I worked there, but we used to be obsessed with temperatures and literally like when I first started in general, all we did was wash them down with tempered water, because their temperature was so spectacular, whether that be for their sepsis or for their head their neuro problem, so we were always dead thrilled for somebody's temperature down, because they used to have such high ones, that was, you would think oh well, the temperatures down so you get back on an even keel, which I know isn't the biggest indicator but when they have very high temperatures, I think it is.”

“I learnt all this of (name of nurse) XXXX. Get the temperatures down, put the fan on, open windows, washing them down, take their blankets off, do anything you can for cooling them down (laugh), old-fashioned nurses.”

Inter 10, lines 614-618

“ And I think, as well, obviously just like kind of little bit more relaxed approach, but I would imagine that, you know, if you are a senior doctor and consultant that has been there for many years and you've got senior nurse or sister that is super good, you can, maybe slightly relax this kind of language and say, pass over to you, yeah keep an eye, because you know what you will get from that keep an eye thing.”

What can be seen in these excerpts is the implicit method of learning characterised by a lack of explicit or definite answers for a patient's problem, and tolerance of uncertainty. These profound uncertainties in the answers seemed a crucial step towards resolving them. The absence of precise answers challenged nurses to learn more about the clues via exploration and experimentation. In addition, the indefinite answer to a patient's problem prompted the search for novel patterns. Within the form of learning, the mode of dialogue is one of investigation rather demonstration,

suggesting a tacit dimension of learning. This is exemplified in the nurses' descriptions which included remarks such as "looking for things" and "anything that might give you a clue".

The excerpt above also shed light on how and when tacit knowledge is learned in a social context. It seemed like nurses were introduced to a pattern of practice through observation, imitation and interaction. Although the learning experiences are guided by others, they seem to occur spontaneously and naturally within a continuous pattern of practice during the course of nursing life.

Problem-solving skills emerging from social interaction

What can be seen in the excerpt above is the social process of learning social interactions, and this facilitated a process by which knowledge new to the nurses was constructed. The process is experimental and generative in nature and entails the construction, revision and reconstruction of meaning of a clinical problem. It offers multiple perspectives and sensory experiences, as well as providing the climate for critical and participatory dialogues. Correspondingly, it offers novel concepts, processes or methods as a result of knowledge construction. In addition to that, the nurse's self-awareness of how alternative perspectives shape one's meaning suggests nurses' reflexive or meta-learning capacities.

Mentorship

The capability to detect clues was linked to practicing in a climate that fostered a positive mentoring relationship, thus encouraging those involved in the teaching to describe what they know. The manner of discourse is one of indications rather than explanations, thus showing a tacit dimension of instructions. Indications of what to look for were provided yet not defined, resulting in the absence of explicit or definite answers to a patient's problem and the presence of uncertainty. This is exemplified in

the nurses' descriptions of learning which included remarks such as "you were alerted of", "it wasn't so sepsis specific", and "looking for general deterioration." This mode of dialogue seemed a way of teaching that was directed more towards indicating rather than proving or leading. This is distinct from the ways of learning seen in the previous categories of well-defined rules and procedures, based on instructions along a specific path of reasoning to a definite conclusion.

Inter 01, lines 105-110

"A good mentorship (Laughing). It worked. And when I trained job, you had a good mentor, preceptor when I first started and so you were alerted of what you were looking for. But it wasn't so sepsis specific then when I started, you were just looking for general deterioration, ..."

Active engagement with physical world

Similarly, to disease-specific care, the dominant part of learning in emergent care stemmed from experience. The key difference, however, was that experience was not something that happened to nurses; instead, it occurred via nurses' active engagement with the physical world. This was evident when nurses encountered ill-defined problems or inconsistencies. The learning by the unreflective nurse from this experience is very limited; he/she learns only to monitor the problem, be on guard, predict the future state or inform the doctor.

Inter 02, lines 213-214

"...so you need to be on your guard as a ward nurse because this is where you get the deteriorating patient, and you need to be identifying that patient quickly, so you have to be very much aware".

However, the reflective nurse will enter into an active dialogue with the situation.

Inter 09, lines 229-231, 239-247, 253-256

"I think, you know, I think what helps me is when they put it on the prompt boards, you know the white boards and they have like, I don't know the theme of the month and I think anything like that helps and talking to yourself helps, because you help cement the knowledge that's already there."

Interviewer: "You mentioned something very interesting, you said you'd, you're kind of talking to yourself. Could you please tell me what do you mean by it?"

Participant 9: So erm... well I like breaking down what I think.

So, when I come on shift, as well as getting a hand over, I always try and assess my patient from top to toe and make sure that I understand what is going on with a patient from a clinical point of view. So, I will always like do a top to toe assessment. Look at what they've come in with. Look at their past medical history. Look at their drugs, what drugs they're on and look at what their blood

results are... and then obviously just wait for the ward round to come round. Assess the patient, see if I have missed anything or and then just what the 24 hours plan of care is.

"It, for me, it just erm... I have, er... I know the baseline level of the patient and I think if you... So, I look, knowing the history of the patient, what's brought them in and I like doing my baseline. So, I know what my baseline is for that patient from the start of the shift. So that if anything else changes throughout that day, you know, I've got a comparative."

Learning environment: Patient-centred learning environment

There were aspects with the learner's environment that predisposed nurses towards adopting emergent care to early recognition of sepsis. The learning environment that allows for constant and unmediated exposure to the patient was emphasized in nurses' accounts. According to Interviewee 01, making sense of patient information was more likely to occur under a climate of direct unmediated exposure to the patient, particularly that which allowed for visual contact with the patient. The capability of making sense of patient information, these nurses suggested, is inseparably situated in the physical context.

Inter 01, lines 158-172, 166-172, 174-178,

"...I took all the training that was available on board to make me more aware. Hmm, I mean I'm, I am a little bit sort of ambivalent about the NEWS score because in theory it's a great idea, NEWS score alert people, alert people, but I don't usually, I usually work on ITU, where we are much more sensitive to changes in a patient and we would deal with that much quicker, so I don't know how effective the NEWS score is on the ward or out of ITU. Do you know what I mean?"

"And there is lot of people who are doing their obs. don't always understand the implications of the obs. When you where on ITU or HDU, you're constantly looking at a patient. You literally, you can see them they are in front of you, but I think if you were in big 40 bed ward you might not see those patients, so those figures the NEWS scores did not really make sense unless you actually looking at the patient. I think that hmm. We look at the patients less and less outside of ITU. "

"Because there's so much stuff to enter into a computer before they see the patient, have to do all that first. Then every time they do stuff, they got to update it in real time, but all that time is time, all that time spent, time spent not seeing (emphasis) actually seeing the patient, but I am old-fashioned you know xxxx (name)."

Inter 01, lines 303-305

"... I literally believe in that patient at the center of everything you do, well, if you start from there, the more you learn the better you will be able to do it."

What can be seen from the excerpts above is that Interviewee 01 advocates against an environment where knowledge management is reduced to information, and limited to a computerised management which involves a search for some information that is easily retrievable on a computer. Instead, Interviewee 01 advocated for a learning climate that fosters learners' awareness of implications, connections and understanding of patient information.

Inter 10, lines 676-687

"I think because... I feel it is because you learn the guidelines from the book and research, but if you analyse the person... patient when... as you look at the patient, specific situation, you have more understanding and I think you will remember more... than reading from the book because you've got the multisensory learning, yeah. You are hearing the explanation, you are looking at the number, you are looking at the patient, you remember the feeling regarding the whole situation and you will remember more than reading the same information from the book. Obviously, from the books you can learn more detailed knowledge, more academic knowledge, but you have more chance of, psychologically speaking, to remember if it's a multisensory experience. "

Inter 10, lines 746-751

"It's academic knowledge from when you read about it. You know the guidelines, you will read the, you know, symptoms, blah, blah, blah. When you look at the patient you will learn the actual feedbacks as well, quickly. Because you will see feedbacks. We've done this because it has been written by a book and you can see that it works or it doesn't work or what is it causing, what's the side effects?"

What can be seen in the excerpts above is that there were additional aspects within the learner's environment's that predisposed nurses towards adopting emergent care to early recognition of sepsis. In the previous categories, the learning environment was distinct in the way that it directed towards searching for specific, explicit content and outcomes. In this category, the characteristics of the learning environment included tacit and ambiguous content emerging from patients. Keeping in mind uncertainty and ambiguity in the environment, nurses described this form of learning environment as directing them towards self-expressive, exploratory and experimental approaches to learning. This is evident in the environments which moved nurses towards self-directed actions.

In the following excerpt, the nurses discussed how the capability to recognise sepsis early emerged in the absence of today's resources, such as algorithms, thus making them use their own cognitive skill and common-sense reasoning about the world. This practical intelligence, which is evident from the remarks such as "it's just common sense" and "*we just looked*", seems to contribute to the development of the experientially grounded capability that allow nurses to navigate selections and actions required for early recognition of sepsis. This account suggests that the development of the capability is more likely to develop under a climate of opportunities of being disciplined into believing in the necessity to secure and improve it for themselves.

Inter 01, lines 62-72

Interviewer: "... how would you describe learning to recognize sepsis?

Participant 01: "Hmm, you mean well. I know there has been, it's a big topic and there is a lot of mandatory learning around it and I'm guessing it's mandatory and I know there is XXXX [name], there is a special, there is a lot of programs to develop awareness of it but going back a few years we didn't have any of this, you know, it's just common sense. You just, we just looked at their obs. We didn't have NEWS scores back when I trained, back when I worked. We didn't even have a NEWS score alert like you have now..."

Inter 01, lines 78-84

"... you would be looking at, it would be their temperature, the heart rate, the resp rate and the blood pressure and the look of them, how they looked. You know because it comes on quite quick and sometimes, their obs don't catch up with them, you know, as you may be a little bit confused or bit unresponsive. They just, this probably sounds very anecdotal, but basically, they are people who just don't look quite right and the obs don't always reflect that immediately."

What can be seen from the above excerpts is that, in the absence of common traits of order such as structures, procedures and rules, nurses were attempting to make sense of situations by constructing un-planned approaches emerging from the patient. This approach allowed them to address the dynamic nature of their work.

Although the nurses had prior factual knowledge, they did not hypothesise about the patient, but instead allowed an interpretation of the patient to emerge within the interaction. They were interacting directly with the patient rather than being controlled by external wisdom, as was found in previous categories. The development and use of tacit knowledge, this study suggests, is inseparably situated in a physical context that

is full of opportunities to verify and experiment with incomplete understanding of things and reflect on gained lessons. Also, the development and use of tacit knowledge was linked to people’s exposure to incomplete information. Being exposed to problems in which there is opportunity to confirm and broaden pieces of information on the base of verification, trial-error and by reflecting on gained lessons, translated into bringing tacit knowledge into awareness. Bringing tacit knowledge into awareness was more likely to occur under a climate of opportunities to verify and experiment with incomplete understanding of things, all while reflecting on gained lessons.

Table 10: Summary of aspects related to learners in emergent care

| Aspect | Meaning |
|-----------------------------|--|
| <i>Learning method</i> | <i>“...when I trained job, you had a good mentor, preceptor when I first started and so you were alerted of what you were looking for. But it wasn't so sepsis specific then when I started, you were just looking for general deterioration...” (Interviewee 01).</i> |
| <i>Learning environment</i> | <i>“...patient at the center of everything you do, well, if you start from there, the more you learn the better you will be able to do it” (Interviewee 01).</i> |

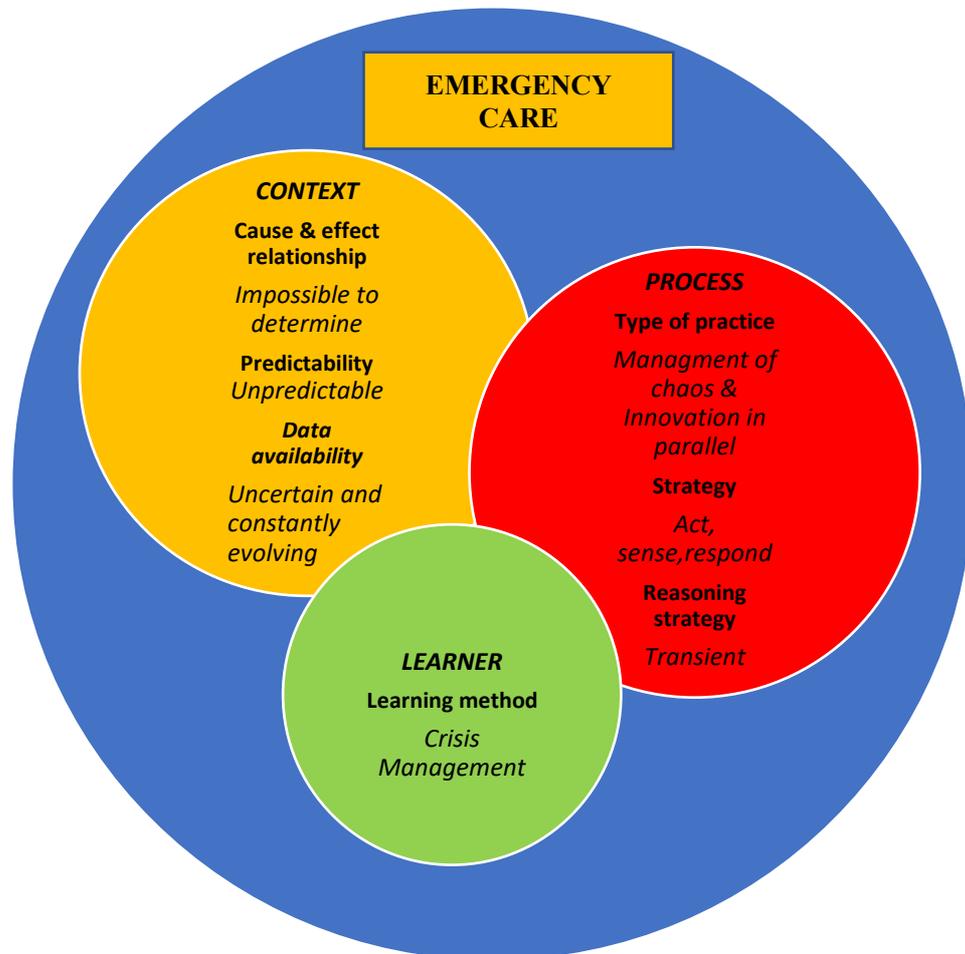
4.3.4 Category D: Emergency care

The fourth category of the outcome space is early recognition of sepsis as emergency care. This category opens with a figure depicting the analysis of the experience of emergency care. The rest of the section will provide more detailed descriptions of where the figure came from and go into more detail around its constituent parts. Although this is the endpoint, the image is presented first to highlight the many aspects of the phenomenon before a more in-depth discussion of its emergence and the evidence from the transcripts are offered.

Figure 8 illustrates analysis of understanding of early recognition of sepsis between the components of context, process and learner that contributes to the meaning of

emergency care. The interrelating circles bonding various components demonstrate how context, process, and learner in the understanding of emergency care are interrelated.

Figure 8: Understanding of early recognition of sepsis as emergency care



Within this category, the primary focus of attention has shifted from an emergent to emergency approach to disease, where life-saving measures and urgent care take precedence over other clinical requirements. Thus, the aim is to decrease exposure to this chaotic context and lower uncertainty. Following life-saving actions, nurses sense the spot where stability is present or absent, and then work towards changing the situation from emergency care to emergent care or disease-specific care to gain

control. The following section will discuss the frequently occurring aspects within the components of context, process and learner central to emergency care.

