Critical Care Nurses' Views on Medication Administration:

An Organizational Perspective

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Dedicated to my parents and family in Jordan……..

Abstract

The Organizational Safety Space Model (OSSM) was developed as a tool to investigate the factors which influence the safety of industrial operations. It is applied in this study to investigate the safety of medication administration in adult critical care settings, including Intensive Care Units and High Dependency Units. In this study, semi-structured interviews were conducted with 33 adult critical care nurses. The participants' views on the safety of medication administration were analyzed using OSSM. The data suggested that the safety of medication administration is subject to complex influences of many organizational factors. Socio-cultural factors, including lack of questioning culture, the perceived hierarchy of professions and the nature of nursing education, were identified as influential safety factors. Furthermore, organizational complexity and structures created tension between organizational, ethical and structural priorities on one side, and the requirements of safe management of medication in critical care a setting on the other, inevitably leading to tradeoffs among these organizational priorities. Some organizational factors are difficult to classify according to the OSSM and the model is not fully operational in identifying factors related to the safety of medication administration. While the OSSM' theoretical framework helped to focus on the underpinning safety factors in the organization of medication administration, it remains unproven as an operational tool to understand the full complexities and interplays between the organization structures, professional differences and socio-cultural impacts on the safety of medication administration in adult critical care setting

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Abbreviations

A&E   Accident and Emergency

The Beech Hospital   First Hospital campus where the study took place

BNF   British National Formula

CD's   Controlled Drugs

C-diff   Clostridium Difficile

ED   Emergency Department

HDU   High Dependency Unit

ICU   Intensive Care Unit

IM   Intra Muscular

ITU   Intensive Therapy Unit

IV   Intra Venous

MAE   Medication Administration Error

MRSA   Methicillin Resistant Staphylococcus Aureus

NHS   National Health Service

NMC   Nursing and Midwifery Council

The Oak Hospital   Second hospital campus where the study took place

The Woodland Hospital   The hospital Trust where the study took place
Trust

OSSM   Organizational Safety Space Model

SC   Sub Cutaneous

SHO   Senior House Officer

NG   Naso Gastric

Transcription Convention

Indented extracts in normal font indicate interview transcripts unless stated.

All interviews were transcribed verbatim.

[…] Words, phrases or sentence of the extract omitted.

[Descriptive material added by the researcher in order to make the context clear and/or meaning clear]

Data have been edited to preserve anonymity.

All names of people and places are pseudomonas.

Table of Contents

Appendixes

List of Tables

List of Figures

Chapter One:
Introduction

1.1 Preface

This thesis is a study on nurses' views on the safety of medication administration in adult critical care settings. It has been carried out at a time when there is increasingly lively and open debate about safety in healthcare. Indictors for changing attitudes towards not only the safety of medication administration in adult critical care settings, but also toward the patient safety in healthcare, include the establishment of National Patient Safety Agency (NPSA) in the UK, and the publications of various white papers by the Department of Heath, which address the patient safety as fundamental to the delivery of high quality services in the NHS. Moreover, leading medical and nursing journals are increasingly devoting a lot of attention and conferences to this topic (Leape and Berwick 2000). A number of initiatives have been implemented in this regard at governmental level in UK, USA, Australia and Canada.

Advances in managing safety in industrial high-risk organizations, such as aviation, nuclear power plants, and oil installations, have provided an impetus for researchers in other disciplines, including healthcare, to examine closely the processes and mechanisms whereby such industries have managed to develop and sustain a model of organizational safety in their own discipline. Investigating the organizational safety of such high-risk industries was found to shift the focus from the individuals at the sharp end of the system (i.e. front line workers), to the organization-wide issues, which are distant in time and place from the human-system interface. The Organizational Safety Space Model (OSSM) has been developed in the field of industrial psychology to understand those organizational factors which can influence the organizational safety,

either negatively (i.e. leading to accident), or positively (i.e. leading to resilience against accident). Much of the advances in high-risk organizations in managing risk and safety have been transferred to the healthcare domain, this has raised questions such as: Can these advances be applied in all contexts of healthcare? And are there any factors that may not be fully applicable in such context? The critical care environment shares, in many ways, similar characteristics with those high-risk industries where the Organizational Safety Space Model (OSSM) was originally developed, where the pace of change is very fast and high-risk, complex operations, such as medication administration, are taking place (Department of Health 2000a). This makes a persuasive case to investigate the consequences of applying the OSSM in investigating the safety of medication administrations in adult critical care settings. In other words, it is worth enquiring whether the OSSM can illuminate the organizational contributions toward the safety of medication administration in adult critical care settings. In other words, how the findings from this thesis can explore the ability of the OSSM to assess and identify the key issues relating to the safety of medication administration in the organization.

The aim of obtaining an organizational perspective on the safety of medication administration was to pursue a line of inquiry which shifts the focus from the nurses, or indeed any one involved in the practice of medication administration, to the organizational issues, in accordance with the human factor approach employed in other high-risk industries. Utilizing this had the potential to reveal unique, and potentially previously unknown, organizational contributions towards the safety of medication administration. Evidence from the literature provided a strong impetus for investigating the safety of medication administration. For example, it is estimated that

each year medication errors cost the NHS £500 million, in additional to patient days spent in hospitals (Vincent et al. 2001). While medication errors can occur at any stage of the medication management process, Medication Administration Errors (MAE's) are reported to be the second most frequent types of medication errors in adult hospital settings, accounting for 26% of all medication errors detected (Bates et al. 1995). Furthermore, they are the hardest to detect, with only 2% of MAE's being intercepted, compared with 48% of prescription errors, and 34% of dispensing errors being detected before they reach the patients (Leape et al., 1995). Unsafe medication administration is reported to occur more often in critical care settings compared with other hospitals settings (Cullen et al. 1997; Van den Bemt et al. 2002), and is often associated with more severe consequences (Calabrese et al. 2001). Critical care settings are considered in many ways to be complex, high risk environments, due to the severity and instability of patient's illness, their frequent need for high-risk interventions, and their frequent medication changes. This reality provided a unique opportunity to apply lessons learned from other settings in studying medication safety in critical care settings.

1.2 Overview of the thesis

This thesis is reported in seven chapters. After an introductory statement in chapter one, chapter two introduces the reader to the research area of organizational safety. It explains how advances in managing the organizational safety in other high-risk industries have paved the way for utilizing a similar approach in the healthcare domain, and in this thesis, in the field of safety of medication administration in adult critical care settings. It also explains why organizational contributions toward the safety of medication administration has been selected as a topic for this thesis, and the

uniqueness of critical care settings in term of their complex environment and their proneness for unsafe medication administration practice. In addition, the chapter illustrates how the Organizational Safety Space Model (OSSM), developed by Reason (1997, 2000) can be utilized as a framework for investigating the factors which influence the safety of medication administration in adult critical care settings.

Chapter three provides a description of the contextual settings in which this study took place. It describes the environment, policies, and guidelines of medication administration, in addition to the routine of work and medication administration in the critical care setting investigated. Chapter four outlines the methodological choices made in planning this research. In particular, it highlights the philosophy underpinning this research, and sets out the study's research methods, including a detailed presentation of related issues such as sampling, recruitment of participants, access, data collection, ethical concerns and data analysis.

The subsequent three chapters (5, 6, and 7) constitute the data analysis, and describe the emerging themes from the participants' interviews. Chapter five discusses the participants' views of the organizational factors which contribute to the resilience of the medication administration in their adult critical care settings. In this chapter, and based on the participants' views, the researcher argues that the route to building a resilient system for medication administration in adult critical care settings appeared to be the sum influence of many factors, with its complex interplay, leading to the establishment of a safety culture. Promoting a questioning culture among all healthcare professionals involved in medication administration (i.e. nurses, doctors and pharmacists) appears to be an influential feature for establishing such a safety

culture. Moreover, there was a perception that the reporting of MAE's or near misses create an opportunity to learn from these incidents, rather than being perceived as a fearful and stigmatizing events. The participants felt that this helps to improve reporting of unsafe practice and the ability of the healthcare organization to collect information about its inherited operational hazards that may contribute to unsafe medication administration practice. Knowledge acquisition and dissemination regarding medication being administered, and the guideline and protocols to administer it, emerged from participants' views as a safety net, where they become familiar with the relevant issues pertaining to the process, the structure, labelling, and the therapeutic action of the administered medication.

Chapter six addresses the participants' views on the organizational factors which jeopardise the safety of medication administration in their settings. A range of factors were suggested by the participants as contributors to unsafe medication administration, such as faulty communication, where some participants felt unable to challenge each other regarding medication safety issues, and the perceived hierarchal pressure to meet the Trust' targets, which may outweigh the safety concerns of medication administration. Poor ward design, inadequate staffing, interruption, and poor medication labelling and packaging were all perceived by the participants as contributing factors to unsafe medication administration.

In chapter seven the participants' views on the contextual influence of some organizational factors towards the safety of medication administration in their settings are presented. The participants' views suggest that some organizational factors have a contradictory influence on the safety of medication administration, depending on the

context in which they are evaluated. This study argues that the safety of medication administration is subject to the complex influences of many organizational factors, and the overall safety of medication administration is likely to be shaped by the context in which such organizational factors are interacting.

In the final chapter, chapter eight, the findings are pulled out together, and discussed in the context of the wider literature. The thesis concludes by arguing that the OSSM can be used as a useful tool in investigating the nurses' views on the organizational contributions toward the safety of medication administration, however, it remains an unproven tool to accommodate the full complexities of organizational factors that influence the safety of medication administration in adult critical care settings. Areas of future research are highlighted based on the limitations of this study.