4.3.4.1 Context

Nurses ascribe emergency care to early recognition of sepsis based on aspects experienced as central to the context, such as unclear cause-and-effect relationships, unpredictability and management of resuscitation outcome data. The following section presents these aspects.

Cause-and-effect relationship: Impossible to determine

As noted in the previous categories, the cause-and-effect relationship is a frequently occurring aspect and serves as central to every category. Cause-and-effect relationships vary across categories, depending on the category they occur in. Comparable to emergent care, nurses continue to ascribe emergency care to early recognition of sepsis based on cause-and-effect relationships that cannot be determined. However, while in emergent care the cause-and-effect relationships cannot be determined, here they are also constantly evolving and changing.

The context was depicted by nurses as too turbulent.

Inter 10, lines 336-338

“Er... you know the situations where they try to be clear and maybe they are, but they just don't really give you time to react, so things are, the sequence of their orders is basically everything at the same time.”

This disabled the option to wait for any knowledge-based response. Therefore, nurses highlighted the need to propose a lifesaving action and then proceed from there. In the following excerpt, the immediate task was not to discover patterns, as the context seemed too unstable to wait for any knowledge-based response. Priority was instead given to life-saving measures. Eventually, Interviewee 03 responded by working to transform the situation from emergency care to emergent care, where the nurse thinks

in terms of interconnected systems with an attempt to resolve the puzzle of the patient's problem.

Inter 03, lines 106-115

Interviewer: "... how do you judge that something that you've done to early recognise sepsis has been successful?"

Participant 03: "There so many so many occasions, so patients get worse in the ward when they are transferred to us into the ITU without being actually diagnosed as having septic symptoms, but when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn't think that would be a cause for sepsis but if you sometimes what I think like when you receive a patient, by looking at them, they are clammy, like a labored breathing, less urine output, I have had these patients several times , for these patients who are going into sepsis you are going to note anything else apart from neuro problems, it is not a respiratory problem, it is like a whole of the systems maybe needing help with."

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Predictability: Unpredictable

As noted in the previous category, predictability is a frequently occurring aspect and serves as central to every category. Predictability varies across categories, depending on the category it occurs in. Within emergency care, nurses ascribe this approach to early recognition of sepsis based on the context that is opposite to order, notably one of chaos that lacks structure and predictability, partially due to the unpredictable outcomes of resuscitation procedures.

In the following excerpt, Interviewee 10 implied that nobody can predict what will occur in advance or the optimal course of actions at that moment. There seemed to be no time for consultation as a fast response was required. The course of action seemed to

depend on the outcomes of resuscitation procedures, implying that a lifesaving action needed to be proposed first, and then further actions taken accordingly.

Inter 10, lines 378-387

Interviewer: "What helped you to realise that, you know, you are on the right track with whatever you've done?"

Participant: "Because er... when we were doing things and although we were not actually pretty much doing anything, so we were definitely on the wrong track, but it was the only track for this patient. There was immediate feedback as well from the doctor. Like, oh this is not working, that's why it's not working, what do we try next? So..."

"We knew that we are not missing things because even though we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we're not achieving, we're having to think about why are we not achieving and what will we do next. So that's what's reassuring why we are doing things so right."

Availability of data: Uncertain and constantly evolving data

Information pertinent to clinical problems emphasised in decision-making varied across categories depending on the category they occurred in. In each category, various types of information had varying probabilities of being deemed worthy of consideration. In emergency care, nurses emphasised the information of a clinical problem that was uncertain and constantly evolving, depending on the outcomes of resuscitation procedures. This is evident in the following excerpts, where nurses described information of the chaotic context within which they operate, but not information on the outcomes.

Inter 03, lines 117-127

Interviewer: "You have mentioned quite a few times organ failure, so I was going to ask you said that patient progressed for organ failure, so what are you trying to achieve with identifying early organ failure, as you've mentioned?"

Participant 03: "I mean, if a patient experience low heartbeat, low blood pressure, or like you know, something which is actually keeping the right organ function, there is always a possibility that they can go in to organ without having it sophisticated in time, so basically, again, it does reflect back to the early recognition and securing the organs well before it goes into like shutdown, so most of the time the patients will be on like CVVH or something to restore the function, so that can be prevented, if we are able to identify these symptoms in time, and treat it, like, say for example, if we have a low blood pressure, treat it with fluid on this occasion and also you know hypertonic solution or with the medications to manage their blood pressure, you know, inotropes and identify it at the same time."

Inter 10, lines 378-387

Interviewer: “What helped you to realise that, you know, you are on the right track with whatever you’ve done?”

Participant: “Because er... when we were doing things and although we were not actually pretty much doing anything, so we were definitely on the wrong track, but it was the only track for this patient. There was immediate feedback as well from the doctor. Like, oh this is not working, that’s why it’s not working, what do we try next? So...”

“We knew that we are not missing things because even though we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we’re not achieving, we’re having to think about why are we not achieving and what will we do next. So that’s what’s reassuring why we are doing things so right. “

Table 11: Summary of aspects related to context in emergency care

| Aspect | Meaning |
|--------------------------------|--|
| Cause and effect relationships | “...when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn’t think that would be a cause for sepsis...”(Interviewee 03). |
| Availability of data | “There was immediate feedback as well from the doctor. Like, oh this is not working, that’s why it’s not working, what do we try next?” (Interviewee 03). |
| Unpredictability | “... we kind of had the feedback on a further plan. So as long as we were sticking to that...” (Interviewee 10). |

4.3.4.2 Process

Nurses ascribed emergency care to early recognition of sepsis based on frequently occurring process-related aspects such as type of practice, reasoning strategy and pattern of actions.

Type of practice: Management of chaos and innovation in parallel

As noted in emergent care, type of practice is one of the most frequently occurring aspects in data analysis and serves as critical to each conception. Type of practice occurs across all participants; however, the meaning associated with it differs

depending on which category it occurs in. In the chaotic context where the cause-and-effect relationships are constantly evolving and changing, imposing best practice knowledge from guidelines seemed ineffective. Best practice assumes order and structure, and in emergency care there is much more chaos and unpredictability than implied by best practice. Similarly, solutions derived from a former experience of dealing with a similar problem were of a limited value since this form of chaotic situation was unique and there was no right solution that could be applied to all patients.

Inter 10, lines 129

“There was no space for analysing the recognition of sepsis.”

Such clinical problems, while not amendable to best practice, could be understood through the practice of management of chaos and innovation in parallel. This practice demanded proposing prompt actions to handle and stabilize the situation, perceiving the outcomes of the resuscitation procedures and then taking further actions accordingly. In this sense, any practice is novel in terms of execution and reliant on the results of resuscitation procedures.

The evidence of these claims is captured in the following excerpts. Interviewee 10 and Interviewee 03 described the chaotic context of urgencies where the patient was rapidly deteriorating, thus neither best practice nor rules or procedures were considered for that kind of problem. Interviewee 10 and Interviewee 03 implied that during emergency situations very little knowledge is available at first, which strongly favoured innovative practice that was required to face the initial stages of patient deterioration, particularly for stabilising the condition and improving outcomes. The initially uncertain knowledge of clinical requirements was reliant on the results of resuscitation procedures. What can be seen from the Interviewee 10 example is that novel practices may be abandoned as quickly as they are adopted in an effort to stabilise the patient.

Inter 10, lines 378-387

Interviewer: "What helped you to realise that, you know, you are on the right track with whatever you've done?"

Participant: "Because er... when we were doing things and although we were not actually pretty much doing anything, so we were definitely on the wrong track, but it was the only track for this patient. There was immediate feedback as well from the doctor. Like, oh this is not working, that's why it's not working, what do we try next? So..."

"We knew that we are not missing things because even though we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we're not achieving, we're having to think about why are we not achieving and what will we do next. So that's what's reassuring why we are doing things so right."

Inter 03, lines 106-115

Interviewer: "... how do you judge that something that you've done to early recognise sepsis has been successful?"

Participant 03: "There so many so many occasions, so patients get worse in the ward when they are transferred to us into the ITU without being actually diagnosed as having septic symptoms, but when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn't think that would be a cause for sepsis but if you sometimes what I think like when you receive a patient, by looking at them, they are clammy, like a labored breathing, less urine output, I have had these patients several times, for these patients who are going into sepsis you are going to note anything else apart from neuro problems, it is not a respiratory problem, it is like a whole of the systems maybe needing help with. But most of the time antibiotics will be started at the earliest, so that is also helpful."

Interviewer: "You have mentioned quite a few times organ failure, so I was going to ask you said that patient progressed for organ failure, so what are you trying to achieve with identifying early organ failure, as you've mentioned?"

Participant 03: "I mean, if a patient experience low heartbeat, low blood pressure, or like you know, something which is actually keeping the right organ function, there is always a possibility that they can go in to organ without having it sophisticated in time, so basically, again, it does reflect back to the early recognition and securing the organs well before it goes into like shutdown, so most of the time the patients will be on like CVVH or something to restore the function, so that can be prevented, if we are able to identify these symptoms in time, and treat it, like, say for example, if we have a low blood pressure, treat it with fluid on this occasion and also you know hypertonic solution or with the medications to manage their blood pressure, you know, inotropes and identify it at the same time."

Interviewer: "And you've mentioned all of this, so once you know all of that, how did you go about that to help recognise sepsis?"

Participant 03: "I mean, it's a team work, so if it is like if it is if you have a doubt about what your patient is experiencing, it should be alerted to the higher level and maybe more investigations could be done, like blood samples to be taken, anyway this will be done if the patient is coming into this kind of situation anyway, so get, you know, blood samples taken and analyse it at the earliest enough, and then maybe they need any what you call it, any treatment at the same time, it should be initiated very early enough with the help of the doctors who is managing that unit, then that can be done."

What can be seen is that, within this practice, clinical problems are not to be addressed with perceived wisdom or comprehended via experimentation and learning from experience. Instead, within this practice, clinical problems are to be stabilised and conditions formed from which patterns can emerge.

Reasoning strategy: Transient

As noted in emergent care, reasoning strategy is a frequently occurring aspect in the data analysis and serves as critical to each category. All nurses emphasised an overall a reasoning strategy; however, the meaning associated with this differed depending on the category it occurs in. In the nurses' reasoning process, life-saving measures and urgent care take precedence over other clinical requirements. Investigation measures were uncertain and reliant on the results of resuscitation procedures. Within this reasoning strategy, communicating with doctors in a top-down style is critically important, as a doctor directs the resources. There is no time for consultation and reaching agreement. In addition, logic and rationality appear to fail in such situations.

This line of reasoning is transient. Once the crisis is over, an ongoing top-down approach seems to be abandoned. Following a life-saving action, nurses sense the spot where stability is present or absent and respond by working towards changing the situation from emergency care to emergent care to understand the problem, or disease-specific care to address the problem. The evidence of these claims is highlighted in the following example. Although nurses began reasoning in terms of emergency care, they moved the reasoning in terms of emergent care and disease-specific care. In this sense, Interviewee 03 seemed to manage chaos and innovation in parallel: while engaged in a crisis, the nurse ultimately thinks in terms of interconnected systems with an attempt to resolve the puzzle of the patient's problem. Should the nurse wait until the emergency is over, the opportunity for resolving the puzzle of the patient's problem might be lost.

Inter 03, lines 106-115

Interviewer: "... how do you judge that something that you've done to early recognise sepsis has been successful?"

Participant 03: "There so many so many occasions, so patients get worse in the ward when they are transferred to us into the ITU without being actually diagnosed as having septic symptoms, but when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn't think that would be a cause for sepsis but if you sometimes what I think like when you receive a patient, by looking at them, they are clammy, like a labored breathing, less urine output, I have had these patients several times, for these patients who are going into sepsis you are going to note anything else apart from neuro problems, it is not a respiratory problem, it is like a whole of the systems maybe needing help with. But most of the time antibiotics will be started at the earliest, so that is also helpful."

Interviewer: "You have mentioned quite a few times organ failure, so I was going to ask you said that patient progressed for organ failure, so what are you trying to achieve with identifying early organ failure, as you've mentioned?"

Participant 03: "I mean, if a patient experience low heartbeat, low blood pressure, or like you know, something which is actually keeping the right organ function, there is always a possibility that they can go in to organ without having it sophisticated in time, so basically, again, it does reflect back to the early recognition and securing the organs well before it goes into like shutdown, so most of the time the patients will be on like CVVH or something to restore the function, so that can be prevented, if we are able to identify these symptoms in time, and treat it, like, say for example, if we have a low blood pressure, treat it with fluid on this occasion and also you know hypertonic solution or with the medications to manage their blood pressure, you know, inotropes and identify it at the same time."

Interviewer: "And you've mentioned all of this, so once you know all of that, how did you go about that to help recognise sepsis?"

Participant 03: "I mean, it's a team work, so if it is like if it is if you have a doubt about what your patient is experiencing, it should be alerted to the higher level and maybe more investigations could be done, like blood samples to be taken, anyway this will be done if the patient is coming into this kind of situation anyway, so get, you know, blood samples taken and analyse it at the earliest enough, and then maybe they need any what you call it, any treatment at the same time, it should be initiated very early enough with the help of the doctors who is managing that unit, then that can be done."

Inter 10, lines 378-387

Interviewer: "What helped you to realise that, you know, you are on the right track with whatever you've done?"

Participant: "Because er... when we were doing things and although we were not actually pretty much doing anything, so we were definitely on the wrong track, but it was the only track for this patient. There was immediate feedback as well from the doctor. Like, oh this is not working, that's why it's not working, what do we try next? So..."

"We knew that we are not missing things because even though we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we're not achieving, we're having to think about why are we not achieving and what will we do next. So that's what's reassuring why we are doing things so right."

Inter 10, lines 112-116

“But it was extremely intense.”

“Like it was nonstop. The only thing that I was doing was the doctors’ orders. I didn’t even do anything with the patient, you know, we didn’t do anything to that patient nursing wise, it was doctor’s orders. Drugs, drugs, drugs. Lines drugs, lines drugs. Nothing else.”

Success: Judging success by evaluating the effects of resuscitation procedures

As noted in previous categories, the success of early recognition of sepsis is another frequently occurring theme in the study. All nurses described success of early recognition of sepsis; however, the meaning associated with it differed depending on the category in which it occurs in. Yet, similar to the previous categories, descriptions of success within emergency care are also seen as an overall judgment if the performance yielded the results expected for it, but in much different terms. In emergent care, judging the performance means evaluating if experimentations yielded the results expected for them. Here, it means evaluating if the performance of resuscitation procedures yielded the results expected for them. The evidence of these claims can be seen in the following excerpt:

Inter 01, lines 142-144

“... if you stop deteriorating and you reverse the process. And if you ideally can identify the root cause of this, that's the big help, but that doesn't always happen...”

Pattern of actions: Act, sense and respond

As noted in the previous categories, pattern of actions is one of the most frequent aspects emergent in data analysis and serves as critical to each category. Pattern of actions occurs across all participants; however, the meaning associated with it differs depending on which context it occurs in. However, like descriptions of the pattern of actions in emergent care, descriptions within emergency care also begin with action. Life-saving measures and urgent care take precedence over other clinical requirements such as performing investigations.

The pattern of actions consists of act, sense and respond. However, in emergency care, an action is not an experimental measure for targeting an insight, but instead is an emergency measure for stabilization. In emergency care, sense is not of patterns but where the stability is situated, followed by responding with turning the chaotic situation into a complex situation.

The evidence of these claims is evident in the following excerpts. To respond within the context, taking immediate action to constrain the problem seems to be the only available way, thus necessitating the pattern of actions of act-sense and response in which the action is to establish stability,. This is followed by sensing where the stability is situated, and then responding by transforming the chaotic situation into a complex situation.