Chapter Two:
Literature Review

2.1　Introduction

Upon admission to the hospital, many patients assume that the hospital is a safe place, where they will receive treatment to improve their health. However, according to published research, some hospitalized patients may unintentionally suffer adverse events, often caused by their healthcare management rather than by their underlying disease (Brennan et al. 1991). It was only relatively recently that adverse events have begun to be given proper attention (Karson and Bates 1999). Benchmark studies, using a wide range of methodologies, are now conducted globally, particularly in North America, Europe, and Australia, to assess the incident rate and the causes and the impacts of such adverse events in healthcare, reflecting an increasing interest in addressing these issues.

Many patients receive some kind of medication upon their admission to hospital. The majority of these medications are administered safely (Barber and Dean 1998). The medication management process encompasses prescribing, dispensing and administration (Pepper 1995; Department of Health 2004). Medication administration is seen as a crucial role for nurses since they are the primary healthcare providers, along with other healthcare professionals. Medication administration is an integral part of the nurse's duties, consuming up to 40% of their time when nursing the patients (Armitage and Knapman 2003). This role is considered a high risk procedure, as it requires high levels of concentration and skill, particularly in those settings which deliver critical care, which, according to published research, sustain higher rates of Medication Administration Errors (MAE's) and near misses when compared

with other hospital settings. Research into the factors which impact on the safety of medication administration in adult critical care settings is therefore needed, particularly in addressing the wider organizational context, which has been reported to impact upon nurses' performance when administering medication (Reason 1990; Vincent 2001).

The focus of this literature review is to examine the evidence on the safe management of medication, and the organizational contributions towards the safety of medication administration. To pursue this, several issues will be examined in this chapter. Firstly, an overview of the impacts of clinical accidents in healthcare and methods to investigate them are presented. The second section outlines the contributions of the human ergonomics approach and the Organization Safety Space Model (OSSM) in investigating organizational safety. In the third section, the review sheds light on the incidence rates, causes, and safety of medication administration practice in hospital settings, including adult critical care settings. Finally, the discussion explores the use of the OSSM as a useful tool to study the safety of medication administration in adult critical care settings. A summary of the research gaps identified in the literature and the implications for the research aims and objectives is also outlined. The search strategy included undertaking a systematic approach search to literature review to identify the key literature evidence on issues of organizational safety, and safety of medication administration in critical care setting. This involved the use of a search strategy where a clear definition of the research question and key words were used, but also the development of the including/exclusion criteria to elicit the specific literature on the topic rather than a more general one. The repeat of the key words search in the individual electronic database used revealed that most of the references

were found in each individual database. This has shown to confirm that the search strategy is well-focused, and accessing the relevant literature (Aveyard 2007).

Relevant studies were found from the search carried out using the database for CINAHL, Medline, British Nursing Index (BNI), PsychInfo for the period 1970 – 2008. Given the fact that organizational and patient safety is relatively new study discipline, it is anticipated that any research prior to 1970 did not have a particular focus on the issue of organizational safety in depth; rather, the research then has mainly focused on organizational safety in general. The search used key words: organization, safety, nurse, critical care, medication administration. Efforts were also made to access a "gray literature", for example, the incorporation of publications which may not fall in the inclusion/exclusion criteria, yet deemed significant for the study. This includes non-academic references, such as the Government policies, unpublished work and literature that is not generally in the public domain (i.e. police data). Most of the references, however, were manually searched from relevant reference list, secondary reference, Government policies, and local Government agencies. Papers were included if they were peer reviewed, published in English on or after 1970 and primarily related to the issue of organizational safety and the safety of medication administration in critical care settings.

There are different areas where the literature comes from. The two most dominant literatures areas were Industrial psychology and nursing literature on the safety of medication administration. However, other literature comes from the social sciences, medical, pharmaceutical literature although the literature of the safety of medication administration was most visible. The vast majority of the studies included in the

literature review were British and American studies. However, other studies included came from countries like Australia, France, Netherland, Finland and Iran. These studies typically included original research which is mostly quantitative studies such as surveys. However, the literature also included references such as published books, Government white papers and official reports, conference papers, conference proceedings and research commentaries.

2.2 The impact of adverse events in healthcare

There has been an increase in national and international interest in patient safety (Department of Health, 2000a). High financial costs, litigation, moral and ethical obligations have all enforced the need to address this issue properly. The following discussion will first examine the definitions of adverse events utilized in the literature. The growing importance of studying the incident rate of adverse events to the healthcare sector, particularly with regard to potential cost, is also demonstrated and discussed.

The term 'adverse event' has been widely used in patient safety research to indicate an incident related to patient safety, although it was defined in many ways. For example, in their study to measure the incident rate of adverse events, Brennan et al. (1991) defined an adverse event as:

> An injury that was caused by medical management (rather than the underlying disease) and that prolonged the hospitalization, produced disability at time of discharge, or both (Brennan et al. 1991.p.370).

This definition has been adopted by most of the subsequent studies that aimed to investigate the incident rate and causes of adverse events in the context of healthcare, although some researchers have adopted slightly modified definitions.

Many national and international studies have drawn attention to the cost of adverse events in healthcare settings. In the United States, the Harvard Medical Practice Study identified an adverse event' incident rate of 3.7% among all patients' records investigated, with 14% of these adverse events leading to death (Brennan et al. 1991). The Utah and Colorado Medical Practice Study suggested that in 1997, around 44,000 people died from preventable adverse events (Thomas et al. 2000). Although it may not be appropriate to extrapolate data from two states (Colorado and Utah) to the entire US states, the results nevertheless demonstrate that adverse events are a significant public health problem in the US. The Institute of Medicine in the US cited these results in its leading report *To Err is Human: Building Safer Health System* (Kohn et al. 1999a), acknowledging the significant impacts of adverse events on the healthcare community.

Similar studies to estimate the impact of adverse events in the UK have been carried out. Vincent et al. (2001) estimated that 11% of NHS admissions sustain adverse events each year, half of which were preventable, and 8% of which contribute to a patient's death. Extrapolating these statistics would cost the NHS - excluding primary care - as much as £1 billion each year from extra bed days alone, without taking into account the human or the wider economic costs (Department of Health 2000a). Furthermore, the litigation claims arising from adverse events cost the NHS £400 million in 1998/1999, in addition to an estimated potential liability of £2.4 billion for

existing and expected claims. Other international studies have estimated higher rates of adverse events among the medical population. For example, the Quality in Australian Healthcare Study (1995) identified adverse events in 16.6% of hospitals admissions. It also claimed that 5% of these events had led to deaths, costing the Australian healthcare system around AUS $4.7 billion a year at the time of the study.

The previous studies used the medical chart review to measure the incident rate of adverse events. Such retrospective studies have reported a relatively low incident rate of adverse events compared with those results reported in prospective studies, which identified a relatively higher rate of adverse events. For example, Andrews et al. (1997) conducted a prospective observational study to measure the frequency of adverse events in three units of a large US urban teaching hospital. They reported a substantially higher rate of adverse events of 17.7% compared with those results of retrospective record reviews (e.g. 3.7% rate for Harvard Medical Practice Study). This discrepancy in the results could be ascribed to many factors. For example, both approaches defined the adverse events differently; hence their inclusion/exclusion criteria were different. Moreover, they observed patient care directly. Observational studies are likely to detect more adverse events than the retrospective ones which rely exclusively on detecting errors that are documented in the medical charts. Poor, sketchy, or disorganized records may be inappropriate for any records-based audit, therefore retrospective reviews of medical charts are likely to miss many adverse events (Vincent 1995). The American studies in particular have narrowly focused on adverse events that have occurred as a result of negligence, without paying much attention to those events which were not associated with negligence. Such an approach is likely to underestimate the true rate of adverse events.

In addition to the financial cost incurred by the organization, adverse events may entail a considerable personal cost to the patient, family, staff and healthcare organization. Many patients suffer unnecessary pain, disability and psychological trauma as a result of adverse events. In Harvard Medical Practice Study, 70% of patients who reported experiencing an adverse event had sustained a slight or temporary disability as a result of the adverse events, 7% of them sustained a permanent disability, and 14% of them died partly as a result of their treatment (Brennan et al. 1991). Patients and family may be further traumatized when their experience is ignored, or where an explanation or apology is not forthcoming (Vincent et al. 1994). The hospital staff may also be affected both by the original incident and the following consequences. Being seen as responsible for injuring a patient can lead to the feelings of guilt, shame, and even depression among the staff involved (Department of Health 2000a). The degree of emotional distress resulting from the incidents will often be sufficient to warrant treatment for the staff as well as the patient and the family, who may need support and counselling (Vincent et al. 1994). Another foreseeable cost of an adverse event is the damage sustained by the public image of the healthcare organization. Stories about poor standards of care help to fuel the impression that the NHS is powerless to prevent such problems, and undermine public confidence in health services generally (Department of Health, 2000a). Rightly or wrongly, this can reinforce the perception that these events may only be the tip of iceberg, beneath which more poor-quality treatment lies.

In summary, the human losses due to service failure are of prime concern in the healthcare sector. The cost of such failure should not be underestimated, including the

heavy financial cost and the impact on patient, staff and organization. Due to the limitations of the methods used to measure the extent of adverse events in healthcare, the true cost could be much higher than has been originally estimated, and presents an indisputable argument for investing in further research to explore this problem.

2.3 Psychological contributions toward investigating organizational safety

There is concrete evidence that much of the current understanding of organizational safety in healthcare has been adopted from advances in other fields, such as aviation and nuclear power plants, where an accident may lead to catastrophic consequences. The following discussion debates how the psychological contributions toward understanding organizational safety in such industries, including the development of Organizational Safety Space Model (OSSM), have been turned into an effective learning tool for these industries, and how OSSM was transferred and adopted at a later stage into the healthcare domain. The discussion will focus on two aspects of safety: organizational accidents and organizational resilience.

2.3.1 Studying organizational accidents

Early psychological contributions to understanding accidents were based on the "person proneness" for an accident, which assumed that some individuals have personality characteristics that make them more prone to accidents (Reason, 2000; Parker & Lawton, 2003). This approach, known as the "person approach", focuses on the individual involved in the accident, assuming that they are incompetent in executing the task. As a result, it targets human behaviour to reduce the accidents.

Individuals may, consciously or unconsciously, often use this approach to justify the occurrence of accidents, for example, by blaming another individual.

A fundamental critique of this approach stems from the fact that causes of accidents are ill-defined. Particularly, in ascribing the adverse event to single origin, which is often the individual personal characteristics, and it does not do justice to the multi-factorial nature of most accidents in complex systems (Parker and Lawton 2006). Once blame has been ascribed to individuals involved in the adverse events, the investigation tends to cease, missing an important opportunity to learn from these accidents to avoid similar ones in the future. In these circumstances, it is likely that events will go unreported in an organizational culture where individuals attract personal blame for accidents. Consequently, the organization may never have a clear grasp on the range and nature of its safety threats, and the same accident will often occur again, signalling that the root causes of the accident have not been addressed adequately.

2.3.2 Human factor and ergonomic approach

Given some recent human disasters such as the Chernobyl nuclear disaster in 1986, the Challenger and Columbia space shuttle disasters in 1986 and 2003, and the Indian ocean tsunami in 2004, and acknowledging the undisputed defects of the person approach, there has been a compelling need for an alternative approach which addresses the complexity of accident genesis. The lessons from the human factors and ergonomics approach have been utilised as an alternative mechanism for investigating adverse events. The term "human factor" is more frequently used in North America, whereas "ergonomic" is more commonly used in Europe; however, both terms are

used interchangeably to cover the same technical areas. Human factor and ergonomics are defined by the International Ergonomic Association (IEA) as:

> … the scientific discipline concerned with the understanding of interaction among human and other elements of a system…and the professions that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance ... (International Ergonomics Association 2000).

The basic elements of the human factor and ergonomic discipline are humans and technology, and the interactions between them. The human factors approach adopts a more holistic view in investigating organizational accidents, focusing not only on the individual, but also on the role of organizational factors (Reason 2000). Moreover, it acknowledges that in order to understand the root of an individual error, it is crucial to consider the physical, social, and organizational environment in which the individual operates. Rasmussen (1987) suggested that human errors are not due to spontaneous inherent human variability, but events in the environment, which act as a precursor for these errors. Accident investigations in large-scale industries, such as aviation and nuclear power plants, have found that the complex interplay of such wider organizational and environmental factors with aberrant human actions contributes largely to such accidents (Taylor-Adams et al. 1999).

Based on the previous research of human cognition proposed by Rasmussen and Jensen (1974) and Rasmussen (1982), Reason (1990) classified human errors according to their origins in human cognition. He first defined human error as a:

> … a generic term to encompass all occasions in which a planned sequence of mental or physical activity fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance failure (Reason, 1990, p. 9).

According to Reason (1990), there are several types of human error, such as skill-based errors, rule and knowledge–based errors (often termed as "mistakes"), and violations. While there are many definitions for these errors, they can mainly be differentiated with respect to the level of human consciousness associated with them. For example, skill-based errors, such as slips and lapses, are usually conducted in an unconscious and automated way, while violation happens when there is a conscious and deliberate deviation from protocols, rules and norms (Reason, 1990). Such variations in the level of human conscious involvement in the error may dictate different remedies to prevent these from re-occurring.

2.3.3 Development of organizational accident causation model

Reason (1990) developed the accident causation model to explain how human cognitive failures interact with the wider organizational and environmental factors in a cascade of events leading to accidents. This section will focus on the development of the accident causation model to investigate the organizational accidents.

According to Reason (1990), an accident is seen as a consequence of events rather than as a result of one particular cause, with human decisions and actions contributing to an accident through active and latent failures. The active failure is an unsafe act committed by an individual at the sharp end of the system (e.g. nurses). Aberrant human actions, which are proposed by Reason's taxonomy of human error, laid the foundation for this type of failure. Those actions can be affected by local triggering factors which influence the human performance, such as inadequate supervision. Latent failures, on the other hand, are created as a result of faulty decisions taken by

higher management level. These failures, which usually take place at the far end of the system, are thought to precipitate the occurrence of the active failure, contributing to a greater or lesser extent to an accident (Reason 1990). The "defence barriers" in a system are described as being like Swiss cheese slices, where the presence of the holes in any "slice" does not necessarily cause a bad outcome, however, an accident opportunity can occur when the hole layers line up momentarily to permit a trajectory of accident opportunity. For an accident to occur, the active and latent failures have to combine together with the local triggering factors to produce an accident. Figure 1 summarises the theoretical framework for Reason's accident causation model.
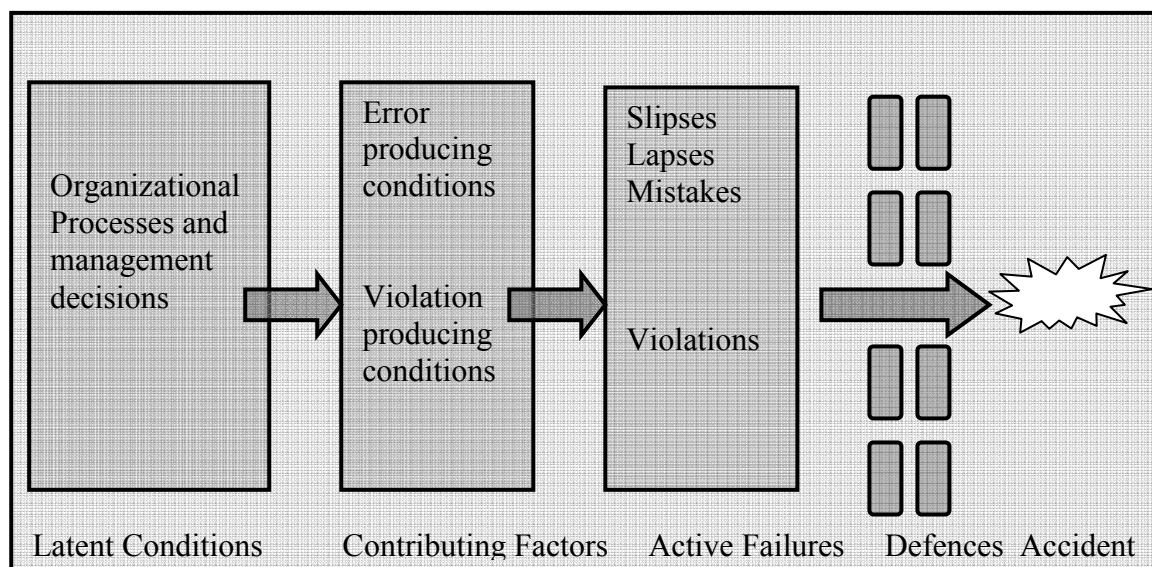
Figure 1: Reason (1990)' Accident Causation Model

An important consideration required to differentiate between the active and latent failure is the time scale needed for an accident to take place following each kind of failure. Active failure generally leads to an adverse event following its occurrence (e.g. hypoglycaemia following an accidental administration of a high dose of insulin

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to a diabetic patient). It is usually committed by the individual working in the front line with direct human-system interface (e.g. doctors, nurses). The latent failure, however, can exist for a long period, and its damaging consequences may lie dormant for a long time, and it only becomes evident when it combines with the local triggering event to penetrate the system defences (Reason 2000), for example, when the hospital management fails to introduce a contingency plan when the staffing level is inadequate (e.g. due to sickness leave).

According to Reason (1990), organizational accidents have their primary origin in fallible decisions made by higher–level management and decision makers. Furthermore, they are an inevitable, and sometimes an unavoidable part of the life cycle, as Reason stated:

> This is not a question of allocating blame, but simply recognition of the fact that even in the best-run organizations a significant number of influential decisions will subsequently prove to be mistaken…fallible decisions are an inevitable part of the design and management process. The question is not so much how to prevent them from occurring, as how to ensure that their adverse consequences are speedily detected and recovered (Reason, 1990, p. 203).

The latent failures are thought to be a crucial precursor for the accident by creating an environment whereby the chain of events takes place. Reason (1997) argued that both individual and organizational accidents have their roots in the upstream organizational and managerial factors, and both types of events are due to latent conditions. Furthermore, all systems harbour latent conditions, and an accident simply makes them manifest.

Dealing with the active failure is undeniably a crucial step in improving system safety, but it only addresses part of the accident causation. The latent failures pose the greatest threat to the safety of the complex system (Reason 1990). Therefore, any attempt to discover and neutralise these latent failures would offer the best route to improve system safety. For example, an analysis of a Canadian aircraft crash (caused by a take-off with wing icing) uncovered 10 latent factors, including aircraft design, inadequate oversight by the government, and organizational characteristics including management disregard for de-icing, and inadequate maintenance and training (Helmreich and Merritt 1998). Until this post-accident analysis, these threats were mostly hidden. It is noteworthy, however, that decisions taken by senior managers in the organizations are often subject to economic, political, and operational constraints, and their decisions are almost always a compromise.

> We cannot prevent the creation of latent failure; we can only make their adverse consequences visible before they combine with the local triggers to breach the system defence (Reason, 2001, p. 16).

It is probably impossible to produce decisions on the higher management level without minor negative impacts. Those decisions should be taken into the context of the organizational climate. Section 2.6 will elaborate on the contemporary development on the concept of latent and local contribution factors.