Inter 10, lines 378-387

Interviewer: "What helped you to realise that, you know, you are on the right track with whatever you've done?"

Participant: "Because er... when we were doing things and although we were not actually pretty much doing anything, so we were definitely on the wrong track, but it was the only track for this patient. There was immediate feedback as well from the doctor. Like, oh this is not working, that's why it's not working, what do we try next? So..."

"We knew that we are not missing things because even though we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we're not achieving, we're having to think about why are we not achieving and what will we do next. So that's what's reassuring why we are doing things so right."

Interviewer: "You have mentioned quite a few times organ failure, so I was going to ask you said that patient progressed for organ failure, so what are you trying to achieve with identifying early organ failure, as you've mentioned?"

Participant 03: "I mean, if a patient experience low heartbeat, low blood pressure, or like you know, something which is actually keeping the right organ function, there is always a possibility that they can go in to organ without having it sophisticated in time, so basically, again, it does reflect back to the early recognition and securing the organs well before it goes into like shutdown, so most of the time the patients will be on like CVVH or something to restore the function, so that can be prevented, if we are able to identify these symptoms in time, and treat it, like, say for example, if we have a low blood pressure, treat it with fluid on this occasion and also you know hypertonic solution or with the medications to manage their blood pressure, you know, inotropes and identify it at the same time."

Interviewer: "And you've mentioned all of this, so once you know all of that, how did you go about that to help recognise sepsis?"

Participant 03: "I mean, it's a team work, so if it is like if it is if you have a doubt about what your patient is experiencing, it should be alerted to the higher level and maybe more investigations could be done, like blood samples to be taken, anyway this will be done if the patient is coming into this kind of situation anyway, so get, you know, blood samples taken and analyse it at the earliest enough, and then maybe they need any what you call it, any treatment at the same time, it should be initiated very early enough with the help of the doctors who is managing that unit, then that can be done."

Table 12: Summary of aspects relating to process in emergency care

| Aspect | Meaning |
|--------------------|---|
| Type of practice | <p><i>"...when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn't think that would be a cause for sepsis..."</i></p> <p><i>"...for these patients who are going into sepsis you are going to note anything else apart from neuro problems, it is not a respiratory problem, it is like a whole of the systems maybe needing help with." (Interviewee 03).</i></p> |
| Reasoning strategy | <p><i>"...there is always a possibility that they can go in to organ without having it sophisticated in time, so basically, again, it does reflect back to the early recognition and securing the organs well before it goes into like shutdown..."</i></p> <p><i>"...if we are able to identify these symptoms in time, and treat it, like, say for example, if we have a low blood pressure, treat it with fluid on this occasion and also you know hypertonic solution or with the medications to manage their blood pressure, you know, inotropes and identify it at the same time" (Interviewee 03).</i></p> |
| Success | <p><i>"... if you stop deteriorating and you reverse the process" (Interviewee 01).</i></p> |
| Pattern of Actions | <p><i>"... we are in the fast track for the patient, we kind of had the feedback on a further plan. So as long as we were sticking to that, hence why we're not achieving, we're having to think about why are we not achieving and what will we do next" (Interviewee 10).</i></p> |

4.3.4.3 Learner

In emergency care, learner-related aspects predisposed nurses towards adopting this approach, such as a learning method.

Learning method: Crisis management

There were aspects from the learners' method side that predisposed nurses towards adopting emergency care of early recognition of sepsis. Learner method emerged in all transcripts and contributed to each way of experiencing early recognition of sepsis.

This method helps explain why nurses in emergency care began seeing things differently and in novel ways.

Much of the power of sepsis recognition in emergency care relies on good crisis management. Much of the basis of this power relies on the ability to establish order, sense the spot where stability is present or absent and respond by working towards changing the situation from emergency care to emergent care, to understand the problem, or disease-specific care, to address the problem. Commonly, management of crisis is depicted as merely a challenging experience full of uncertainty and a sense of urgency to avoid potential negative impacts on the patient. Here, it served as an essential condition under which creative action and innovative outcomes emerge. In addition, some nurses provided indications that explained why engagement in management of crisis inspires innovation. During the management of a crisis the limitations, such as entrained patterns, seemed to dissolve, allowing nurses to see things differently and identify novelty. This is because, under such conditions, nurses' conventional modes of reasoning and action have no longer benefited them.

There are a number of examples that demonstrate the management of crisis as a prerequisite for the emergence of new ways of thinking. An engagement in crisis management encouraged Interviewee 09 to see a clinical picture of the patient.

Inter 09, lines 113-119

"I think what made it so memorable was because she had gone in for a fairly straight forward surgical procedure and we weren't really expecting her... we were just expecting her to recover and then get downgraded back to the ward and I think because she was quite young and we attributed some of her elevated respiratory rate due to anxiety and her mum was with her at the time and I think her mum was creating quite a lot of anxiety for her by being present, and because her mum was quite anxious, and I think in hindsight I would probably

have removed myself away from the emotive issue of her being anxious to more of a clinical picture of her...

Interviewee 03 implied that crisis management promoted a state of genuine hesitation and served as an impetus for thinking in more broader terms, because the conventional ways of thinking were no longer viable.

Inter 03, lines 195-204

Interviewer: "...can you remember any example when you have realized that you've gained new knowledge and skills to recognise sepsis?"

Participant 03: "Hmm, I have to really think about it because my knowledge whatever I gained I've always tried to put it into practice, so when I look after a patient, I always think broadly if there's anything, say for example, that if I work in neuro ITU, although I just mainly focusing on neuro patient, we do get several patients out of hours like coming from different department, so those times it's like it making you think more widely just not just to focus on one you know specific area, so I always use my knowledge then, although this is not like you know, concrete deep, whatever knowledge I knew then, I had then, I've always used them to look after my patients, that's what I was thinking when I think back."

An engagement in crisis management also encouraged Interviewee 14 to think in broader terms and consider sepsis alongside other conditions. The experience left them with a sense of urgency coupled with the realisation that immediate actions were required to reduce the possibility that detrimental effects would follow.

Inter 14, lines 183-187

"Yeah, the patient, my patient is having sepsis and I didn't really raise it as a very serious matter. I know it is serious because my patient is unwell, but I only knew that it was very serious, you know, when the doctor told me, it is sepsis. Erm, and he's not very well. So he's not going to do very well. He needs like proper monitoring, he needs to be in the high dependency unit and that's when I only know, oh it is a very serious matter."

Inter 14, lines 143-144, 151-154

Interviewer: "Can I ask what have you learned from it that maybe informs your future decisions now?"

"I was like, oh that's true, it could be sepsis and that's when it only made me aware you know that when these things happen I should, I should always consider sepsis and not just the other, other diagnoses, because at that time, I wasn't just very aware of sepsis, and I think that is the most important thing".

Inter 10, lines 394-407

Interviewer: "What does it take to learn all of that?"

Participant 10: "...when you have a few situations that are pretty er... so again, experience probably because you can't learn [0:29:44] by the book. You can learn the parameters by the book, but unless you will be a few times in the situation, feeling like shit and stressed as hell, you will learn that the way to move forward is the team work and a good leader.

But it takes a few. You can write it in a book but I think it takes a few situations to realise, alright this was really er, a horrific situation with patient, but I was working with this and that and that and that's what went wrong. This was a horrific situation with the patient, but I had really good people around and good plans and good communication. So that's why it felt right the next day. Even though you felt tired.

Table 13: Summary of aspects relating to learners in emergency care

| Aspect | Meaning |
|------------------------|--|
| <i>Learning method</i> | <i>“You can learn the parameters by the book, but unless you will be a few times in the situation, feeling like shit and stressed as hell, you will learn that the way to move forward is the teamwork and a good leader...” (Interviewee 10).</i> |

FOUR CATEGORIES OF UNDERSTANDING EARLY RECOGNITION OF SEPSIS

As described above, four different ways of understanding sepsis recognition were discovered:

- (A) Protocol-based care
- (B) Disease-specific care
- (C) Emergent care
- (D) Emergency care

Several themes could be seen as highlighting the differences between the categories related to early recognition of sepsis: availability of data, predictability, cause and effect relationship, type of practice, reasoning strategy, strategy, and learner-related aspects. These aspects contributed to larger components of context, process and learner. Based on the differences, it was possible to organise the categories in a hierarchical manner so that the first category represents the least complex way of understanding, and the fourth category the most complex way of understanding.

How the categories are related – the outcome space

The research outcomes of phenomenographic research are not only the development of the categories, but also the logical relationship between them, which is examined in the final phase of the data analysis. The four categories of understanding and the internal relationships between them constitute the outcome space.

In this study, there is a logical relationship between understanding (A), (B), and (C). Nurses with the conception (B) process information by analysing multiple options. To achieve that, nurses must, for instance, have understanding of established practice. That is, they must also bring aspect (A) into focus.

The opposite is, however, not the case; it is possible to process information based on established practice without analysing multiple options. Also, it is possible to adhere to established knowledge (A) without exploring new possibilities and knowledge with intention to find the truth (C). This hierarchy is supported by the distribution of ways of experiencing; understanding (C) does include understanding (B) or (A). In an analogous way it can be presented that understanding (D) also includes (C) and (B).

Interviewee 03 described this concept with respect to knowledge.

Inter 03, lines 374-379

Interviewer: '...what does learning to recognise sepsis mean to you?

Participant 03: 'A lot to me because unless you know what you 're doing, you won't be able to act, so if you have the knowledge, you will be able to, you know, put into practice of your daily nursing care, so it is after the knowledge you actually alerted to the theoretical knowledge. That's my experience.'

What it takes to understand something

The following section outlines the development of understanding, which deals with the flow and movement of understanding between categories. This study found that developing understanding, in this case recognising sepsis, is a multistage process that takes advantage of a series of different understandings of sepsis recognition

depending on the context in which nurses operate. This preferentially occurred as a constant refinement of the current understanding. In this respect, developing expertise means learning the different ways early recognition of sepsis can be understood.

The key aspect to developing understanding is a shift of understanding of work in question, which occurs generally only when nurses were challenged with a situation that cannot be accomplished within the present understanding. In this study, even if nurses predominantly drew upon one way of understanding, they also drew some of the time upon all or some of the other ways of understanding or transitioned to and from one way understanding to another. Nurses took advantage of a series of reasoning strategies, and which strategy was used was dependent on the context in which nurses were working. Even though different categories made use of different thinking strategies, they communicated via the continuous flow of knowledge that is gradually generated, reflecting a context-driven and flexible approach to clinical practice.

In the following excerpt, three distinct levels of processing to generate knowledge and recognise sepsis were noticeable within one transcript, demonstrating that if nurses predominantly process information in one specific category, they also process them some of the time in all or some of the other categories, or shift to and from one category to another to generate knowledge. For Interviewee 21, protocol-based reasoning is only a point of departure and is followed by conceptualising the problem with investigatory forms of reasoning to confirm whether or not the patient has sepsis. The nurse demonstrated an understanding of different contexts within which she/he was working with a corresponding change in clinical behaviors and decisions to match that context.

Inter 21, lines 80-85

“So, a little like the qSOFA that they have at XXXX [name of hospital]. So, it was if you had any two out of the three, so I think resp. over 22, a systolic blood pressure below 100 or a new altered conscious state, state of consciousness. !

think if it was any two out of those three. If I remember rightly then you would treat or investigate whether they did have sepsis.”

Interviewee 03 demonstrated that the ability to recognise sepsis was made up of three distinct forms of reasoning. Conceptualising the patient’s clinical presentation only in terms of providing emergency care was merely a point of departure, and followed by incorporating other forms of reasoning to generate knowledge and recognise sepsis. The first form of reasoning was based on taking immediate action to stabilise the patient and observe patterns (emergency care); this continues with forming connections among the various systems according to emergent patterns (emergent care); and was followed by calling in experts and analysing multiple options (disease-specific care).

Inter 03, lines 106-116

Interviewer: “And, uh, back to your experience, how do you judge that something that you’ve done to early recognise sepsis has been successful?”

Participant: “There so many so many occasions, so patients get worse in the ward when they are transferred to us into the ITU without being actually diagnosed as having septic symptoms, but when you come when you receive a patient like you know, going or having very, needing intubation say for example, so you wouldn’t think that would be a cause for sepsis but if you sometimes what I think like when you receive a patient, by looking at them, they are clammy, like a laboured breathing, less urine output, I have had these patients several times , for these patients who are going into sepsis you are going to note anything else apart from neuro problems, it is not a respiratory problem, it is like a whole of the systems maybe needing help with. But most of the time antibiotics will be started at the earliest, so that is also helpful.”

Inter 03, lines 128-135

Interviewer: ‘And you’ve mentioned all of this, so once you know all of that, how did you go about that to help recognise sepsis?’

Participant : ‘I mean, it’s a team work, so if it is like if it is if you have a doubt about what your patient is experiencing, it should be alerted to the higher level and maybe more investigations could be done, like blood samples to be taken, anyway this will be done if the patient is coming into this kind of situation anyway, so get, you know, blood samples taken and analyse it at the earliest enough, and then maybe they need any what you call it, any treatment at the same time, it should be initiated very early enough with the help of the doctors who is managing that unit, then that can be done.’

As illustrated in the excerpt above, the nurse indicated that the shift of understanding from A to B to C required a more comprehensive way of understanding the

phenomenon. However, there is no evidence in this study to support that such a shift occurs in a stepwise manner through years of professional experience.

Table 14: Twenty-six qualified nurses' predominant (++) and less dominant (+) ways of understanding the sepsis recognition role

| Interviewees | | Protocol-based care | Disease-specific care | Emergent care | Emergency care |
|--------------|----------------|---------------------|-----------------------|---------------|----------------|
| 6 | Female (<5) | ++ | + | | |
| 21 | Female (<5) | ++ | + | | |
| 8 | Female (<5) | + | ++ | | |
| 5 | Female (<5) | + | ++ | + | |
| 7 | Female (<5) | + | + | ++ | |
| 04 | Female (<5) | + | ++ | + | |
| 19 | Female (<5) | + | ++ | | |
| 25 | Male (<5) | + | ++ | | |
| 24 | Male (5-10) | + | + | ++ | |
| 02 | Female (5-10) | + | ++ | + | |
| 10 | Female (5-10) | | | ++ | + |
| 13 | Female (5-10) | + | ++ | | |
| 14 | Female (5-10) | + | ++ | | |
| 11 | Female (5-10) | + | ++ | + | |
| 16 | Female (5-10) | + | + | ++ | |
| 20 | Female (5-10) | + | ++ | | |
| 22 | Female (5-10) | | + | ++ | |
| 26 | Female (5-10) | + | ++ | | |
| 01 | Female (15-20) | + | + | ++ | |
| 15 | Female (15-20) | + | ++ | + | |
| 18 | Female (15-20) | | + | ++ | + |

| | | | | | |
|----|----------------|---|----|----|---|
| 23 | Female (15-20) | + | ++ | | |
| 03 | Female (>20) | + | + | ++ | + |
| 17 | Female (>20) | | ++ | + | |
| 09 | Female (>20) | + | + | ++ | + |
| 12 | Female (>20) | + | + | ++ | |

The number in brackets indicates years of practice after becoming a qualified nurse.

4.4 Summary of the data

This chapter presented four distinct ways how nurses understand early recognition of sepsis which are arranged in an outcome space. This includes descriptions of the relationships between the components of context, process and learner and of the aspects that contribute to every component that nurses find essential to the meaning they ascribe to every way of understanding early recognition of sepsis. *Figure 4* illustrates these relationships. According to the participants of this research, differences in the experience of contexts, process and learning influenced the meanings nurses assign to early recognition of sepsis. The outcome space of the research was arranged in a hierarchical manner and offers a new understanding of learning processes pertinent to early recognition of sepsis. It shows how learning processes become more complex as nurses move from the simple to more complex context. This also shows that, although understandings are related, they are not a greater reproduction of each other but rather qualitatively different. Each understanding has qualitatively distinct characteristics that distinguish it from the other. While some understandings of early recognition of sepsis are limited to learning tasks, others look beyond that to the world that opens up new possibilities because of the distinct ways of making use of knowledge.