2.3.4 Applying the organizational accident causation model in healthcare

Rappaprt (1970) argued that there is a profound need for the application of human factor technology to biomedical problems. The contribution of organizational factors, that is the latent conditions and contributing factors, have received increasing

attention in healthcare. Vincent et al. (1998; 1999; 2000) used Reason's accident causation model as a framework to investigate adverse events in many medical specialities, including obstetrics (Stanhope et al. 1997), mental health (Vincent et al. 2000), and nursing practice (Meurier, 2000). The model has also been applied to investigate two recent high-profile inquiries into serious adverse events in the NHS; the cardiac surgery deaths in the Bristol Royal Infirmary (Kennedy 2001), and the intrathecal fatal injection of vincristine at Nottingham' Queens Medical Centre (Toft 2001). Both inquiries demonstrated that utilizing Reason's (1990) accident causation model can facilitate organizational learning. For example, the injection of the fatal intrathecal vincristine at the Queens Medical Centre was shown to arise from a combination of errors and violation, but it also highlighted some unforeseeable latent failures such as medication labelling and the design of syringe connections, problems of communication between staff, conflicting protocols, and the design of medical devices.

In summary, Reason' accident causation model utilizes a more sophisticated perspective than the individual/person approach when investigating an accident, focusing not only on the individual, but also on the role of organizational factors (Reason 2000). It acknowledges that in order to understand the roots of accidents, it is necessary to consider the physical, social, and organizational environment in which the individual operates. This approach has made significant progress in investigating the accidents in other industries by uncovering previously unknown failures, and shifting efforts towards targeting more rewarding solutions. More recently, it has been utilised to investigate medical mishaps.

2.4   Studying organizational resilience

The debate thus far has centred primarily on organizational contributions towards accident causation within the organization, where the focus has been on understanding the accidents that occurred, and trying to understand why they occurred. However, it was suggested that safety research should also focus on the accidents that do not occur, in order to understand why they do not occur (Hollnagel 2006). Reason (1990) emphasized that studying the wider physical, social, and organizational factors which contribute to the accident causation, particularly those latent conditions, is a useful approach to pin-point the origin of the hazards in the organization. However, it became evident that a similar approach can also provide a useful understanding about how the organizational factors contribute to the establishment of a reliable organization, where robust decisions and a well-designed environment can enhance the organizational resistance to accidents.

Highly reliable organizations are said to achieve high error-free performance, or less susceptibility to accidents (Weick 1987; Bierly and Spender 1995), and in order to achieve high-reliability status within the organization, the focus of any accident and near misses' investigations again takes a holistic approach by assessing the wider social, physical, and organization factors. Reason (2000) argued that high reliability organizations are prime examples of resilience, and gave an example of studying safety successes in organizations, such as a nuclear submarine (Bierly and Spender 1995) and aviation (Helmreich 2000), rather than their infrequent but more conspicuous failures. Examples of safety success can be drawn from the US Federal Aviation Administration (1997), which claims that the risk of dying in a domestic jet flight was 1 in 2 million flights during the decade of 1967 to 1976, which decreased to

1 in 8 million by the 1990's. While there is no way to confirm this suggestion, it gives

an indication about the level of safety that such industry claimed to have achieved.

Carthey et al. (2001) suggested that safety has two faces: the negative and positive

faces. The former is revealed by adverse events, mishaps, near misses, but the latter

offers a more satisfactory means of assessing safety. This positive face can be defined

as the system's intrinsic resistance to its operational hazards, and some organizations

will be more robust in coping with the human and technical dangers associated with

their daily activities. Such factors are likely to contribute to the organizational

resilience. The organizational resilience is defined as:

> The ability of the system to prevent or adapt to changing condition in
> order to maintain (control over) system property (Leveson et al.
> 2006.p.96).

The term "resilience" in the above definition entails that the system must be proactive

by avoiding failure and losses, as well as reactive by responding appropriately after

the accident in order to achieve system resilience. The concept of resilience requires

both the capacity to anticipate and manage risk before it materializes into a serious

safety threat, as well as being able to survive situations in which the operation is

compromised. Such survival is usually concerned with the organizational response to

that challenge (Mc Donald 2006).

Many organizational features were cited in the literature as essential for engineering

organizational resilience. One of the most important and extensively discussed

characteristics of organizational resilience is to establish a clear picture about the

potential risks to the safety of the organization, such as latent factors and local environmental factors (Hale et al. 2006). Such ability to predict when, and how, an accident may occur, has been institutionalized in high-risk industries, and has contributed significantly to their resilience, by promoting a "no blame" culture, where any accident or near miss can be reported without fear of reprisal. For example, the US Aviation Safety Reporting System guarantees immunity against prosecution to any pilots who report an accident or near miss (Federal Administration Association 1997). In UK aviation industry, British Airways operate a similar safety reporting system, although it acknowledges that negligence will not be tolerated (O'Leary 2002). Moreover, the Public Interest Disclosure Act 1998 (commonly referred to as the Whistleblowers' Act) introduces a specific statutory protection against victimisation and dismissal for those employees who "blow the whistle" on their employers for wrongdoing at work (Office of Public Sector Information 1998). While the Act can also apply to healthcare settings, evidence from the literature suggests that under-reporting of medical mishap is still a problem in the healthcare context (Leape 1994; Department of Health 2000a; 2001a). No-blame or blame-free cultures are ones in which people are encouraged to report incidents and near misses on the promise that they will not be held accountable for the human errors involved (Department of Health 2000a; Carthey et al. 2001). The experiences of the nuclear and rail industries (Berman and Collier 1996; Davies et al. 1998) in the United Kingdom have shown that "no blame" incident reporting cultures have not worked in practice, because sooner or later an incident occurs, and a senior manager disciplines a member of staff, thus undermining the whole ethos of the system. Anonymity in reporting any unsafe act or event has to be balanced with the objective of getting the best description of the incident or near miss, and the need for excluding negligence (Davies et al. 1998). The

safety agenda necessitates switching the focus from individuals to the system (Reason, 1990, Vincent at al., 1997, Leape, 1994). However, it was suggested that in making the shift, professional accountability has been overlooked (Walton 2004). The focus on the latent factors in particular could render the individual involved in the safety problem blameless, with little responsibility, when in fact there is for example evidence of negligence (Waring, 2007). This would undermine the confidence in healthcare system and the way adverse events are dealt with. Thus the concept of a "low blame" or "Just" culture was introduced. Reason (1997) defined "Just Culture" as:

> An atmosphere of trust, in which people are encouraged, or even rewarded, for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour (Reason, 1997, p. 195)

A "Just" culture has been suggested as an alternative way to get the balance right between the need for uncovering system problems by encouraging reporting of incidents, and to safeguard the professional accountability and public confidence in healthcare professionals and systems (National Patient Safety Agency 2004; Waring 2007). An effective "Just" culture depends on how an organization handles incentives, rewards, blame and punishment. A "no-blame" culture is neither feasible, nor desirable, as most people desire a certain level of accountability when mishaps occur (Global Aviation Network working Group E 2004). In a "Just" culture environment, the culpability line is more clearly drawn.

2.5 Organization Safety Space Model (OSSM)

The previous sections in this chapter discuss the research evidence that addresses how wider organizational, physical and social factors can contribute to the safety of the organization, whether in negative ways (i.e. organizational accidents), or positive ways (i.e. organizational resilience). Evidence from organizational and patient safety literature suggests an imbalance in addressing the two faces of safety. Specifically, safety research appears to devote more attention towards what can negatively impact on the safety of organization, with significantly less attention being paid towards what can contribute to the resilience of operations within the organization. Indeed, research into organizational safety has been criticised for placing a lot of emphasis on understanding how accidents occur, with no comparable efforts in understanding how the organizations can adequately assess and reduce risks (Carthey et al. 2001; Hollnagel 2006). Reason (2000) acknowledged that more attention should be paid towards the organizational factors which are responsible for improving system safety. For this reason, and in order to address the balance in researching the two faces of safety, Reason (1997; 2001) developed the Organization Safety Space Model (OSSM) to address the influence of the factors which contribute toward the organizational accidents, as well as the organizational resilience, and how the influence of those competing factors addresses overall organizational safety.

In developing the model, the organizational factors are seen as forces which exert their influence in the organizational safety space. The organizational safety space is a continuum with two extreme ends. The horizontal axis of the space runs from an extreme end of maximum resistance to accidents that any organization can achieve against its operational hazards, to a maximum vulnerability toward the accident on the

other end. Organizations can move along this space in either direction. In doing so, they are subject to two types of forces: those forces which push the organization toward the end where the vulnerability toward accidents is increased, and those systems with intrinsic factors which push the organization toward the end where there is increased resistance towards the accident, and, consequently, an enhanced organizational resilience against accidents (Reason, 1997). The safety of an organization is determined by the net impact of those forces (Carthey et al. 2001). Figure 2 shows a depiction of OSSM.
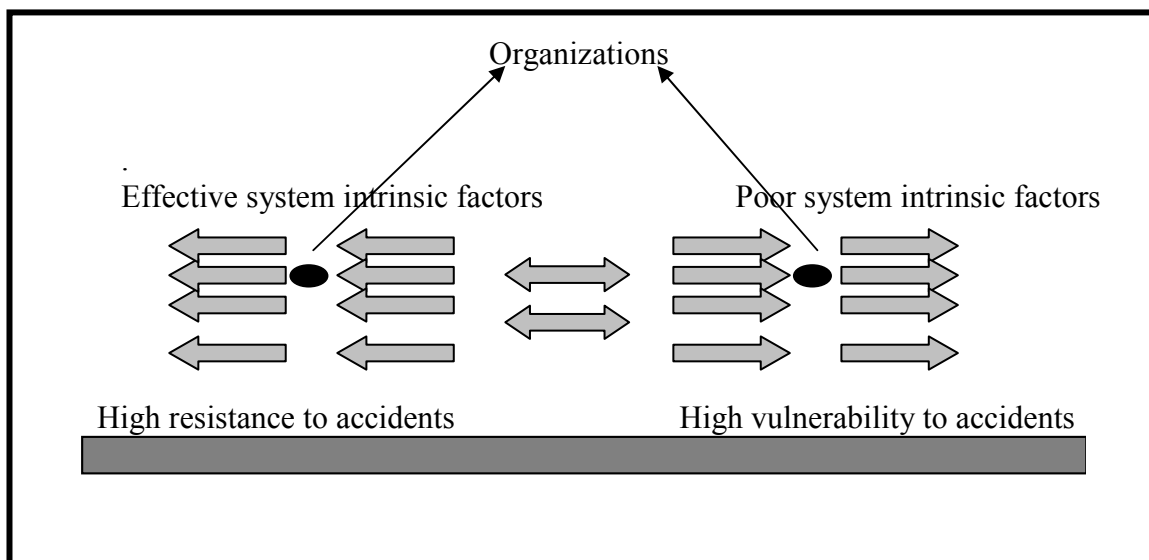
Figure 2: The role of system intrinsic factors in shaping the organizational safety
(Adopted from Reason, 1997)