These different ways of understanding of early recognition of sepsis reveal that, depending on which context they worked in, nurses think and learn differently rather than one size fitting all. These different ways of understanding early recognition of sepsis help to reveal that developing understanding, in this case recognising sepsis, is a multistage process that takes advantage of a series of different understandings of sepsis recognition, depending on the context in which nurses operate. The following chapter discusses the outcomes of this study in order to explain their contribution to sepsis recognition practice, education and research. These are then considered in relation to the literature.

Chapter 5: Discussion

5.1 Introduction

The aim of this research was to explore a range of nurses' experiential perspectives to understand what constitutes early recognition of sepsis. In the second chapter, directions in, and influences on, our current understanding of nursing competence, the development of nursing competence and the nursing competence research were examined. Based on the literature review, it was then argued that researching sepsis recognition expertise in terms of the varying ways in which it is understood or experienced in nursing community would lay a foundation for adopting a relational view of sepsis recognition competence and its development. This was made possible as a result of the use of a phenomenographic approach to research.

In traditional view of nursing competence:

- Descriptions of nursing competence are made in terms of attributes of individuals.
- Development of nursing competence is viewed as making possible the acquisition of these attributes.
- Research is conducted into desirable attributes of knowledge users.

In this new relational view of nursing competence, however:

- Investigation was conducted into understandings of sepsis recognition.
- Descriptions of competence were made in terms of understandings of the phenomenon.
- Development of nursing competence is now seen as learning to understand effective knowledge use, that is sepsis recognition expertise, in new and increasingly sophisticated ways.

5.2 Discussion of findings in comparison to relevant literature

The outcomes of this study are now discussed in order to explain their contribution to sepsis recognition practice, education and research. These findings are analysed in the light of the literature and compared with existing thinking about nursing competence and its development. The comparison has led to the development of implications and recommendations for education, practice and research.

The following headings are used to organise the discussion:

- How may the findings of this study be interpreted in light of the literature?
- How does this study contribute to our understanding of sepsis recognition?
- How does this study contribute to sepsis recognition education?
- How does this study contribute to sepsis recognition research?

How may the findings of this study be interpreted in light of the literature?

Findings from this study revealed four different understandings representative of the variation in understanding of early recognition of sepsis: protocol-based care, disease-specific care and emergent care and emergency care. One category of the outcome space broadly corresponds to one way of understanding sepsis recognition highlighted within the literature and recommended for clinical practice (Daniels, 2012, Daniels et al., 2011, Evans et al., 2021, Singer et al., 2016). However, in exploring the variation of understandings within the categories of descriptions a much more complex picture than simply one way of understanding was found. A phenomenographic approach has allowed for both differentiation between distinct understandings of early recognition of sepsis as well as for more comprehensive ways of understanding early recognition of sepsis which can be differentiated from those less comprehensive ones.

It is interesting to note that, even though four different ways of understanding early recognition of sepsis were identified, only very few nurses' practices limited the

recognition of sepsis by following protocol-based care. A possible explanation for this result is that guidelines pay little attention to patient preferences and values (McCormack and Loewen, 2007), and instead implicitly assert that all patients share the values of people producing the guidelines. In the case of patients do not share those values, problems become complex. It is not surprising therefore that knowledge that emerges from individual patients is seen as of great value to inform management of the patient's condition, particularly if patients' values and goals are combined with evidence.

Towards a new understanding of nurses' educational needs

According to the research participants, variations in the experience of contexts, process and learning influenced the meanings nurses assign to knowledge and skills related to early recognition of sepsis. A number of related aspects are highlighted by the findings. First, knowledge and skills do not have fixed meanings, but instead acquired meaning through the specific way that work is experienced. For example, the findings show that the meaning of the reasoning capability varied depending on what experience it occurs in. In protocol-based care, reasoning capability means understanding how the patients physiological values match predetermined criteria from a protocol. In disease-specific care, reasoning capability meant complicated analysis and understanding the consequences at various levels. In emergent practice, reasoning capability meant adapting to novel and unique stimuli from the clinical environment. Lastly, in the fourth conception, establishing order and knowledge of early recognition of sepsis meant knowing the presence and absence of stability from established order to ultimately recognise patterns.

In light of these findings, the educational needs for early recognition of sepsis are not mainly a fixed set of knowledge. Rather, nurses' knowledge, skills and other attributes used in recognising sepsis are proceeded by and founded upon their ways of experiencing the phenomenon. It is the nurses' ways of experiencing the phenomenon

that constitute, shape and organise their knowledge and skills into different expertise in carrying out sepsis recognition.

The findings of the present study do not support previous research that describes competence in the workplace as an attribute-based phenomenon. According to Sandberg (2009), traditionally the approaches to competence (which differ in the ways they identify competence), still provide similar theories of workplace competence as all view competence as an attribute-based phenomenon. Within those approaches, competence is described as constituted by a definite set of attributes that people utilise to carry out their work. Furthermore, attributes are mainly seen as context-free. In other words, a fixed attribute is perceived as having a fixed meaning in itself; it is viewed as separate from context and thus able to be implemented in a variety of work performances. According to Sandberg (2009), this view of competence is then reflected in the simplified version of competence development, which is based on a principle of transferring knowledge and skills as efficiently as possible to the learner who lacks them.

In light of this evidence, it can be deduced that the current view of the educational needs for early recognition of sepsis is mainly a fixed set of knowledge, which is not only oversimplified, but also founded on a false premise which views knowledge as a fixed entity. Therefore, there is a need to shift thinking about sepsis recognition expertise from the acquisition of attributes, to seeing it as coming to conceive of sepsis recognition in different ways of relating to the phenomenon.

Another significant finding is an improved insight into what it takes to understand something. This study found that development of understanding is related to the flow and movement of understanding between categories. More specifically, this study

found that developing understanding, in this case recognising sepsis, is a multistage process that takes advantage of a series of different understandings of sepsis recognition depending on the context in which nurses operate. It preferentially occurred as a constant refinement of a current understanding. The key aspect to developing understanding is a shift in the understanding of the work in question, and this occurs generally only when nurses are challenged with a situation that cannot be accomplished within their present understanding.

In this study, even if nurses predominantly drew upon one way of understanding, they also drew some of the time upon all, or some of the other ways of understanding, or transitioned to and from one way understanding to another. Nurses took advantage of a series of reasoning strategies, depending on the context in which nurses were working. Even though different categories make use of different thinking strategies, they communicate via a continuous flow of knowledge that is gradually generated, reflecting a context-driven and flexible approach to clinical practice. In this sense, a single form of reasoning was not, by any means, highly advantageous in the realm of nursing behavior. A combination of multiple forms of reasoning were used cooperatively. For example, reasoning in terms of an interconnected system was used simultaneously in one situation with some other reasoning strategies, such as analytical approaches, although one was typically a dominant part of the process.

The literature shows that scholars are opting for interpretations which emphasise one way, or a limited number of ways, in which people think about the timely detection of clinical deterioration and sepsis, instead of embracing the full range of reasoning approaches. Many of these articles lean in the direction of protocol-based care. In 2021, the Surviving Sepsis Campaign Guidelines recommended sepsis screening to improve the timely recognition of sepsis as part of sepsis performance improvement programmes (Evans et al., 2021). The measures, such as early warning systems, are recommended for the detection of patient deterioration in a broad range of

geographical areas, particularly the National Early Warning Score (NEWS) and its modified version NEWS2 (Hydes et al., 2018, Kim et al., 2020, Scott et al., 2020) and advocated for as screening tools for sepsis (Lim et al., 2019, Pullyblank et al., 2020, RCP, 2017). Despite their wide dissemination, timely detection and response to clinical deterioration remain suboptimal and a major risk to patient safety (Azimirad et al., 2020, Cho et al., 2020). Despite this, Early Warning Scores are widely implemented in acute care and recommended in UK hospitals by the NHS (NHS England, 2017a), the National Confidential Enquiry into Patient Outcome and Death (NCEPOD, 2015) and the National Institute for Health and Clinical Excellence (NICE, 2016) .

In the present study, timely detection and response to clinical deterioration, as we know it, in which one set of criteria is applied to a huge spectrum of clinical situations without consideration for heterogeneous populations of patients with sepsis, was often found of limited value. Protocol-based care was often found to be an important point of departure, but not the only one. Rather, a context-specific approach to sepsis recognition that takes advantage of a series of strategies was more relevant. This is because detecting patient deterioration and sepsis is a matter of holistic clinical assessment, drawing upon multiple reasoning strategies and considering multiple sources of information.

In the literature, the inclination towards a focus on protocol-based care is not universal. Some significant papers within this field do not emphasise it at all in their approach to sepsis recognition. Vincent et al. (2021), for example, continue to describe early recognition of sepsis in terms of protocol-based care, and whilst they focus on protocol-based care, they also acknowledge the importance of individualised care. The view is broadly complemented by Petersen (2016), Odell et al. (2009), Campanelli et al. (2022), and Filbin et al. (2018), who argue that the timely detection of patient deterioration and sepsis is vastly complex and affected by the context, demanding an improved insight into the context within which deterioration is detected.

In light of the findings, it can be deduced that the current view of detecting clinical deterioration and sepsis that entails only protocol-based care seems oversimplified. Therefore, there is a need to shift thinking about the detection of clinical deterioration and sepsis from merely protocol-based care to coming to conceive the phenomenon in many different ways.

The intention is not to leave the impression that the established approaches to early recognition of sepsis have no place in informing educators about practice, as they do when they are taken within the appropriate context of clinical practice. Consistent with Sturmberg and Martin (2008), each approach to practice is value-free, and neither is superior than any other; however, each approach takes advantage of different thinking strategies to generate knowledge and solve problems.

With this approach in mind, developing understanding, in this case, recognising sepsis, means learning the different ways early recognition of sepsis can be understood. The key aspect to developing understanding is a shift of understanding of the work in question. Shifting understanding from sequential A to B to C thinking requires a more comprehensive way of understanding the phenomenon. There is no evidence in this study to support that such a shift occurs in a stepwise manner through years of professional experience, as reported in previous studies.

Benner (1984) detailed the acquisition of nursing competencies and identified five possible levels of competence acquisition, originally identified by Dreyfus and Dreyfus (1986) and labelled as novice, advanced beginner, competent, proficient; and expert. In the study, Patricia Benner sought to determine the ways in which practice between nurses at diverse stages in their professional experience differed via examination of the critical incidents that her research participants experienced. She was able to match the data of the nurses' experiences to the model of skill acquisition espoused by Dreyfus

and Dreyfus (1980). By drawing on this concept of competence acquisition, Benner (1984) positioned competence at the centre of a continuum that ranged from novice through advanced beginner, competent and proficient, to expert. According to Benner (1984), progressing through these five levels resulted in beneficial improvements and skill acquisition.

The present study challenges this view of competence development; there is no evidence in this study to support that such a shift occurs in a stepwise manner through years of professional experience as reported in previous studies. The potential explanation for this is that learning to recognise sepsis preferably occurred as a constant refinement of the current understanding. With this approach in mind, a more appropriate way of competence development assumes a transition in understanding, and this typically occurs when the context changes and the current way of solving a problem does not serve the purpose. This concept might be explained in terms of two ways of relating to the world and to the self. It is based on a non-dualistic ontology which believes that reality is constructed in each person's individual relationship with the world in their personal experience. The reality evolves and gets more complex with every new experience, resulting in a better comprehension of the world (Marton and Booth, 1997).

These results have not previously been described. In the Dreyfus model (Dreyfus and Dreyfus, 1980) and other staged models, a focus on phases veils more essential aspects of development; it diverts attention away from the question of how understandings operate. As a result, a central dimension of professional expertise, such as understanding of and in practice, are neglected. Findings from this doctoral study also broadly supports the concept of reflective practice, which has been described as a process of learning and development that incorporates evaluation of one's own practice, and involves experiences, judgments, feelings and activities and knowledge for the purpose of enhancing it (Atkins, 2004, Duffy, 2007). Several assets

attributed to reflective practice are consistent with this study, such as the development of the knowledge embedded in practice (Argyris and Schön, 1974) and the importance of nurse's expertise (Johns, 2000), the development and improvement of professional practices (Boyd and Fales, 1983, Reid, 1993), the probability of linking the theory-practice gap (Schön, 1983) and finally, generation of innovative learning tools (Conway, 1994, Driscoll and Teh, 2001, Walsh et al., 2002).

As described above, the significant finding generated by the phenomenographic approach is identifying the key aspect to developing and shift understanding of the work in question. The question remains how does the shift of understanding of work happen? According to the findings of the present study this question is of significance. The common difficulty reported in this study was perceived changes from a common frame of reference for determining actions and drawing conclusions to a more holistic frame of reference for interpreting events, particularly in novel and unexpected situations. In such situations, nurses experienced a tendency to fall back on the familiar, well-established problem-solving techniques. The tendency was depicted as a trained response according to what is familiar based on the viewpoints obtained from recent experience, thus preventing them from appreciating subtle signals indicative of sepsis.

In bringing in the literature regarding Dewey's account of habit, Dewey (1973) and Dreyfus and Dreyfus models (Dreyfus and Dreyfus, 1986) have called attention to the concept of thoughtless mastery of the daily practice that occurs in the absence of thoughtful deliberation. Dewey (1932) points out that even when intuitive decisions appear evident, it might not necessarily be an optimal decision and, thus, prior to responding, prolonged mental contemplation might be needed. Intuitive decisions may need to be treated as subject to improvements, validation and reconsideration through examining, inquiring, and turning things over in the mind. In relation to the concept of thoughtless mastery of the daily practice, Dewey (1922) introduced a distinction

between routine and intelligent habits. The former is a form of repetition, commonly nondeliberate with a goal of supporting the ability to replicate a preconceived set of practices, despite changing contexts. The latter is a form of habit complemented by critical reflection, which involves reconstruction of habits based on gathered experience.

According to Hansen and James (2016), the goal of intelligent habits is to remain open to change and cultivate them to allow improved responses to changing contexts. While the cultivation of routine habits can be achieved through training, intelligent habits include continual and persistently increasing exposure to challenges and complex problems, as well as reflection and adjustment, as it demands reacting in flexible and diverse ways rather than just pursuing repetitions (Glăveanu, 2012). Based on this distinction, according to Dewey (1922), the world can be approached in two ways. One is experimental and reflective and results in development, and the second is experiential in that it upholds established practices and routine (Hickman and Alexander, 1998). Dewey claims that the central principle of reflective practice and learning is not purely thinking but testing the effects of theory in reality. Dewey places value on deliberate, functional processes that aim to learn something formerly undetected in order to complete an intellectual task, while referring to learning as a passive recipient of knowledge as intellectually ineffective.

This present study is in agreement with Dewey in recommending that while the cultivation of routine habits can be achieved through training, the intelligent habits includes continual and persistently increasing exposure to challenges and complex problems, as well as reflection and adjustment, as it demands reacting in flexible and diverse ways rather than just pursuing repetitions (Glăveanu, 2012). This view is consistent with the present study in the sense that the necessary shift of understanding of work in question happened when nurses were challenged with a situation that could not be accomplished within the present understanding. In the present study,

management of crisis, which is depicted as a challenging experience full of uncertainty and a sense of urgency to avoid potential negative impacts on a patient, served as an essential condition under which creative action and innovative outcomes emerge.