Reason (1997; 2000) suggests that latent conditions, and to lesser extent the local contribution factors, pose the greatest threats toward any accident in the organization, and they will always be present in organizations. The likelihood of their adverse conjunction with other factors within the organization is always greater than zero. This means that even the safest organizations on the left side of the continuum can still have bad accidents, while unsafe organizations on the opposite side of the

continuum can escape them for a long time. As latent conditions always exist, the organizational position within the safety space is determined by the quality of processes used to combat such latent conditions and other operational hazards. It was suggested that the only realistic goal of safety management is to achieve not zero adverse events, but the maximum degree of intrinsic system resistance against accidents (Carthey et al. 2001). Therefore, the system's intrinsic factors are thought to play a crucial role in determining the safety of the organization. They help to identify and neutralise the latent conditions, the local contributing factors, and any additional natural hazards, therefore contributing to enhancing the overall safety of the organization.

There are two requirements which drive the system intrinsic factors: the system navigational aids and the system counter measures (Reason 1997). The system navigational aids are combinations of reactive and proactive safety measures, which help to assess and identify the organizational safety threats, particularly those latent conditions and local contributing factors leading to an accident, and to provide information about the system reliability and resilience to withstand and neutralize any safety threats. The system counter measures, in turn, work to overcome the latent conditions and other operational hazards identified by the systems' navigational aids, therefore shifting the organization towards the end where there is an increased resistance to accidents in the safety space. In any system with counter measures, three cultural drivers should be available: commitment, competence, and cognizance (Reason 1997; Carthey et al. 2001). The commitment comes when the organization strives to be a good model for safety practice, by investing both money and human efforts in managing the risk perceived within the organization. The organization must

also possess the technical competence necessary to achieve enhanced safety, including methods used to identify the hazards and safety of critical activities. Cognizance refers to how the organization makes sense of its inherent risks and hazards - that is, its sense making processes (Weick et al. 1999). Cognisant organizations maintain a state of intelligent wariness even in the absence of bad outcomes. This "collective mindfulness" of the ever-present risks is one of the defining characteristics of resilient organizations (Carthey et al. 2001). Furthermore, the ability of the organization to balance the resources for production and protection is said to be a vital element for the survival of any organization, and determines whether the organization is adequately resourced to combat its inherited risks (Reason 1997). Both production and protection drives in the organization need to be well-balanced by the decision-makers. Too much emphasis on production within the organization could divert most of the resources toward production, rendering the organization more vulnerable to accidents. On the other hand, when the protection exceeds the danger posed by the productive hazards, it is bound to consume productive resources, such as people, money, and materials, and the overprotected organization soon becomes inefficient and unprofitable.

In summary, evidence from safety research suggests an imbalance in addressing the organizational contributions towards the safety of the organization, with more research being devoted to organizational accidents, and less to organizational resilience. The OSSM has been developed to address the imbalance between the two safety faces. The system intrinsic factors play a vital role in enhancing the organizational resilience against any safety threats, by shifting the organization from one end to another in the safety space, depending on its ability to identify the risks

and neutralise the effect of latent conditions and other factors and move the organization towards having more resistance to accidents.

2.6 Contemporary developments related to the Organization Safety Space Model (OSSM)

The OSSM (Reason, 1997; Carthey et al., 2001) provided a unique explanation for organizational contributions towards the safety of an organization. A number of researchers have attempted to operationalize aspects OSSM, and have discussed critiques of Reason's OSSM model. It is important to assess how these debates contribute to the current understanding of organizational contributions towards safety, in terms of both organizational accidents and resilience.

In examining the contributions of the latent conditions and local environmental factors towards organizational accidents, Thomadsen (2007) suggested that in investigating organizational accidents, identifying the latent failures remains more difficult to expose, and to that end, the lack of explicit organizational classifications may leave the reader with little objective guidance regarding how to describe and identify such latent conditions. While there may be a consensus among patient safety researchers on the definition and nature of latent conditions within an organization, identifying such organizational factors remains a subjective issue, which is open for debate, with diverse researchers focusing on different organizational issues claiming to be latent conditions contributing to unsafe practice (McLean 1993). Others have identified difficulties in eliciting the latent conditions and local contributing factors due to the vague casual links between latent conditions and the accidents. A recent study funded by European Union, led by Reason himself, found that while the search

for latent conditions and other operational hazards provides a valuable insight into important aspects of organization, latent conditions are insufficiently specific regarding the nature of the 'holes in the cheese' and their inter-relationship (Reason, 2006). Thus, it is not easily applicable as an investigative tool. Moreover, casual links between the latent condition and the accident are vague, and the influence of hindsight bias cannot be underestimated.

To some extent, the aforementioned debate has been reflected in the search for latent conditions and local contributing factors in investigating healthcare adverse events, particularly due to subjectivity in addressing the fundamental problems associated with adverse events. Many researchers have tried to elicit the latent failures and local environmental factors in various healthcare specialties (Stanhope et al. 1997; Vincent et al. 2000; Dean et al. 2002b). However, Waring et al. (2007) argued that, in practice, Reason's approach focuses on the relationships between individual performance and the immediate work context, where the psycho-social context of the individual behaviour remains the focus of attention, albeit in a systemic context, and this, does not dig deep inside the "roots of the safety," and does not engage fully with the underlying causes of risks in healthcare organizations, as many researchers indicate inconsistent attitudes for addressing the latent conditions. Consequently, the analysis tends to focus on the micro-level analysis of individual or group performance (i.e. nurses, doctors and pharmacists), while the macro-level analysis at the organizational level is not analysed as a distinct, interrelated level of analysis, as it is usually claimed by Reason (1990, 1997). To conflate the analysis of the individual in the immediate work environment (i.e. the psycho-social), rather than considering the distinct and inter-connected factors (i.e. the cultural, organizational and institutional context, and

the socio-political level), does not adequately address those fundamental socio-cultural or organizational casual factors, attention being diverted to the apparent factors located within the immediate work environment.

Shorrock et al. (2003) suggested the misapplication of latent failures and local contributing failures can shift the blame from the front line operator to the management staff, therefore fuelling the blame culture, as opposed to targeting the fundamental problems associated with the accident. They also criticized the tenacious search for latent factors leading up to an accident, where the active failures in the sharp end of the system play simply a major role in the run up toward the accidents. They based their suggestion on their investigation of an aircraft crash in Thailand, and concluded that the pilot "irrationally" violated the normal aviation protocols which were in place, and therefore latent conditions were inappropriately "forced" into the investigation without evidence, and while the importance of analysing the human factors throughout the accident is not in question, the dogmatic insistence on identifying the latent condition should be challenged. These views were galvanised by the opinion of Reason himself who expressed some concerns in widening the search for the "upstream" or "remote" factors in a safety investigation. His views were expressed recently in two separate 'human factors' conferences:

> The pendulum may have swung too far in our present attempts to track down possible errors and accident contributions that are widely separated in both time and place from the events themselves (Reason 2003 a; 2003 b).

Such criticism from the architect of the approach was seen as an invitation to other researchers to carry out research into the adequacy of such concepts in addressing the fundamental problems in the safety investigation. For example, Qureshi et al. (2007)

suggested that an accident results from a combination of factors, of which, according to Reason, 1990, some are manifest, whereas some are latent, and they happen to co-exist in a space and a time to cause the accident. The sequence of events occurs in a consequential way as they show the direction of casualty in a linear fashion. Therefore, such a consequence of events cannot provide an explanation for the non-linear relationships among many factors which may also have contributed towards the accident, particularly those factors which can be part of the problem in one context, but can also contribute to the resilience of organization in another context. This opinion is supported by Luxhoj and Kauffeld (2003), who suggested that without a detailed account of distinct linkage and the interrelationships among organizational causal factors, the influence of latent factors and local contributing factors are too vague to be of significant practical use for organizational safety. It may also provide a biased picture of how safe the organization is, because it is likely to overlook the contextual influence of those organizational aspects which may have a non-linear or non-sequential influence on the safety of the organization. The existence of mixed contextual influence of some organizational factors may present a challenge to the notion of the consequential nature of accident causation, as proposed by Reason (1990, 1997).

Another opinion which relates to the contributions of latent conditions towards organizational accidents can be gleaned from Perrow's study of "Normal Accidents" (1984). He suggested that accidents are inevitable, and sometimes "normal" in complex organizations, not necessarily because of the high-risk nature of work systems as Reason (1990; 1997) suggested, but because of the ways the organization at work is organized into discrete failures, where one failure can cascade into other

failures, potentially leading to an ultimate climactic, final catastrophe. Two unique features of an organization may contribute significantly to such a cascade of failures: Interactive complexity and organizational coupling (Waring et al. 2006). Interactive complexity relates to the process by which commonplace, small, and discrete failures often located within different organizational subsystems can interact and combine in an unexpected, and sometimes undetectable ways, to produce a profound accident (Perrow 1984; Clarke and Short 1993). The tightly-coupled nature of the organization, which is investigated for adverse events, is comparable to the dependence and inter-dependence of the organizational components, where breakdown in one unit can combine and spread across the wider failures in other locations, and then become manifested as a wider organizational breakdown. While Reason's (1990) latent conditions may lie dormant in the organization until they combine with local environmental factors to make them manifest, Waring et al. (2006) suggested that organizational complexity and inter-dependence have the potential to turn minor or isolated failures into more profound uncertainties, where the inflexibility of the organization to respond, accommodate, or tolerate these small or isolated failures underlies the accident causation in the organization.

Another issue which becomes apparent when discussing the OSSM is the ability of the organization to successfully predict any forthcoming risk. Risk identification is said to be a fundamental pre-requisite for establishing resilience in the organization (Hale and Heijer 2006). The OSSM (Reason 1997; Carthey et al. 2001) emphasizes the importance of the organizational "navigational aids" in detecting the operational risks and hazards of the organization. However, how such concepts can be established in the organization has been open to debate in the safety research community.

Drawing on the Vaughan (1996)' study in analysing the Challenger shuttle disaster in 1986, the risk - which often materialized in non adherence to protocols and sub-optimum maintenance - becomes accepted, taken-for-granted, or a normalized part of the job, and therefore does not need to be communicated as a risk, which in many ways can undermine the organization learning from the occurrence of such risks. The Columbia Accident Investigation Board, which oversaw the investigation into the disintegration of the Columbia space shuttle over Texas on the 1st of February, 2005, found many parallel causes between the Columbia disaster and the Challenger shuttle disaster in 1986, particularly the ritualistic properties of the system and individuals who control the "sense-making" of risk within the organization (Vaughan 2005). This may suggest that identifying risk within the organization can be linked to the social and cultural context that influences risk perception, and how people can make sense of the risk in the organization. This notion was well-demonstrated in the findings of a recent study conducted by Waring (2007) on professional ritualistic behaviours in the Operating Department. The study demonstrated that it was common for surgeons and anaesthetists to tolerate certain levels of risk within the operating theatre in favour of getting the job done. Many of them accommodate the perceived risks through slight modifications, or innovations, in their clinical practice. For example, a lack of equipment in a urological procedure led to a surgeon modifying and reshaping a piece of tubing designed for another use, for the sake of getting the procedure done. Such findings emphasize that when risks are accepted, tolerated, and taken for granted, there is little impetus to communicate such risks, leading to the possibility that danger can impact upon others. Therefore, risk identification can be said to be situationally-generated, whilst also subject to cultural and social rituals. It was argued that these contexts may need to be considered when assessing how the organizations can make

sense of the risk, and how operational hazards can be identified in the organization (Vaughan 2005).

In summary, several questions and debates were raised in the contemporary safety research community regarding how wider organizational, social, and environmental issues contribute to the safety of an organization. Latent conditions were criticized for not only being difficult to excavate in the context of accident causation in patient safety research, but also for not engaging fully with the underlying risks in the organization. Moreover, some researchers suggested that the complexity and interdependence of organizations, and not necessarily their high-risk nature, makes accidents inevitable. Organizational and cultural rituals were said to have a significant impact on the organization's ability to make sense of its operational hazards, and in predicting the potential risks.

Having discussed the organizational contributions to the safety of operations within the organization, the discussion now turns to the area of medication safety, particularly to how lessons from these developments can be usefully utilized to investigate the safety of medication administration in adult critical care settings. A brief discussion on the definition, incident rate, and causes of medication errors in the three stages of medication management is discussed. The nature of critical care settings and how it contributes to the safety of medication administration is then explored. Finally, the application of OSSM in investigating the safety of medication administration in adult critical care settings is discussed in the light of the identified problems.

2.7 Medication Errors

Medication error is one of the most common types of adverse event in hospitals. The Harvard Medical Practice Study reported that drug complications were the most common type of adverse events, accounting for 19% of the total adverse events reported (Leape et al. 1991). Bates et al. (1995) estimated that 1 -2% of the patients admitted to hospitals in the US suffer from medication errors that result in harm, and 12% of the adverse drug events were life-threatening. It is becoming increasingly difficult to ignore the effect of medication errors, and for this reason, there is a need to research their origin, causes and consequences. The following review seeks to address some aspects of medication error, specifically, their definitions, prevalence, causes, and some error-reduction strategies in each stage of medication use: prescription, dispensing, and administration.

2.7.1 Definition

The related literature lacks a universally accepted definition of a medication error, leaving researchers with an incomplete knowledge of the actual rate of medication errors. In response to the Department of Health (2001) recommendation to address the definition of medication error, the UK National Patient Safety Agency (NPSA) has adopted the terminology of the US National Coordination Council for Medication Error Reporting and Prevention (1998), which defined a medication error as:

> ... any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of health professional, patient or consumer (National Coordinating Council for Medication Error Reporting and Prevention 1998.p.1).

To distinguish between medication errors and other related definitions, the International Conference on the Harmonization of Technical Requirements for Registration of Pharmaceutical for Human Use (1995) defined adverse drug reaction as:

> A response to a drug which is noxious and unintended and which occurs at doses normally used in man for prophylaxis, diagnosis, or therapy of disease, or for the modification of physiologic function (International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use 1995.p.3).

The patient safety community is understandably interested in reducing the harm resulting from a broad range of events. Therefore, a strong drive emerged to adopt a definition which looks at the properties of drugs beyond their normal uses, hence the adoption of the concept of an "adverse drug event". Bates et al. (1995) defined an adverse drug event as

> … an injury resulting from medical intervention related to a drug (Bates et al., 1995, p. 29).

Some of the aforementioned definitions seem to suggest that adverse drug reactions may be predictable, and are an accepted risk of treatment. On the other hand, some adverse drug reactions were said to be unpredictable, and therefore unavoidable (Department of Health 2004). In contrast, medication errors, mistakes, lapses, and slips are made when medicines are prescribed, dispensed, or used, and theoretically they are avoidable. They occur when human and system factors interact in the complex process of prescribing, dispensing, and administration of medicines, to produce an unintended and potentially harmful outcome. The Department of Health (2004) has acknowledged that attention is usually focused on the individuals who are

considered to be the cause of the errors, while the latent conditions within the organization and the triggering factors are often ignored, which could be important factors in the genesis of the error.

2.7.2 Medication management stages

Medication management processes include three main stages: prescribing, dispensing, and administration (Pepper 1995; Department of Health 2004; Schull 2005), although some researchers specified additional steps such as monitoring and storage (Rich 2004). Errors in medication management processes are not isolated incidents that occur infrequently. Rather, a broad range of systematic factors related to the medication use process including prescribing, documenting, dispensing, administration, and monitoring, all of which appeared to be associated with medication error (Santell et al. 2003). This section sets out the risk of errors in the primary stages of medication management process, and while the main discussion examines the issues relating to the medication administration stage, a brief discussion of the identification, causes, and reduction strategies of medication errors in the prescribing and dispensing stages of medication use is conducted.

2.7.2.1 Medication prescribing

Prescribed medicine is the most frequent treatment provided for patients in the NHS (Department of Health, 2004). GP's in England issue more than 660 million prescriptions every year, with an estimated additional 220 million prescriptions in hospitals (Department of Health 2004). While the majority of the medications are prescribed safely, some avoidable errors may take place. There is no generally accepted definition of what constitutes a prescribing error. Difficulties arise,

therefore, when an attempt is made to compare or generalise the estimates of prescribing error rates in different healthcare settings. Acknowledging this problem, Dean et al. (2000) conducted a two stage Delphi technique study to develop a practitioner-led definition of a prescribing error. They eventually defined the clinically meaningful prescribing error as occurring:

> … as a result of a prescribing decision or prescription writing process, there is an unintentional significant reduction in the probability of treatment being timely and effective or increase in the risk of harm when compared with generally accepted practice (Dean et al. 2000.p.235).

This definition clearly recognises the prescribing error through two main processes: failure in a prescribing decision, and/or failure in the prescription writing process. This assertion, which was later adopted by the Department of Health (2004), contrasts with the definitions adopted by some previous studies, which define prescribing errors as deviations from hospital standards and policies (Folli et al. 1987; Blum et al. 1988).

Many studies have been conducted to measure the incidence rate of prescription errors in the UK. Dean et al. (2002a) conducted a study to explore the incidence rate of medication prescription errors, and to evaluate their clinical significance in Britain. The study adopted the definition of the prescribing error developed by Dean et al. (2000). 25 ward pharmacists screened 36,200 medication orders written during the study as part of their routine prescription duties. Prescription errors were identified in 1.5% of all orders. The results were consistent with the published estimates of prescribing errors (Lesar et al. 1990; Lesar et al. 1997). Moreover, potentially serious prescription errors (i.e. those having the potential to lead to patient harm or

discomfort) were identified as 0.4%. Although the majority of prescription errors originated in the medication order writing process (61%), most serious errors originated in the prescribing decision (58%). The study employed pharmacists to prospectively check and intercept the prescribing errors. They are likely to have had more information about each patient available to them than by retrospectively reviewing medical notes, implying high accuracy levels in detecting prescribing errors. However, the pressure of workload meant that underreporting and variations in reporting such errors were inevitable. For this reason, the number of unreported or undetected errors was unknown. Moreover, the study was conducted in one teaching hospital, which makes it difficult to generalize the findings for other settings.