Nurses also explained why engagement in management of crisis inspires innovation. During the management of a crisis the limitations, such as entrained patterns, seem to dissolve, allowing nurses to see things differently and identify novelty. This is because under such conditions nurses' conventional modes of reasoning and action have no longer benefited them.

Much debate has also occurred in contemporary literature about how a change in action can take place when habit, which favors stability, is influential in human actions (Weiss, 2008). Weiss argued that the question is as critical for today's education as it was when John Dewey argued a century ago about the dynamic role of habits in people's reactions to novel stimuli and situations. According to Hansen and James (2016), Dewey's view of habit is highly relevant to the current educational system as it continues promoting high-stake testing and top-down accountability procedures that contribute towards the formation of personal habits which may prevent any effort to participate in community contemplation and activities.

Several authors argue that a change in context can influence the inclination for repetitions or routines and dissolve fixed habit (Bourdieu and Wacquant, 1992, Hickman and Alexander, 1998). In particular, in the context of deep uncertainty, we are driven to think and act in novel ways (Dewey, 1910). Several creativity researchers have also observed that encountering ill-defined issues may trigger creativity and imagination (Craft, 2015, Greene, 1995, Pretz et al., 2003). This might explain why Dewey viewed habit formation as "an expansion of power not its shrinkage" (Dewey, 1922, p.41).

Learning method

The present study was designed in a way that enabled examining learning and explaining why some learners possibly learn better than others. This study confirms that a learner's conception of learning is a valuable variable in that learning since it shapes their approach, and consequently influences the quality of learning outcomes (Marton and Booth, 1997). According to research participants here, variations in the experience of contexts, process and learning influence the learning outcome, which in the case of this study is the way of understanding early recognition of sepsis. Thus, when nurses were describing the experiences in this study, all of them discussed the way they understand their work in relation to how they engaged in learning. A specific way of learning was only relevant to the specific way of understanding early recognition of sepsis, indicating a strong relationship between the way nurses understand their work and conceptions of learning. For instance, the nurses who were recognising sepsis mainly by following protocol-based care engaged in learning through formal training. The nurses who were recognising sepsis mainly by following disease-specific care described their learning to recognise sepsis mainly through the application and replicability of previous experience, most notably information related to the patient observation which was compared to the previous experience with similar patients, allowing the same rules for drawing conclusions or for determining actions. Consequently, applying gained knowledge gained to future solutions methods in similar contexts.

The nurses who were recognising sepsis mainly by following emergent care mainly described their learning as making meaning of tacit clues, which involved perceiving, paying attention and acting upon tacit unspecifiable information that would often be ignored, not noticed nor critically evaluated. The implicit nature of learning took place within a social context. The nurses who were recognising sepsis mainly by following

emergency care described their learning mainly through management of chaos and facilitating change in parallel. Here nurses described their learning not as merely a challenging experience full of uncertainty, but also as an essential prerequisite for the emergence of new ways of thinking, thus expanding the learning to creative action and innovative outcomes. The emergency care approach is therefore chaotic and minimally structured and stable. Therefore, different ways of learning led to qualitatively different ways of understanding their work.

Learning environment

Equally, this concept was observed with respect to the learning environment. In describing their experiences, all nurses discussed the way they understand their work in relation to the learning environment. A specific learning environment was only relevant to the specific way of understanding early recognition, indicating a strong relationship between the way nurses understand their work and the environment in which learning occurs. Starting from category A, when the emphasis of the learning was on application of protocol, learning mainly takes place within clinical departments and universities. It entails posters on the walls, and information on the media, conferences, universities and publications, which all combine to confirm their beliefs that following information from protocols is the way to recognise sepsis.

However, the nature of the learning environment changes between categories A and C. The information approaches above become insufficient at a time when tacit unspecifiable clue management takes greater focus. At this point, the learning mainly takes place within an environment that allows for constant and unmediated exposure to the patient. It thus involves a learning climate that fosters learners' awareness of implications, connections and understanding of patient information. Therefore, different learning environments led to qualitatively different ways of understanding the work.

These findings offer a new understanding of the learning processes pertinent to early recognition of sepsis. It shows how learning processes at work become more complex as nurses move from the simple to more complex learning environment. These findings do not support the debates which have raised concerns about the generation of knowledge within the work-based learning context, questioning workplaces as a sustainable environment for learning (Fuller and Unwin, 2002). Dewey's (1987) view on work-based learning contributes to this discussion since he indicated that experiential learning does not occur in just any environment with just any individual or in every instance. Dewey (1987) proposed that learning environments for experiential learning need to be enriched. The conditions under which experiential learning occur include rich performance feedback and opportunities to communicate and reflect on experiential learning as part of a deliberate plan.

The inseparable relation among the way of engaging in learning and the outcome of that learning has also been empirically demonstrated by others who examined learning with attempt to explain why some learners learn better than others (Marton and Booth, 1997). This study confirms that a learner's conception of learning is a valuable determinant in that learning since it shapes how they go about learning, and accordingly influences the quality of learning outcomes (Marton and Säljö, 1976, Trigwell and Prosser, 1991).

Contextually specific conceptions of learning

This study found that particular conceptions of learning were relevant only in the particular context in which they performed their task, thus indicating a strong relationship between the way nurses understand their work and the context in which learning occurs. The phenomenographical approach allowed for description of the contexts under which different learning approaches are more or less relevant to justify using a particular approach. The methodology facilitated discerning whether one way

of learning can be more relevant than others and, if not, then linked it to more relevant conceptions of learning.

In describing their experiences, all nurses discussed conceptions of learning in relation to the specific context. The application of protocol conception seemed relevant in the context of decision making based on specific data from protocols. In this context, nurses could apply rules from a protocol to draw conclusions or for determining actions based upon objective facts and subjective features of the situation that are assumed to be recognizable without experience in the field. However, protocol-based care assumes single pathways, and in the disease-specific care, there was a much more diversity than implied by best practice. Therefore, in this context, learning is regarded as a reproduction or application of experience, and knowledge gained is then applied to future solutions and methods in similar contexts, even without sufficient evaluation of their viability. Both ways of understanding early recognition of sepsis, protocol-based care and disease-specific care, were characterised as having a high structure and high stability. Cause-and-effect relationships could be directly understood. Knowledge could be represented using explicit language. Thus, understanding here is more explicit and easier to articulate.

On the other hand, emergent care is less structured and stable, and we can see no cause-and-effect relationships. Understanding here tends to be intuitive and difficult to articulate to others. Learning via application and reproduction of experience becomes insufficient at a time when nurses had to make decisions on incomplete data. When dealing with incomplete data, meaning making enters the discussion. Therefore, when the focus of the learning expands to emergent care, learning is regarded as meaning making. When dealing with incomplete data, the implicit nature of learning takes place within a social context. In the context of crisis management, the meaning-making nature of learning becomes insufficient. In this context, management of chaos and facilitating change in parallel enters the discussion.

What these context-specific conceptions of learning signify is the approaches adopted by nurses are not an inherent trait but can vary from one context to another depending on factors such as availability of data. This means that that same nurses may adopt an application-directed learning strategy (following formula) to early recognition of sepsis, but they may adopt a meaning-directed learning strategy (seeking in depth meaning) to early recognition of sepsis when exposed to incomplete data because they may find it difficult to apply protocol to such data. In this respect, these results match a previous study (Vermunt and Donche, 2017) which provides further evidence that learning approaches are not stable and inherent traits.

These findings are also consistent with previous research on students' conceptions of learning that also demonstrated some commonalities in the conceptions of learning (Marton et al., 1993, Säljö, 1979, Trigwell and Ashwin, 2006) with variations predominantly depending on the context. This study confirms Säljö's (1979) notion concerning awareness of individuals with a completely developed conception of learning who show the ability to adopt various processes of learning for various purposes, and also adopt processes appropriate to various duties. Similarly, Trigwell & Ashwin (2006) suggested that conceptions of learning were contextually specific, which means that students have to develop methods of learning appropriate to the particular subject being studied, and even within the goals of the particular teaching methods. Others have also observed that the development of conceptions of learning takes place in specific contexts and are dependent on that context (Grácio et al., 2012).

The findings here demonstrate that conceptions of learning in nursing are multidimensional in nature and thus that cannot be simply limited to one way of learning. This study found that a specific way of learning is mainly relevant to one specific context but learning at work entails a wide range of situations that vary,

depending on the situations in which nursing care is being provided. These findings contribute to broader debates which have raised concerns about the limitations of one way of learning. Donald Schon discussed the limitations of classroom learning in relation to professional competence. He criticised traditional views of competence on the basis that “what aspiring practitioners need most to learn, professional schools seem least able to teach” (Schön, 1987, p.8). Wenger also challenged the notion of learning merely through teaching of subject-matter content (Wenger, 1999). In Wenger and Lave’s publication, *Situated Learning: Legitimate peripheral participation*, they argue that learning is more than merely to receive and absorb information. Instead, in their observation, learning is “increasing participation in Community of Practice” (Lave and Wenger, 1991, p.49). Wenger also acknowledged that theoretical models may inform learning yet argued that codified knowledge into subject-content can act as impediments among learners and learning endeavour.

This concept that subject-content can act as impediments to learning has been observed within protocol-based care where participants’ conception of learning was described as straightforward, owing to the clearly stated, not-detailed objectives and requirements regarding what to give and take. It reduced information overload and effortful deliberation, thus requiring negligibly mindful data processing.

To conclude, this study contributes to that discussion by indicating that the importance of classroom learning should not be denied. What is argued against is seeing only that part of the whole picture, as proponents residing in a particular category assert that one conception of learning is the right one for all others. The limitations of the one-size-fits-all approach is the lack of necessary flexibility when a certain way of learning is not adequate to accomplish the required outcome (Sturmberg and Martin, 2008)

5.3 Implications of the outcomes of the research

In chapter three, it was discussed that a map of ways of experiencing early recognition of sepsis was required to allow for the development of a relational approach to sepsis recognition education. It could now be possible to commence development of such a method. Although substantially more research needs to be conducted in this area, this study provides the target understandings which nurses and educators can use in learning contexts. The availability of the relational model provides a framework within which to:

- develop new outcome objectives for early recognition of sepsis curriculum.
- develop new teaching methods.
- re-examine the existing curriculum.
- facilitate staff development for educators.

The most important elements of the new framework for sepsis recognition education are the categories of descriptions and the view of learning as coming to conceive effective knowledge use in new and more complex ways. In the educational settings, it is hoped it can help nurses understand the complexity of early recognition of sepsis and learn to use learning approaches appropriate to the level of complexity that takes account of various sorts of knowledge.

Developing new outcome statements for sepsis recognition curricula

The picture of sepsis recognition that emerged from this study provides the opportunity to redefine learning to recognise sepsis in terms of conceiving effective knowledge use in new and increasingly complex ways. From this starting point, descriptions of learner's understandings of sepsis recognition can impact the content of curriculum in two key areas. Firstly, they enable curricula to be devised in a way that puts emphasis on understanding, that is experience or content of thinking, about sepsis recognition.

Learning to recognise sepsis is no longer regarded as acquisition of a set of attributes. Secondly, they provide a framework within which to ensure that a more complete spectrum of understandings is included. In addition to the development of current curricula, the categories could also be applied to reframe teaching and learning according to a relational approach.

Using the relational approach for the design of outcome statements for teaching and learning will, thus, result in a focus on understandings and experience instead of knowledge and skills of learners. The formulations of such statements would be based on recognition that ways of thinking about what effective use of knowledge means are more central to sepsis recognition than skills and knowledge. This is not to say that the acquisition of skills and knowledge does not take place as it does, but skills and knowledge are secondary to understandings; acquisition of skills and knowledge takes place within a holistic framework of learning to conceive knowledge use effectively in many distinct ways. With this approach in mind, the outcome of sepsis recognition curriculum cannot be measured. Being able to recognise sepsis means to experience sepsis recognition in a variety of distinct ways, and being able to identify the nature of experience, it is essential to rely upon new contexts.

This section outlines two groups of learning outcomes which are based on the notion that the categories of descriptions are utilised as foundations for defining outcomes statements. The first group is founded upon understanding of sepsis recognition taken from the outcome space as whole; the second group is founded upon the individual categories which depict the understandings:

Outcomes statements that focus on the demand to learn about the sepsis recognition holistically include that learners will:

- Conceive of knowledge in a variety of ways.

- Use knowledge in effective ways in a variety of contexts.
- Differentiate the ways of thinking about use of knowledge effectively in order to apply new knowledge to issues they will be exposed to.
- Understand the socially distributed nature of sepsis recognition.

Aims focussing on the demand to learn about particular expressions of sepsis recognition include that learners will:

- Use relevant ways of processing information.
- Use appropriate gathering strategies.
- Make appropriate discriminations.
- See cause-and-effect relationships.
- Use appropriate pattern of actions.
- Construct knowledge in new area of interest.
- Work with knowledge and personal assumptions in such ways that novel insight emerges.

The aims/learning outcomes need to be interpreted in the sense of in-depth descriptions of the categories defining experiences of sepsis recognition. For instance, learning to use knowledge of the patient does not mean that nurses should have ability to use all knowledge at hand; he or she should have the ability to learn to use relevant knowledge required for the specific purpose.

Designing novel teaching approaches

If learning sepsis recognition is to be defined as to experience effective knowledge use in novel and increasingly sophisticated ways, then teaching sepsis recognition requires teachers to facilitate this transition. In a relational view, teaching would be directed towards modifying the internal relations via which students experience aspects of the world. The role of teachers who adopt the relational view of teaching would be to assist

learners to conceive of and experience sepsis recognition in the wide range of ways described in the outcome space. Embracing this new approach to teaching sepsis recognition would mean placing emphasis on reflective and experiential methods of teaching and learning.

This study offers a useful resource in the form of categories of descriptions to assist educators who wish to implement a relational approach to teaching sepsis recognition. The categories offer clear pictures of the understandings that they could aim for in their teaching; they provide a framework with content-rich phenomenographic data which might aid identifying current understandings; whether the understandings are aligned with generally understood approaches and, if not, what makes them variant. In addition to evaluating current understandings, they can be used to evaluate the evolution of their understandings.

In addition, the categories provide a picture which might assist both students and teachers recognise the distinctions between the different interpretations of the phenomenon. The categories allow educators to fulfil the role of ensuring that students can apply the holistic picture of understandings and have the ability to identify which is most relevant in a particular context. Educational methods aligned with a relational approach would revolve around:

- Determining ways conceiving of, or experiencing, sepsis recognition
- Assisting learners to develop awareness of their current repertoire of understandings.
- Assisting learners develop awareness of the variety of possible understandings.
- Assisting learners conceive of, or experience, sepsis recognition, in new ways.

These recommendations stem from the perspective that learning is about broadening the learner's current repertoire of understandings.

5.4 Contribution to our understanding of sepsis recognition Expertise

The findings of this study influence our understanding of sepsis recognition expertise in a number of ways. Firstly, they introduce a new way of thinking about sepsis recognition expertise in terms of varying relations between the learner and the aspects of the world around them. Sepsis recognition expertise has, until now, been regarded in terms of attributes of learners, instead of in terms ways in which people relate to various aspects of world. Secondly, the outcomes of this study provide a picture of a varying structure of awareness which constitutes people's experience of sepsis recognition. We now have an insight into how people are aware of various aspects of the world around them when they are experiencing sepsis recognition in particular ways.

Additional outcomes also follow from the those previously described. This research brings to light aspects of sepsis recognition expertise which are not being considered in contemporary discourse about sepsis recognition expertise. These aspects will be described in this section.

Recent literature shows that scholars are opting for interpretations which emphasise one way, or a limited number of ways, in which people think about the phenomenon, instead of embracing the full range of reasoning approaches. Many of these articles lean in the direction of protocol-based care reasoning to sepsis recognition. Here sepsis protocol-based care achieves prominence in one category or becomes a domain to which protocol-based care is also applied. The inclination towards a focus on protocol-based care is not universal. Some significant papers within the field of sepsis management do not emphasise it at all in their approach to sepsis recognition. Vincent et al. (2021), for example, continue to describe sepsis recognition in terms of

protocol-based care, and whilst they focus on protocol-based care they also acknowledge the importance of individualised care. That is not to say that reasoning in terms of protocol-based care is regarded irrelevant, rather it is not thematised and is treated as one amongst many ways of thinking of sepsis recognition.

From the perspective of educational provision, Acedo and Hughes (2014) argue that people think and learn in many different ways. While subject domains are directed towards conceptual understanding, others involve mastery of technique, or others even analytical or reflective approaches. Therefore, according to Acedo and Hughes (2014), insight into the fundamentals of the cognitive architecture of people's thinking and the way it operates in various fields is critically important for effective curriculum design, teaching and learning.

The novelty of the approach in this doctoral study is that it brings the different ways of understanding and learning about the phenomenon together and reconciles them within a framework, which incorporates the understanding of and learning about sepsis recognition as following protocol-based care. Central to this framework, however, is the importance of the effects of different contexts which are characterised by their unique properties. The significance of this framework is that the categories of descriptions substantiate the close relationship between sepsis recognition expertise and the ability to learn at many levels. This was possible by using a phenomenographic approach to map out the different ways people learn. Of greatest interest are those ways of learning in emergent care which move towards knowledge constructions and knowledge extensions, which emphasise the ability to distil meaning from incomplete data.

Within this framework, we were able to compare and contrast different ways of learning discussed in the literature, such as reflective compared to analytical approaches within the same framework. Further novelty of this approach is that we are able to organise the approaches from the least to the most complex ways of learning about the

phenomenon to aid effective pedagogy and curriculum mapping. This study is able to demonstrate that different approaches demand different forms of knowledge, as well as the demand for knowledge in different types of situations. In other words, these findings will prove useful in making accurate decisions of how much and what knowledge is required in various contexts.

The current definitions of sepsis recognition focus on explicit knowledge and does not entail various forms of knowledge, which literature, and this study, emphasise as central to effective performance. Neither do those current definitions of sepsis recognition place intuitive measures in their lists of quantifiable measures, which this study emphasise as central to effective performance. As a result, educational programmes, guidelines and decision aids mainly focus on quantifiable measures alone. Furthermore, the definitions are focused more on knowledge of specific sources than on how those sources are arranged, or mapped, in a world of so much information. As a result, sepsis recognition education operates at a disadvantage. The contribution of this study has been to offer a more comprehensive understanding of what knowledge nurses rely on in their clinical assessment, which is outlined in the outcome space developed in this study.

There is also a generalisable distinction between this study's categories of descriptions and contemporary thinking about sepsis recognition; many authors have a tendency to think sepsis recognition is the responsibility of individuals, whereas the categories in this study indicate that sepsis recognition is a social responsibility. In the emergent care category, for instance, sepsis recognition is achievable when responsibility for sepsis recognition is shared, or distributed, within groups of nurses. In the disease-specific care category, sepsis recognition often entails a reliance on a third party to elaborate on sepsis suspicion. These distinctions suggest that the adoption of a relational model will demand that scholars and practitioners think in terms of communities of knowledge users instead of individuals.

The contribution of this study has been to offer a changed view of the role of context in learning to recognise sepsis. This study describes the contexts under which different learning approaches are more or less relevant, as well as the type of knowledge that nurses require to justify adopting a particular approach. A significant implication of the study is that nurses do not require only knowledge itself for the capability to make appropriate judgment, but also context-specific knowledge to know when to use a particular approach. As such, the key to effective judgemental performance rests on having the knowledge essential to direct the choice of relevant approaches. The same emphasis is not placed on the learners in higher education by some scholars of conceptions of learning. According to the findings of this study about context-specific conceptions of learning, there is a need for context-based education to recede from the foreground of attention to enable effective knowledge use.

The significance of a context-based approach to early recognition of sepsis is that it improves our understanding of the relationship between sepsis recognition expertise and 'learning to learn', thus endorsing the rhetoric that regularly aligns the two. The categories of descriptions substantiate the close relationship between sepsis recognition expertise and the ability to learn at many levels. For example, the knowledge construction conceptions highlight the close relationship between sepsis recognition and the ability to distil meaning from incomplete information. The knowledge extensions include the ability to engage in crisis management and facilitating change in parallel.

5.5 Contribution to sepsis recognition and the wider research base

This study has made both substantive and methodological contributions to sepsis recognition research. The key areas in which contributions have been made are outlined below. This research has:

- Developed a relational model for early recognition of sepsis expertise.
- Proposed an emphasis on understandings as a framework for sepsis recognition research.
- Developed a map of early recognition of sepsis as it is experienced in clinical practice.
- Challenged traditional thinking about sepsis recognition and sepsis recognition education.

Numerous methodological contributions have been made. This research has:

- Offered an example of phenomenographic research as applied to sepsis recognition.
- Shown the significance of using phenomenography in sepsis recognition and educational needs of nurses.
- Enabled us to draw implications for sepsis recognition researchers.
- Shown that the phenomenography has the potential to continue to progress theoretically as new research is conducted.

This study has demonstrated how changes are needed in how we think about researching knowledge users in order to use phenomenography in this field of research. The relational approach to research which was used in this study of nurses' understanding of sepsis recognition entailed two profound changes from what was the standard when the study began. Firstly, there was a shift from researching knowledge users, to examining users' ways of understanding the world. This meant that understandings, rather than knowledge users, were the object of this research. This does not mean that knowledge users were not of importance for this study, but users were viewed as interacting with the world instead of being a separate entity from it. Secondly, the research entailed a shift from viewing knowledge as being constructed by the user, to viewing knowledge as being a product of awareness, and thus equally constructed by knowledge users and aspects of their world.

The value of adopting a phenomenographic approach

The research has shown the value of adopting a phenomenographic approach to sepsis recognition and educational needs. As discussed earlier, the phenomenographic approach has provided a deeper understanding of sepsis recognition. Viewing sepsis recognition as a phenomenon, that is the sum of people's understandings or the subject-object relations via which it is constituted, has challenged the conventional perspective of sepsis recognition as being a measurable attribute of people via their ability to implement knowledge, skills and processes. According to the outcomes of this research, what constitutes knowledge is not fixed, but fluid and contextually dependent. Moreover, even though differing experiences of sepsis recognition are appropriate in different circumstances, it is also clear that the nature of these experiences, as described via the outcome space, becomes progressively more complex. Subsequently, learning to become competent in sepsis recognition, within the work context, may be said to entail coming to conceive of effective knowledge use in increasingly sophisticated ways. It is likely that equally important insights are to be gained via applying this approach to other objects of sepsis recognition and educational needs. In general terms, it can be concluded that the phenomenographic approach is an effective strategy for illuminating knowledge users' experiences of the world.

Phenomenography has shown to be a methodology which enabled the following:

- Acknowledging the variation and fluidity of meaning associated with the notion of sepsis recognition.
- Acknowledging the variation and fluidity of meaning which is likely to be attributed to the other.
- Components of the world of knowledge to be illuminated.

- Revealed variations in understandings which are of application both in theoretical and practical terms.

There are key implications which might be derived from this study which should be regarded by future sepsis recognition researchers. This includes that our understanding of sepsis recognition and related concepts will continue to deepen if the experience of knowledge users is given priority in research.

Chapter 6: Conclusion

The chapter will draw conclusions from the research findings and offer recommendations for education, practice and future research. It will also consider the limitations of the study and present research reflexivity.

6.1 Recommendations for further research

Determining a new research agenda for sepsis recognition and educational needs

The successful completion of this study makes it possible to speculate about new directions for the research agenda for sepsis recognition and the broader area of educational needs based on continuing use of the phenomenographic approach. As this study shows that examining understandings has both theoretical and practical benefits, researchers in these fields should give serious considerations to making people's understandings an object of research. The recommendations for future research which follow are based on developing the present study and adapting the approach to other aspects of sepsis recognition research.

Building on present research

This recommendation for research arises primarily from the variation in understanding how different people relate to aspects of the world. The focus is thus on the further refinement of the outcomes of this study. The outcomes of this study provide an initial benchmark of descriptions of sepsis recognition which additional research could confirm, enhance and build upon. Two main areas of research are proposed:

- People's experience of sepsis recognition.
- People's experiences of learning sepsis recognition.

More defined recommendations for how the phenomenon of sepsis recognition can continue to be researched are as follows:

RESEARCH RECOMMENDATION ONE: The current study be replicated in other healthcare organisations contexts, such as primary care. This would make it possible to establish if the understandings revealed in this research are present in other sites within healthcare sectors. The outcome of replications of this research will also be the confirmation or alterations of the outcome space developed here as a visual picture of the phenomenon.

RESEARCH RECOMMENDATION TWO: The current study be replicated in other healthcare professional groups, such as practitioners, for example doctors, allied health professionals and others. This will make it possible to establish how probable it is that members of such groups use any or all of the understandings in the outcome space. Such research will make it possible to commence addressing questions such as: Do doctors conceive of sepsis recognition in the same way as nurses?

RESEARCH RECOMMENDATION THREE: The present study be replicated in other individual groups involved in education such as lecturers, clinical educators and learning counsellors. Examining the understandings from a single discipline will make it possible to reveal variation in understandings amongst members of specific groups of educators. Such studies will add depth to our understanding of sepsis recognition and will reveal how understandings in particular groups are related to the broader picture presented in this research.

RESEARCH RECOMMENDATION FOUR: The present study be replicated with nursing students. This will make it possible to determine if students' understandings of sepsis recognition correspond with or vary from the understandings of those in present study. Such research will be of particular interest to educators who desire to assist their students conceive of effective knowledge use in specific ways.

Researching sepsis recognition is of significant value. The phenomenographic approach has undoubted power to change the way in which we understand sepsis recognition. All the recommendations presented are a reflection of the importance given to understanding different ways people relate to aspects of the world. If we continue to investigate sepsis recognition using this approach, it is likely that the knowledge users, learners and scholars will continue to challenge and assist us in reframing our insight of this phenomenon. It is essential that we, as researchers, should not strive for artificial interpretations of the phenomenon by developing our own descriptions or inspiring other sepsis recognition scholars to provide it. Rather, we need to work at describing the experiences realistically or, as has been performed in this study, the different ways of experience of those actively involved in using knowledge.

6.2 Recommendations for practice

The complexity of early recognition of sepsis found in this study exposes the empirical and philosophical limitations of current models designed to improve early recognition of sepsis. This exposure raises several challenging questions for practice, research and education: If the message emerging from this study is the need to broaden approaches to early recognition of sepsis, what changes needs to take place if they are going to deliver improvements?

As a result of this exposure, limitations of current models designed to improve early recognition of sepsis are apparent, and I argue to replace the current unidimensional models for early recognition of sepsis for the multidimensional framework which reflects the complexity of early recognition of sepsis in clinical practice. This study shows that developing understanding of early recognition of sepsis is often a matter of holistic clinical assessment, draws upon multiple sources of information and takes into account a variety of factors. It consists of four categories; each represents a distinctive adoption

of practice to fit the context and define one way of understanding the phenomenon. Based on these findings, it is recommended that nurses fit their problem-solving approach to the actual condition at hand instead of relying on an approach that might work well in one circumstance but not in others. This multidimensional complexity-informed framework provides a common language of reference to help draw appropriate conclusions for insights, decisions and actions.

In addition, it is recommended that nurse clinical educators use the framework for the evaluation of nurses' sepsis assessment practices in a way that identifies if nurses rely on single or multidimensional measures to examine the patient. This will allow for the complexity of patient assessment to be examined in more detail.

6.3 Recommendations for education

This research has illuminated a series of findings which suggest a reappraisal of nurses' capacity to learn how to recognise sepsis. This reappraisal mandates that nurses credit themselves with a much more comprehensive view of learning than traditional methods might permit. It is recommended that, in educational settings, the framework is used to help nurses understand the complexity of early recognition of sepsis and learn to use learning approaches appropriate to the level of complexity that takes account of various levels of understanding. A recommendation for learning is that we should match the expected level of understanding of sepsis recognition to the specific learning environment. Although a focus on classroom learning is inevitable, we also need to consider what level of understanding we would expect from classroom learning would be different from what level we would expect from learning at the patient bedside. This is because learning to recognise sepsis is clearly multidimensional in nature where one size does not fit all. Therefore, determining the best method of learning, or learning environment, may be of limited value. It is domain specific, as learning to recognise sepsis entails numerous ways of learning that vary, depending on

the expected level of understanding. This approach demands flexibility; however, unless we learn to match the learning environment and learning method in a manner which is appropriate to the expected level of understanding, significant development in learning to recognise sepsis might not be seen.

6.4 Limitations

METHODOLOGICAL LIMITATIONS OF THE STUDY

TRANSFERABILITY

The primary limitation of this study was the selection of the participants, who were recruited mainly from intensive care units, which could influence the transferability of the findings. However, it is worth noting that intensive care nurses had much broader experiences compared with the rest of the sample. The participants had former multiple exposure to a variety of settings. This heterogeneity in the exposure to a variety of settings made it possible for the researcher to describe diverse learning contexts, which includes, but is not limited to, formal learning contexts, and as well those that induce qualitative changes in understanding of the phenomenon. Achieving a heterogeneous sample with regards to gender in the nursing profession was also problematic, which could be concerning in respect to ultimate transferability of the results to other settings since this study reported the majority of the sample was female. In order to obtain a varied sample and strengthen the transferability of the findings to similar settings, the researcher maximised a variation in the sample by achieving a heterogenous sample in respect to nurses' work, age and work experience at various settings. This, together with the informants' varied education experience, might increase the transferability of our findings to similar contexts.

Twenty-six nurses, varying in age, education, and work experience and from two hospitals, were included in this study, which can be regarded as sufficient to ensure

variation in ways of perceiving and conceptualising the same phenomena (Marton and Booth, 1997). However, it is worth noting that the aim of phenomenography as a research method is not to generalize the characteristics of the phenomenon, but rather to understand the meaning of a phenomenon for the subjects who experience it.

The information of the scope and adequacy of the selection of participants can help users to draw a conclusion and be in a stronger place to make their own judgments of how well the findings can be used or applied in other contexts.

In consideration of healthcare services facing overwhelming demands associated with the impact of COVID-19, this research could be an asset to health services rather than a burden, with potential longstanding benefits of this research to a broad population within the healthcare sector. Although the research sample consists of nurses, the longstanding impact of this study has a great potential to reach a wider population within the healthcare system.

SAMPLE SIZE

The sample size, although limited, is considered sufficient with regard to the objective of phenomenographic research (Marton and Booth, 1997). Phenomenography assumes a limited number of ways in which a phenomenon can be understood (Marton and Booth, 1997), and therefore a sample of about 20 participants is generally adequate to identify these variations. In addition, in phenomenographic research, the number of variations in conceiving the phenomenon is the focus rather than the number of participants (Olsson et al., 2012). Furthermore, when determining the sample size, Olsson et al. (2012) referred to Bowden and Green (2005) for the consideration of manageability of data.