Published research has also sought to explore the causes of prescribing errors. In the second part of their study on prescribing errors, Dean et al. (2002) reported the factors which may give rise to such errors. Themes emerging from 44 interviews with doctors who committed prescribing errors were presented according to Reason's (1990) accident causation model. Slips in attention and the prescribers' application for the wrong rule of prescription were mostly noted as active failures (e.g. how to reduce the dose of a drug in renal failure). Also, error-producing conditions were identified, such as busy work environment, workload, lack of communication within teams, and lack of knowledge of the drug. Latent conditions included inadequate training, low perception of the importance of prescribing, whereby the doctors understand prescribing as naming the drug, and all other subsidiary information were seen as secondary (e.g. dose, time, and route). The ward pharmacists, and to some extent the nurses and midwives, were seen as the main defence against prescribing errors, as they check the drug charts daily, and potentially intercept errors, suggesting that

pharmacists should be given a greater prescribing role. This assertion was supported by Leape et al. (1995), who suggested that a lack of knowledge and timely access to patient information is the major root cause of medication prescribing errors.

Acknowledging system defects in the process of drug prescription, automation was perceived as being the major driver in improving the safety of prescription practice. As part of an initiative to reduce adverse events in the NHS, the government expressed its commitment to providing modern Information Technology management to the NHS. £2.3 billion were allocated between 2003 to 2006 to provide the necessary modernisation (Department of Health 2004). There has already been considerable experience overseas with the computerized use of medicine. Electronic prescribing is a routine practice in many US hospitals (often referred to as Computerised Physician Order Entry, CPOE), and has been shown to significantly reduce the serious medication error rate by 55% by providing timely, legible information (Leape et al., 1995; Wyatt & Walton, 1995; Bates et al., 1999). Computerized systems designed to prevent errors both in prescription decisions and writing processes have also reduced the incidence of errors and increased the efficiency of medical treatment. In one study, a 23% fall in the rate dosing errors was highly related to the fact that prescribers made selections from menus that showed only appropriate alternatives (Bates et al. 1998). In the UK, the experience of electronic prescribing in acute NHS settings is growing, but is still short of that in the US, being limited to a few sites. The use of computerized prescribing is well established in primary care, with the vast majority of the prescriptions being prescribed electronically (Department of Health, 2004).

2.7.2.2 Medication dispensing

Dispensing medicine is one stage of the medication process that is the responsibility of the pharmacist. Published studies in the UK and overseas suggest that dispensing errors occur less frequently than prescribing ones (Department of Health 2004). Nevertheless, when they do occur, they may cause serious harm to patients. In a baseline survey of dispensing errors made by community pharmacists, Quinlan et al. (2002) reported a mean dispensing error rate of 0.26%. Buchanan et al. (1991) reported a higher rate of 3.38%, in an army outpatient pharmacy in the US. It is important to point out that many published rates of dispensing errors should be cautiously interpreted, partly because much of this research has been carried out in different types of pharmacies, each with unique settings (e.g. inpatient, community and outpatient pharmacies), while any comparison of incidence rates can only be made across the same settings. The fact that dispensing errors have been ill-defined by the literature dictates further caution when interpreting the results. For example, a dispensing error was referred to as the one that originated from pharmacy staff or from the pharmacy department (Allan and Barker 1990; Cohen and Smetzer 1999), or any deviation from the perfect prescription, without defining the context of "perfect" prescription (Bower 1990). This lack of consistency in defining dispensing errors would inevitably make the incidence rates of dispensing errors within the UK, as well as internationally, incomparable, thus the real rate of dispensing errors may remain unknown. More recently, however, several attempts have been made to develop a universally-accepted definition of a dispensing error. Flynn et al. (2003) conducted a national observational study of prescription and dispensing accuracy and safety in 50 pharmacies across the US. They defined a dispensing error as:

[a] deviation from an interpretable written prescription or medication order, including written modification to the prescription made by a pharmacist following contact with the prescribers, or in compliance with the pharmacy policy (Flynn et al. 2003.p.192).

In this study, the overall dispensing accuracy rate was 98.3%, implying a dispensary error of 1.7%, 6.5% of which were clinically significant. This definition of dispensing errors seems to have been adopted by many subsequent studies. For example, Beso et al. (2005) adopted the same definition to measure the frequency and potential causes of dispensing error in UK hospital pharmacies. Furthermore, they utilized Reason's (1990) accident causation model to understand the causes of dispensing errors. Dispensing errors were identified at the final check stage in 2.1% of the 4849 dispensed items, suggesting similar rates to those recorded in the US. Slips in medication dispensing, such as picking up the wrong product, and mistakes of making assumptions about the dose concerned were the primary type of active failure noticed. Contributing factors include method of labelling and storage, interruption, and distraction. Latent failures included a lack of guidance on how to prioritise tasks when interrupted during dispensing poor labelling of stock boxes, the absence of a formal system for dealing with ward enquiries, and the presence of a culture whereby errors were seen to be inevitable, and 'minor' errors did not matter.

Many strategies are currently being devised and implemented in order to improve the safety of medication dispensing in the NHS. Double-checks have been reported to have significantly reduced the incident rate of dispensing errors. For example, a study of more than one million dispensed items in a group of UK teaching hospitals identified 173 errors (0.018). The error rate was 0.01% when the dispensing pharmacist and technician were double-checked, compared with 0.035% when there

was no double-check (Spencer and Smith 1993). Although the study result is likely to be biased by its methodology, which largely relied on analyzing the reported dispensing errors, other studies have confirmed the benefit of double-checking in reducing dispensing errors (Baker 2003).

2.7.2.3 Medication administration

Drug administration comprises delivering the medication to the patient. Accurate administration of medicines is critically dependent on the quality of all of the previous steps, which include the prescribing and dispensing processes (Department of Health 2004). The following section reviews some aspects of medication administration practice. It also examines the emerging definition, incidence rate, and causes of Medication Administration Errors (MAE's), and the strategies available to reduce them.

The vast majority of medications are administrated by nurses and to a lesser extent by doctors, although there has been a growing trend for hospital patients to self-administer their medications in appropriate circumstances (Department of Health 2000a). The study of the medication-use system must be grounded in the acknowledgment of their complexity. It was reported that between 80 and 200 steps may be associated with the administration of a single dose of medication in the hospital (Executive Sessions 2003). The process of medication administration is an integral part of nursing duties. It is claimed that hospital nurses spend up to 40% of their time administering medication (Armitage and Knapman 2003). Moreover, they are often seen as the last defence before an MAE occurs, with its subsequent potential for patient harm and litigation. Unsurprisingly, research has focused on this last

defence not only for measuring the incidence rate of the MAE's, but also for investigating their causes.

It was suggested that nurses are legally responsible for applying and ensuring the "five rights" of drug administration, which include the right patient, the right drug, the right dosage, the right time, and the right route (Pepper, 1995; Cohen, 2000; Schull, 2005). Other institutions have adopted the right for monitoring, as well as documentation and patient education, as crucial, complementary steps to the "five rights check" (Cohen 2000). However, nursing responsibilities do not rely only on these five rights when administering medication. The Nursing and Midwifery Council (NMC) (2004) stressed that for nurses, the process of medication administration is not solely mechanistic, to be performed in strict compliance with the written prescription of the medical practitioner. Rather, it is a process that requires operating thoughtful and professional judgment. Exercising such accountability is underpinned by a series of guidelines and policies for medicines administration published by the NMC. In the US, the Joint Commission on the Accreditation of Healthcare Organization (JCAHO) has called for similar guidelines (Cohen 2000).

Recent evidence suggests that medication errors in general, and Medication Administration Errors (MAE's) in particular, have become a critical indicator for the quality and adequacy of the drug delivery system in a healthcare setting. For example, all 50 states in the US are required to conduct an annual survey of MAE's in nursing homes and non-accredited hospitals as a pre-requisite for accreditation of Joint Commission on Accreditation of Healthcare Organization (JCAHO). In addition to that, the MAE's rates should not exceed a predefined national rate in order for an

institution to be granted this accreditation (Flynn et al. 2002). This presents a challenge for the healthcare organizations, as MAE's are harder to intercept than other types of medication errors, such as prescribing and dispensing errors. Leape et al. (1995) conducted a study to analyse Adverse Drug Events (ADE's), and found that 48% of prescription errors and 34% of dispensing errors were intercepted before the error affected the patient, compared to only 2% of MAE's.

A fundamental component of researching MAE's, in terms of incidence rate, causes, or reduction strategies, is to establish a comprehensive operational definition of the MAE, which can be used across the studies. Among those definitions published in the literature, the MAE definition produced by the American Society of Hospital Pharmacists (1993) seems to have been accepted and adopted in a range of subsequent studies both in Europe and North America. It defines the MAE as

> …any discrepancies between printed or handwritten physician orders and drug delivery to the patient (American Society of Hospital Pharmacists, 1982, p. 306).

Some medications have to be prepared before administering them, such as those administered Intravenously (IV), so that any errors in the preparation stage could also be classified as administration errors.

2.7.3 Incident rate of the Medication Administration Errors (MAE's)

Most studies aimed at measuring the incidence rate of MAE's have been conducted in acute secondary care settings. In UK hospital wards, most of the studies found MAE rates of around 5% (Barber and Dean 1998), although the majority of these errors were not harmful, typically involving missed or delayed doses. The following discussion examines the incidence rate of MAE's. It also reviews two main pathways that have been used to measure such incidents: assessing the outcome, and the process of medication administration.