RESEARCHER'S STANCE

The researcher's preconceptions can be a limitation, especially when have experience in the participants' setting, which is why preconceptions were reflected upon, surfaced

and controlled where possible, to try to ensure limited influencing on the research processes. The researcher's stance increases the risk of taking things for granted during interviews (Jangland et al., 2011). Therefore, the researcher paid particular attention to this during the interviews and asked nurses for clarifications and concrete examples of their own experiences. In addition, assumptions and preconceptions can also (positively and negatively) influence data analysis and interpretation, therefore reflexivity, as discussed in the following section can be a valuable approach.

6.5 Reflexivity

Reflexivity is becoming a more frequently used term and concept in qualitative research reports. Commonly, the concept is acknowledged as good practice since it allows researchers to examine their own position as it pertains to the practice and process of performing the study (Greenbank, 2003). It enables researchers to identify their own biases, assumptions and beliefs how they are initially introduced in the research and how they can influence the outcomes of the study. It allows researchers to examine the impact of these biases, assumptions, and beliefs on each phase of the research process and how they are managed.

According to Lincoln and Guba (1985), the challenge is not whether the researcher has had an impact on the research process or not. What is more important is how this impact has been addressed. In qualitative research, reflexivity is a central concern in terms of the trustworthiness of the research. Greenbank (2003) responded to this concern by arguing that educational research does not lack value, instead reflexive explanations need to be part of any forms of research and researchers who do not incorporate such explanations need to be a subject to criticism. Generally, phenomenographic studies rarely provide reflexivity reports. Nevertheless, Sandbergh (1997) points out the fact that the fundamental idea of phenomenography is the identification and descriptions of individuals' conceptions of the phenomenon in the

most faithful way possible. The justification for this claim is that the researchers' faithfulness to individuals' conceptions of the phenomenon can improve researchers' ability to comprehend human activities, such as learning and teaching. Therefore, it is of great importance that researchers show how they have explicitly dealt with their interpretations during the process of conducting their research. According to Sandbergh (1997), this can be achieved by interpretative awareness, which explicitly manages the subjectivity of the researcher.

Despite the understanding of how reflexivity can contribute towards the improved trustworthiness and integrity of this research, there is very little guidance on how to perform reflexivity, suggesting its individualised in nature and potentially challenging in performance. In this study, reflexive practices took place at various times and in various ways. Reflection on informal consultations with other doctoral researchers frequently resulted in new insights that were then taken into consideration with respect to this study. Formal supervision meetings allowed for discussion of the new insights. This serves as a safe environment for free expression of uncertainties or issues and obtaining constructive feedback.

A research diary was also used as soon as the research process began. The rationale for adopting such an approach was it has proven beneficial in the past when completing masters research. The diary mainly comprised free text. Entries were made at diverse times throughout all phases of research process. The diary was regarded as a dialogue with myself. Most entries were concerning methodological issues or its management. Many entries, mainly in the initial phases of the process, reflected my impediments in navigating ethical approvals of the doctoral study, as I struggled with obtaining them for my research during the pandemic. All entries enabled the recognition of problems, discovery of alternative ideas and continual reflection on my own stance. While some of the reflections were filled with uncertainties, others were filled with optimism. The diary provided an essential tool for reflexivity as each entry

played a role in framing my mind. A collection of entries has been attached in appendix six to make the original context of the entries available to the reader. A statement of researchers' stance is incorporated in section 3.5.5.1.

6.6 Conclusion

The findings of the research indicate that it is time to acknowledge that the educational needs required for early recognition of sepsis are fundamentally complex, and for educational institutions to enact a context-driven flexible approach is an important step forward. Complexity is normal and cannot be eliminated. The framework developed in the present study can help us to deal with that more comfortably. This framework can provide the direction for decision making in different contexts, especially in dynamic and not well-defined circumstances, allowing nurses to understand the context in which they are working and act in contextually appropriate ways.

It can be concluded that learning for effective performance conceptualised as acquisition of defined knowledge and skills seems not only oversimplified but also founded on a false premise which views the learner and object of learning as separate entities. Considering this view, it is argued for the need to shift thinking about sepsis recognition expertise from seeing learning to recognise sepsis as the acquisition of attributes, to seeing it as coming to conceive of sepsis recognition in different ways of relating to the phenomenon. As a result of this change, we would design educational programmes around changing understandings rather than around desirable attributes. This study suggests that the failure to make educational programmes effective is perhaps not related to the learning theories and methods themselves, but due to a dualistic ontology that underlies the approaches to learning. Given this enhanced understanding, this study proposes an interpretative approach, named phenomenography, for research in various, and not only sepsis-related, phenomena. I

argue for the shift in thinking about expertise from seeing learning to develop expertise as the acquisition of attributes, to seeing it as coming to conceive of sepsis recognition in different ways. As a result of this change, we would design educational programs around changing understandings rather than around desirable attributes.

Future patients with suspected sepsis, and society, in general, might benefit from the evaluation of nurses' educational needs as the shift in thinking I have outlined, especially when used to inform the development of educational resources that can improve nursing clinical decision-making, ensure that patients receive the right care at the right time and health service resources are optimally used. This is an important consideration for a potential reduction in sepsis mortality and the costs to the NHS.

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Appendix 1: Consent Form

CONSENT FORM: Version 3

Version Date: 10.12.2020

IRAS Project ID: 280396

R&D Reference Number: 09635

Participant Identification Number for this study:

Research Title: Exploring the lived experiences of nurses to understand what constitutes early recognition of sepsis.

Research: This research will explore nurses' perspectives to understand what knowledge and skills constitute early recognition of sepsis. It will also seek to explore nurses' perspectives to understand what the most relevant ways are for gaining knowledge and what learning environment nurses perceive as the most relevant for learning. Interviews will be used to allow nurses to talk about their experiences with the recognition of sepsis.

Researcher: Marika Nemeckova

Please initial box

Mandatory

1. I confirm that I have read and understand the Participant Information Sheet dated 10.12.2020

(Version 3) for the above study.

2. I have had the opportunity to consider the information and ask questions which have been answered to my satisfaction.

3. I understand that I do not have to take part and that non participation or withdrawal from the study will not affect me in any way.

4. I agree to take part in a recorded 1 to 1 interview.

5. I understand that the transcripts and results from the study will be anonymised and my name and details will not appear in any

printed documents.

6. I agree to take part in this study.

Optional:

7. I would like to receive a summary of the results of the study.

| | | |
|----------------------------------|-------|-----------|
| _____ | _____ | _____ |
| Name of Participant | Date | Signature |
| _____ | _____ | _____ |
| Name of Person taking consent | Date | Signature |

*1 copy for participant; 1 copy for researcher site file.

If you have any concerns about any aspects of this research project and your involvement in

it, please contact:

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Appendix 2: Information Sheet for Participants

Information Sheet for Participants

Version: 3

Version Date: 10.12.2020

IRAS Project ID: 280396

R&D reference number: 09635

Research Title: Exploring the lived experiences of nurses to understand what constitutes early recognition of sepsis.

Sponsor of the study: Northumbria University at Newcastle

I would like to invite you to take part in my doctoral research examining the experiential learning of nurses in relation to early recognition of sepsis. The details of what this study will involve are outlined below. Please read this information carefully and make a note of anything you would like to be clarified. If you wish to participate in this study, please send me an email and I will contact you to arrange a suitable date and time for the participation in an individual interview. If you decide to participate in this study, I will ask you to give your consent by signing the consent form, which will be electronic and paper-based consent form, depending on the mode of interview.

What is the purpose of this study?

Very little research has been carried out to understand the educational needs of nurses in relation to early recognition of sepsis. By trying to find out more about these educational needs we hope to contribute to improvements in the educational resources offered. In this research, we would like to hear from nurses who have experience in caring for patients with sepsis to help us understand what knowledge and skills constitute early recognition of sepsis, what the most relevant ways are for gaining

knowledge and also what learning environment nurses perceive as the most relevant for learning.

Once the research has been analysed, the research findings, in an anonymised form, will be made available to all participants. Some components might also be disseminated through conference papers and articles, and also used to guide future research.

Why have I been asked to take part in the research?

Because you are a nurse working in one of the clinical areas of The Newcastle upon Tyne Hospitals NHS Foundation Trust where early recognition of sepsis is considered to be highly important as it allows initiation of appropriate management that can improve patient outcomes.

What are the possible benefits of taking part?

If you decide to participate in this study, you will get the opportunity to raise your personal awareness of sepsis by reflecting on your experiences of caring for patients with sepsis and discuss the issues of sepsis recognition. While confidentiality is guaranteed, you might find it interesting to see how your perspectives relate to your colleagues' views. You will also be able to record in your Continuing Professional Development Portfolio that you have participated in the research project as part of your on-going professional development.

What is involved and what am I being asked to do?

If you decide to participate, you will be asked to take part in one confidential interview session, which will be audio recorded. No video will be captured. The interview will last 30 to 60-minutes but may be shorter depending on your availability. The interview will be undertaken remotely, which will be via telephone or Microsoft Teams, depending on your preference. If you decide to participate, you will be asked to reflect on your experience of caring for patients with sepsis, describe your ways of handling early recognition of sepsis and explain what influenced the choice on which you have

decided to concentrate. The interview will be arranged for a time and date at your convenience.

PLEASE NOTE: The interview may be arranged either in or out of your working hours, depending on your preference and the circumstances at the time of the data collection in your department.

The interview will be undertaken remotely, unless the circumstances with the COVID-19 outbreak will change, social distancing measures will no longer be necessary, and the University and Trust guidance will allow for face-to-face interviews to be arranged.

What happens if I do not want to participate?

Participation is on a voluntary basis. The decision to participate or not will not affect your work, or your relationship with me or any other member of the working team.

What would happen if I agree and then change my mind?

If you decide to participate, you are free to change your mind and withdraw at any time without giving a reason. If any data has been collected from you at that point, it will be destroyed and not included in the study. Your withdrawal will not affect any aspect of your work.

What if I disclose a patient safety issue that I didn't report?

The purpose of this study is to understand your experiential perspectives about early recognition of sepsis. The Trust has policies in place to help you raise a concern and this interview should not be looked upon as an opportunity to raise a concern that requires action. It is important that you are open and honest when discussing your experiences as this will add to the richness of the data collected. However, it is important to be aware that the researcher is an NMC registrant and is duty bound to report any information that exposes any activity that may harm patients. If this should happen, you will be invited to withdraw from the study and offered support from the Trust services.

Will my participation in the research be kept confidential?

Your participation will be kept confidential. The interview will be transcribed with all identifiable information removed. All quotations used in the final report will be anonymised. You will not be named on any documents or your work setting identified.

How will we use information about you?

We will need to use information from you for this research project. This information will include the following:

Name

Contact details

Gender

Role and responsibilities

The length of time working in hospital

We will use this information to do the research to make sure that the research is being done properly. People who do not need to know who you are will not be able to see your name and contact details. Your data will have a code number instead. We will keep all information about you safe and secure. We will write our reports in a way that no-one can work out that you took part in the study.

Once we have finished the study, we will keep some of the data so we can check the results. The research data will be stored in the University's research data repository for a period of seven years and the personal data for 6-12 months, all in an anonymous form.

The information collected will be kept confidential and stored securely in a password protected file in my university drive. Only the PhD researcher of this study and the two academic supervisors, Dr Tony Conner and Prof Alison Steven will have access to the information. The transcripts will be analysed and used to draw conclusions and

recommendations in the final doctoral thesis. Transcripts will be destroyed after the completion of the study.

The findings and the knowledge gained from this study will be shared with colleagues at the University as part of developing a shared understanding of the educational needs of nurses related to early recognition of sepsis.

What are your choices about how your information is used?

You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have.

We need to manage your records in specific ways for the research to be reliable. This means that we won't be able to let you see or change the data we hold about you.

If you agree to take part in this study, you will have the option to take part in future research using your data saved from this study.

Where can you find out more about how your information is used?

You can find out more about how we use your information

- by asking one of the research team
- by sending an email to : m.nemeckova@northumbria.ac.uk
- by ringing us on 0191 215 6353
- by contacting the University Records & Information manager, Duncan James on 0191 243 7357 or via email Duncan.james@northumbria.ac.uk

For more generic information about how health researchers use information from participants, please click on the link: <https://www.hra.nhs.uk/planning-and-improving-research/policies-standards-legislation/data-protection-and-information-governance/gdpr-guidance/templates/template-wording-for-generic-information-document/>

Thank you for taking the time to read this.

If you have any concerns about any aspects of this research project and your involvement in it please contact:

Dr Tony Conner

Coach Lane West

Coach Lane Campus

Northumbria University

Newcastle upon Tyne

NE7 7XA

Tel. 0191 215 6353

Email: Tony.conner@northumbria.ac.uk

Marika Nemeckova

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Department of Nursing, Midwifery and Health

Faculty of Health and Life Sciences

Northumbria University

Newcastle upon Tyne

NE7 7XA

Email : m.nemeckova@northumbria.ac.uk

Appendix 3: Invitation to participate in doctoral research

Version: 1.0

Version Date: 01.09.2020

IRAS Project ID: 280396

R&D reference number:09635

From Marika Nemeckova

Sent:

To: xxxxx

Cc: xxxxx

Subject: Invitation to participate in doctoral research

Dear XXXXX

I would like to invite you to take part in my doctoral research aiming to explore the lived experiences of nurses to understand the educational needs of nurses necessary for successful recognition of sepsis.

You are being invited to participate in this study because you are a nurse working in one of the clinical areas of The Newcastle upon Tyne Hospitals NHS Foundation Trust where early recognition of sepsis is considered to be highly important as it allows initiation of appropriate management that can improve patient outcomes.

Before you decide you need to understand why the research is being done and what it would involve from you. Enclosed is an information sheet which details the research and what you will be agreeing to do if you decide to take part. Please read this carefully.

The research is funded by Northumbria University Faculty and Researcher Development Framework (RDF).

Very little research has been carried out to understand the educational needs of nurses in relation to early recognition of sepsis. By trying to find out more about these educational needs we hope to contribute to improvements in the educational resources offered.

If you are interested to take part in this research, please contact the Principal Investigator, Marika Nemeckova who can provide further information about this study and answer any questions you may have. Please see contact details below.

You will be offered a period of one week to consider whether you wish to be involved. If you do get involved all of the information collected from you will be held in the strictest confidence. In addition, you will be free to withdraw from the study at any time without this affecting you in any way.

Thank you for taking the time to consider being involved in this study.

Yours faithfully,

Marika Nemeckova

Principal Investigator

Tel:

Email: m.nemeckova@northumbria.ac.uk

Appendix 4: Interview Schedule

Version 1.0

Version Date: 01.09.2020

IRAS Project ID: 280396

R&D reference number: 09635

Interview Schedule

- Introduction
- Welcome the participant
- Reinforce the purpose of the research study and remind the participant of the ethical rules and use of data.
- Obtain written consent to record and use the interview data

Use the questions as a guide:

- Can you tell me what your role is and little about your history as a nurse?
- Based on your experiences so far, what does learning how to recognise sepsis early mean to you?
- If the participant ask for further explanation:
What sort of things do you do? What are you trying to achieve?
- Can you give me a concrete example of experience?
- How do you judge that something that you have done to early recognise sepsis has been successful?
- Can you give me a concrete example of something you have done to help you develop or grow your knowledge and skills?

These questions are a guide and will be used at each interview. Depending on the responses given, they may be expanded upon using the following probing questions.

- How did you go about that?
- Why did you do it that way?
- What did you gain or hope to gain from it?
- Why do you do that?
- What were you hoping to achieve?

Thank the participant for their contribution.

Appendix 5: Amendment Tool

| | |
|--|--------------------------|
| Amendment Tool <small>v1.4 30 Nov 2020</small> | For office use QC: No |
|--|--------------------------|

| Section 1: Project information | | | | |
|---|---|--------------------------|-------------------------------------|--------------------------|
| Short project title*: | Exploring Experiential Learning of Nurses about Recognition of Sepsis | | | |
| IRAS project ID* (or REC reference if no IRAS project ID is available): | 280 396 | | | |
| Sponsor amendment reference number*: | 1 (This is first amendment for this study) | | | |
| Sponsor amendment date* (enter as DD/MM/YY): | 10 December 2020 | | | |
| Briefly summarise in lay language the main changes proposed in this amendment. Explain the purpose of the changes and their significance for the study. If the amendment significantly alters the research design or methodology, or could otherwise affect the scientific value of the study, supporting scientific information should be given (or enclosed separately). Indicate whether or not additional scientific critique has been obtained (note: this field will adapt to the amount of text entered)*: | I have made a change on the participant information sheet for my study. I have deleted the following sentence: 'Due to increased demands on healthcare services during the COVID-19 outbreak, the interview will be arranged outside of your working hours, unless the circumstances will change, and the Trust will allow for the interview to be absorbed in your nursing time.' I have replaced the sentence for the following: 'The interview may be arranged either in or out of your working hours, depending on your preference and the circumstances at the time of the data collection in your department.' The purpose of the change: To clarify the flexibility and make one participant information sheet applicable to all departments. This is because I am recruiting participants from various departments and some departments within the Trust prefer the interview to be absorbed in nursing hours, others prefer to have them done outside working hours. Due to this change, I have change the consent form accordingly. | | | |
| Project type (select): | <input checked="" type="radio"/> Specific study <input type="radio"/> Research tissue bank <input type="radio"/> Research database | | | |
| Has the study been reviewed by a UKECA-recognised Research Ethics Committee (REC) prior to this amendment?: | <input type="radio"/> Yes | | <input checked="" type="radio"/> No | |
| Is review by a UKECA-recognised Research Ethics Committee (REC) being sought for the first time because of this amendment?: | <input type="radio"/> Yes | | <input checked="" type="radio"/> No | |
| Did the study involve NHS/HSC organisations prior to this amendment?: | <input checked="" type="radio"/> Yes | | <input type="radio"/> No | |
| Did the study involve non-NHS/HSC organisations OR does the amendment introduce them?: | <input type="radio"/> Yes | | <input checked="" type="radio"/> No | |
| | England | Wales | Scotland | Northern Ireland |
| Lead nation for the study: | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Which nations had participating NHS/HSC organisations prior to this amendment?: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Which nations will have participating NHS/HSC organisations after this amendment?: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Section 2: Summary of change(s) | | | | |
|--|--|--------------------------|--------------------------|--------------------------|
| Please note: Each change being made as part of the amendment must be entered separately. For example, if an amendment to a clinical trial of an investigational medicinal product (CTIMP) involves an update to the Investigator's Brochure (IB), affecting the Reference Safety Information (RSI) and so the information documents to be given to participants, these should be entered into the amendment tool as three separate changes. A list of all possible changes is available on the "Glossary of Amendment Options" tab. To add another change, tick the "Add another change" box. | | | | |
| Change 1 | | | | |
| Area of change (select)*: | Study Documents | | | |
| Specific change (select - only available when area of change is selected first)*: | Other minor change to study documents (e.g. information sheets, consent forms, questionnaires, letters) that can be implemented within existing resource in place at participating organisations - Please specify in the free text below | | | |
| Further information (free text - note that this field will adapt to the amount of text entered): | The amendment involves a clarification of one aspect on the participant information sheet for this study. I have deleted the following sentence: 'Due to increased demands on healthcare services during the COVID-19 outbreak, the interview will be arranged outside of your working hours, unless the circumstances will change, and the Trust will allow for the interview to be absorbed in your nursing time.' I have replaced the sentence for the following: 'The interview may be arranged either in or out of your working hours, depending on your preference and the circumstances at the time of the data collection in your department.' The purpose of the change: To clarify the flexibility on participant information sheet and make one participant information sheet applicable to all departments. This is because I am recruiting participants from various departments and some departments within the Trust prefer the interview to be absorbed in nursing hours, others prefer to have them done outside working hours. Due to this change on the participant information sheet, I have updated the consent form and specified in the first mandatory question that the participants will be signing version 3.0 of the document. | | | |
| Applicability: | England | Wales | Scotland | Northern Ireland |
| Where are the participating NHS/HSC organisations located that will be affected by this change*?: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| | | |
|---|--------------------------------------|----------------------------|
| Will all participating NHS/HSC organisations be affected by this change, or only some? (please note that this answer may affect the categorisation for the change): | <input checked="" type="radio"/> All | <input type="radio"/> Some |
|---|--------------------------------------|----------------------------|

Add another change:

Section 3: Declaration(s) and lock for submission

Declaration by the Sponsor or authorised delegate

- I confirm that the Sponsor takes responsibility for the completed amendment tool
- I confirm that I have been formally authorised by the Sponsor to complete the amendment tool on their behalf

| | |
|---------------------------------|-------------------------------------|
| Name (first name and surname)*: | Laura Hutchinson |
| Email address*: | laura.hutchinson2@northumbria.ac.uk |

Lock for submission

Please note: This button will only become available when all mandatory (*) fields have been completed. When the button is available, clicking it will generate a locked PDF copy of the completed amendment tool which must be included in the amendment submission. Please ensure that the amendment tool is completed correctly before locking it for submission.

After locking the tool, [proceed to submit the amendment online](#). The "Submission Guidance" tab provides further information about the next steps for the amendment.

Section 4: Review bodies for the amendment

Please note: This section is for information only. Details in this section will complete automatically based on the options selected in Sections 1 and 2.

| | Review bodies | | | | | | | | | | | | | | | | Category: | | |
|------------------------------------|--|---|---------------------------------------|------|---------------------|-----------------|--------------------|-----|--------|-----------------------|------------|------|------------|--------------------------------|---------|--------------------|-----------|---------|--------------------------------|
| | UK wide: | | | | | | England and Wales: | | | | Scotland: | | | Northern Ireland: | | | | | |
| | REC | Competent Authority MHRA - Medicines | Competent Authority MHRA - Devices | ARSA | Radiation Assurance | UKSW Governance | REC (MCA) | CAG | HIMPSS | HRA and HCRW Approval | REC (AWIA) | PBPP | SPS (RAEC) | National coordinating function | HSC REC | HSC Data Guardians | | Prisons | National coordinating function |
| Change 1: | | | | | | (Y) | | | | | | | | | | | | | C |
| Overall reviews for the amendment: | | | | | | | | | | | | | | | | | | | |
| Full review: | | | | | | N | | | | | | | | | | | | | |
| Notification only: | | | | | | Y | | | | | | | | | | | | | |
| Overall amendment type: | Non-substantial, no study-wide review required | | | | | | | | | | | | | | | | | | |
| Overall Category: | C | | | | | | | | | | | | | | | | | | |

Appendix 6: Reflexive Diary

10/2019

Continue writing my literature review in the following way:

- Write a summary of each paper that I read.
- To use mind mapping to help inform both the next stages of the literature review and probably also the refining of the research aim and objectives.
- Use the mind mapping to exercise either on paper or use mind genius on the computer or to use an app called Grafiio.
- To do mind mapping/drawing out (mind map or spider diagram) as many of the possible elements /perspectives/subtopic areas that I think may be related to the central focus of nurses educational needs for sepsis recognition and management.
- To use a flip chart/white board or Mindgenius on the university computers to mind map.

05/2020

The importance of allowing participants to choose whether the interview will be done in staff time or outside of their working hours and away from the hospital premises, it has to be when and where the participants want and whatever participants feel comfortable with. Therefore, the ideal would be if I would have an option to do both.

30/06/2020

Ongoing challenges of gaining a provisional agreement to act as a site instead of a Participant Information Centre.

- This is a learning process and in order for me to avoid similar problems in future, what could I do differently to avoid this. The challenge often is that we don't know what is needed until I get to a certain point of time. It means that I am going to the process with a certain expectation and then it often becomes more and more difficult.

12/2020

The questions to consider:

1. Does it fit with the methodology, if I can give it a good rationale and substantiate why I want to involve both groups?
2. Band 5 nurses may not know what they need to know.

If there are going to be the only band 5 nurses, their experiences are going to be limited, therefore actually we do need more senior nurses. Having both ends, we can then contrast and compare, I may end up with senior nurses with different outcome spaces and different descriptions and identifications of levels of competence and

expertise, so band 5 can't get because they are not there, so include both can potentially give me a different type of data, and more comprehensive set of variations and outcome spaces and so on.

11/2021

The importance of prioritising participants' recruitment at this point in time and going to systematic review when possible. The systematic review has to take the second place because I need to raise awareness of research around the Trust.

- An update on the recruitment process.
- Identifying the smallest number of participants in relation to reaching saturation of conceptions, which I may reach around 15 to 20 participants, 30 is far too much.
- The importance of balancing that theoretical approach with the pragmatism needed to actually undertake the research. 30 would be brilliant, but it is a huge task, so the reality is I would probably not be able to recruit those 30 participants or even have a difficulty in doing so in the best of times. We are in the middle of pandemic and have no idea how things going to plan out. Using that notion of saturation of conceptions is good, so pragmatically recruiting as many people as possible, starting to do my analysis, and then maybe further down the line recruiting more participants. So maybe I get 5 or 10, whatever I can at the moment in the next couple of months.
- Justifying small sample size: It is about the depth and if it fits with the methodology and theoretical underpinnings. To justify then why, I will show the depth of analysis I have done, and the rigour of analysis are sufficient.
- I would like to have more participants, however, as long as I feel that I have reached the saturation of conceptions. This could be a pilot for further postgraduate research, where I need to improve on, as I need more participants, that would go national study.
- Interview schedule and clarifying demographic data such as role, area of work, age. I need age range, for example, in their 30s, 40s or 50s and that may give me different dataset.
- From alternative questions: from your own experience, how would you describe learning to recognise sepsis? that is a relevant question.
- Regarding learning, to find out whether it is formal learning or informal if they learn tacitly by working with somebody or from the university course. This question to not ask directly or to begin with, rather have it in mind. To ask the broad question first and let them start to tell me their thinking and then follow it up with those sources of questions.
- Regarding learning, to ask where did you learn that, how did you learn that, who from,
- Delete the word 'concrete', rather 'Can you give me an example of your experience?' this is bit more open question, Concrete is about right or wrong, and I can miss some data.

- Consistency of questions in each interview. Interviews must be covering the main core elements to have that consistency.
- When I do my transcripts, to use line numbers to save me a time. I can give the panel transcript and audio recording and prove where a quote is from.

02/21

REFLECTIONS ON THE INTERVIEW PROCESS

The reflection on the whole interview process and how it enabled me to think of improvements for the next interviews. Also, cautious use of the word learner or learning as people automatically think of learning as only formal teaching. The plan is to use more day-to-day terminology, such as spotting sepsis, rather than recognising sepsis as it may be more accessible for nurses.

The challenge has been to remember the sequence of questions while actively listening. Also, identifying, holding onto and following important aspects that participants talked about, such as confidence or advocacy, and asking to elaborate on it in the following questions.

Participants often talked about what education programs are available in the Trust or University. The plan is to make it relevant to my study, use it to my benefit, and ask the following questions: have you engaged in any educational programs? What have you learnt from this?

DATA ANALYSIS

The plan is to develop a detailed protocol for the data analysis to enable a reader to follow the logic of the whole analysis process.

It also allows me to be transparent about what I've done, showing that I had a systematic method to what I've done.

At the initial stages of writing my research protocol, I have been inspired by the Developmental phenomenography book, which describes the Åkerlind approach. This allows me using the Åkerlind approach, as proposed in my protocol, while developing a detailed description drawing from the thesis.

03/2021

THE RECRUITMENT PROCESS.

The proposed plan is to continue recruiting until I reach the saturation of conceptions,

the recruitment of 20 participants being an optimum. The reality of the recruitment process has been quite different from my original assumption of it. Surprisingly, the majority of participants preferred to have their interview out of duty hours in their own time.

As a researcher how do we influence the research process and how does the topic influence the research process as well. In addition, when writing about participant recruitment, one aspect is assumptions we hold, or others might hold about the recruitment. If I would be influenced by other people's assumptions about recruiting nurses in the pandemic, such as if I may or may not be able to recruit, I may be discouraged to recruit, yet the reality is quite different. The lesson learnt is the importance of being quite careful about assumptions and assumptions of others and how that might influence what we think participants will do.

04/2021

I got to a certain point when I require participants to be able to get more detail to certain categories. For example, in exploring how nurses make sense of the world in a chaotic environment, I may need to recruit some nurses from the emergency admission unit and emergency department.

The plan is to do more analysis and then go back to recruiting to fill the gaps in my analysis or add to those places where I need more analysis either to confirm or challenge my analysis.

There is a potential to extend my data collection with the Trust if needed, depending on the circumstances. The plan is to evaluate the situation in June.

04/2021

TRANSCRIBING INTERVIEWS

The consideration has been given to decide whether to transcribe all interviews or some of them. It is all about a desire to be as theoretically rigorous as possible with the resource and the feasibility that I have.

Regarding the frequency of the concepts, a table has been designed to set out how many participants I have; I identify the contexts from which those participants come from, such as complex, chaotic, etc. Also, novice to expert will be included. I will be keeping track of which of these emerging categories I feel I have more or less just to keep track of that visually.

06/2021

THE PROGRESS WITH THE RECRUITMENT OF PARTICIPANT

- There are difficulties in recruiting nurses from wards. However, the data from nurses recruited from the ITU has given me better data than I have expected.
- The rationale and substantiation for the data is that even though I did not manage to get people from the wards, what I have got is really powerful because they are nurses who worked in various wards settings before and can compare different settings and different experiences. As a result, they are giving me richer data than I would have from the nurses who worked only in ward settings.
- The plan is to continue trying to recruit from wards as it will allow me to do my best to try.
- The importance of having multiple exposures to different kind of specialities or different environments. People who have ward and ITU experience probably provide greater rich data than people who worked only in a single environment as their experience will be very limited and focused on that one ITU.

THE POTENTIAL APPLICATIONS OF MY FRAMEWORK

- Developing a framework may offer insight into which people approach sepsis and insights into ways they learn about, conceptualise, and make sense of.
- A framework like that can be used to develop educational initiatives, it can be used as research that can be tested out. It can be added to other pieces of research, it can provide a basis for an educational model or continuing professional development.
- Developing a model has been done many times; however, something that is more flexible like the framework which shows a variety of ways in which people learn, a variety of ways in which people make sense of and understand, how that expertise develops, how that chaotic or complex situation or contexts have an impact, can be much more useful. That could be a foundation for my postdoctoral research.

07/21

The proposed plan for recruiting until I reach the saturation of conceptions, the recruitment of 30 participants being a maximum. The data analysis is an essential component of the research and that it must be rigorous as possible, therefore, the temptation to continue recruiting will have to be resisted, and a cut-off point be decided upon.

01/22

The discussion was related to the following points:

The use of my new findings as a framework, which provides a shortcut to look at other transcripts.

The importance of not doing a whole set of analysis again that might take a lot longer than anticipated.

- Regarding the structure of my PhD, each domain does not follow the same template because they are different. The simple domain is very a simplistic way of learning, and the complex domain is more and thus is presented differently

05/22

The need to inform the reader that the information contained within the sections of each category may vary slightly, and this is necessitated by the fact that the findings have been organised under four domains and each of those domains is slightly different.

- The need to inform the reader what they look for in each quote included in the findings.

- In the section recommending further research, the complex domain seems to be psychologically orientated; touching on some of this, for example, from educational psychology would be a very valuable addition. Therefore, the plan is to touch on some of that in future research; as it is beyond the scope of my current research.