Much of what is known about MAE's is derived from a series of investigations by the Adverse Drug Prevention Study Group in the US. Those investigations, for example Bates et al. (1995), Leape et al. (1995), and Bates et al. (1997), have primarily used the daily prospective chart review and voluntary reporting to investigate the incidence, causes, and costs of errors associated with actual and potential Adverse Drug Events (ADE's). The studies estimated that MAE's accounted for 34% of all preventable ADE's in units under investigation, with the wrong dose being the most frequent type of MAE's (27%). However, the results of those studies are thought to underestimate the true incidence rate of MAE's, simply due to the methodological shortcomings of the retrospective chart review (Vincent 1995). This data collection method used by the Study Group is unlikely to detect errors unknown to nurses who were administering the medication (e.g. error in infusion rate), so unless the nurse detects the error, it will go unreported. Furthermore, errors of "minimal potential for injuries" were excluded, which means that many MAE's were not detected.

The second type of studies of MAE's incidence rates focused on errors in the process of medication administration. It is widely reported that most MAE's do not actually result in patient harm (Kohn et al. 1999a; Department of Health 2000a). Unlike the method adopted by the Adverse Drug Prevention Study Group, which focuses on harmful outcomes as measurements for errors, this type of studies which focused on studying the process of MAE's is likely to capture many more MAE's by focusing on the process of medication administration *per se*. The majority of research which adopted this approach used an arguably potent method for detecting the MAE's. The observational methods, particularly the covert observational methods, where the researcher discloses to nurses a different reason for observing them, have been reported to more accurately detect MAE's than other methods such as the retrospective chart review (Andrews et al. 1997; Dean and Barber 2001). This research method dictates that researcher accompanies the nurse who is preparing and administering drugs, records details of all doses administered, and compares the doses given with the doses prescribed. This method has been reportedly described as the "golden method" for detecting the MAE's (Allan and Barker 1990; Dean and Barber 2001; Van den Bemt et al. 2002).

Routes through which the medication is administered appear to be a determinant factor for MAE's incidence rates. In a covert observational study of two UK teaching hospitals, Taxis and Barber (2003) reported that errors in preparing and administering Intravenous (IV) drugs occurred in about half of the drug doses observed (49%), and a third of these errors were potentially harmful. Another study which compared the IV MAE's between German and British hospitals found error rates of 27% in the British hospital, and 22% and 49% in two German hospitals (Wirtz et al. 2003). In sharp

contrast, oral MAE's were found to be significantly less frequent than the IV ones, with rates of 3% in the British hospital, and 8% in the US hospital (Dean et al. 1995), and 2.4% - 8% in the two German Hospitals (Taxis et al. 1999). This is probably due to the complexity of preparing and administering IV drugs, including differences in the pharmacy-drug distribution system in each hospital. Some drugs have to be prepared in the nursing units in some hospitals, whereas in other hospitals the medication had to be prepared in the pharmacy, thus minimizing the risk of preparation errors.

2.7.4 Medication administration in critical care settings

The uniqueness of critical care settings, in terms of the frequent nurses' activities, the types of medication administered, and the often distinctive drug distribution system utilized all mean that special attention should be paid to the context of medication administration in these settings. While the following sections review incidence rates and causes of MAE's in the context of adult critical care settings, more detailed information on critical care settings is presented in chapter three.

2.7.4.1 Incidence rate of Medication Administration Errors (MAE's) in adult critical care settings

Critical care settings, such as Intensive Care Units (ICU's) and High Dependency Units (HDU's), are considered places with high mortality rates. Between 400,000 and 500,000 patients die in ICU's in the US each year (Angus et al. 1996). In the UK, based on data from England, Wales, and Northern Ireland, the overall hospital mortality rate after adult intensive care admission was estimated as 30.8%, ranging from 17.7 to 48.7% across hospitals (Intensive Care National Audit and Research

Centre 2001). Such high mortality rates can be attributed to many reasons. For example, patients in critical care settings are among the sickest in the hospital, and because of the severity and instability of their illness, they are in frequent need for high-risk interventions and frequent medication changes (Cullen et al. 1997).

Evidence from the literature suggests that critical care settings appear to have higher rates of MAE's compared with other hospital settings. The literature cited two major studies which have been conducted in Europe and have reported contradicting results. Tissot et al. (1999) covertly observed the medication administrations in an adult ICU in a French Hospital, and reported an incidence rate of 6.1%. In sharp contrast, Van den Bemt et al. (2002) observed a significantly higher MAE's rate of 44.6% (33.0% when "wrong time" is excluded) in adult ICU's in two Dutch hospitals. These discrepancies in MAE's rates could be ascribed to the fact that Tissot and his colleagues' observation periods were shorter, overt (nurses were aware of the true purpose of the study), and a fewer number of error categories were included. The latter fact may have prompted Van den Bemt and his colleagues (2002) to include more minor errors in the study than those included by the French study. Therefore, the results of the Dutch study are likely to be more inclusive. One study in the US compared medication-related errors that occurred among adult patients inside and outside the ICU. Preventable adverse drug events were found to be twice as common in the ICU, although when the number of drugs used or ordered was taken into consideration, ICU errors were comparable (Cullen et al. 1997).

Calabres et al. (2001) conducted a study to quantify the incidence and types of MAE from a list of error-prone medications in a number of US hospitals. Using covert

observation of medication administration in five adult ICU's, they reported MAE's rates of 3.3%, far less than the incident rates published in the literature, with the drug Lorazepam being the top drug associated with the most severe administration errors and ease of going undetected. Infusion errors were the most frequent type of administration error. The American researchers acknowledged, however, that variations in the observational techniques used and the great involvement of the pharmacists in the process of drug administration were the most likely factors to contribute to such a low rate of MAE's being detected. A recent overt observational study of IV medication errors in an Iranian teaching hospital reported an incidence rate of medication error of 9.4% during the preparation and administration stages (Fahimi et al. 2008). However, the tool used by the observer in this study to determine the occurrence of the error was not validated. Using a previously validated tool in the context of Iranian hospitals was difficult to apply, due to the differences in the settings and context from the western hospitals. Therefore, the result should be cautiously interpreted.

It is clear that the MAE's rates reported in adult critical care settings are significantly higher than those MAE's rates reported in other adult hospital settings (e.g. general medical and surgical wards), although no empirical study appears to have been conducted to measure the incident rate of MAE's in UK critical care settings. Several factors have been mentioned in the literature as potential causes for such high incidence rates. ICU patients usually receive more drugs than those in a general ward, and the majority of these drugs are given parentrally (i.e. via injection) (Van den Bemt et al. 2002). Studies have already shown that MAE's are more likely to occur in the parentrally route of administrations (including IV) compared with other routes

such as the oral route (Wirtz et al. 2003). In addition, ICU patients are usually sedated, and therefore cannot detect and correct possible errors themselves (Tissot et al. 2003).

2.7.5 Methodological considerations for studying incidence rate of Medication Administration Errors (MAE's)

It is noteworthy that unlike the studies conducted to measure the incidence rates of prescription and dispensing errors, the majority of the studies carried out to measure the incidence of MAE's have utilized covert observation as a method of choice. Observational methods have been described as the most accurate method for capturing the activities on the scene (Bernard 2000). The covert nature of an observation, where the nurses were aware that they were being observed without knowing the true purpose of the observation, allows the detection of errors that cannot be otherwise detected by other observational techniques (e.g. overt or participant observation). It is thought that such a technique would minimize the effect of the Hawthorne phenomena, whereby the presence of the observer may affect the behaviour of the participant under investigation (Bernard 2000; Patton 2002), especially when studying a sensitive issue such as a medication error. However, there are huge ethical and moral challenges in conducting a covert observational study. The debate on this issue ranges from completely opposing any kind of such observation on the grounds of the deceitful approach it follows (Shils 1959), to the other end of the continuum which argues that all covert methods are acceptable in search of the truth (Douglas 1976). However, the argument for gaining consent from participants to be observed has become increasingly powerful in the literature (Armitage 2005) which

creates a challenging situation for those who seek ethical approval to conduct such research.

In addition to the comparative use of the observational technique, the aforementioned studies have generally used the same definition of the MAE of the American Society of Hospital Pharmacists (1982). This may suggest that, unlike the studies of prescription and dispensing errors, the results of the studies which aimed to measure the incident rate of MAE's can be compared relatively against each other. For instance, comparing the MAE's incidence rates in the ICU's with those from other wards may be justifiable. Unfortunately, however, other variables intervene and may make such comparison between those studies unhelpful. For example, MAE's studies have investigated hospital wards with different specialities, and have used different types of pharmacy distribution systems, including the unit dose system (where the pharmacy dispenses and prepares all medication for nurses to administer), and the traditional ward stock systems (where nurses pick up and prepare the entire drug from the medicines stock in the ward) (Taxis et al. 1999). Thus, the study settings and parameters are not always comparable. The complexity of such issues becomes more apparent when attempting to compare the incident rates of MAE's between two settings. Using Barker et al.'s (2002) medication error frequency of 19% in the ward as a benchmark, MAE rates in an adult ICU may be lower (6.6%) (Tissot et al. 1999), or higher (44%) (Van den Bemt et al. 2002). This example illustrates how difficult it is to compare the results across those studies. However, whatever the results of the studies, the main point of interest remains how generalizable they are. The more sites used, the longer the study, and the more recent it is, the more generalisable it becomes (Barber and Dean 1998). Observational studies have been conducted in different

settings, hospitals, and countries, and under a broad range of circumstances. A lot of these differences are not documented in the literature. Consequently, caution must be taken in generalizing from another hospital or country's findings to another setting.

In summary, despite the huge ethical and moral challenges associated with them, the observational methods, particularly the covert ones, have been shown to be the most accurate method for detecting MAE's. For this reason, they have been used extensively to measure the incidence rate. Most of the studies have used relatively similar definitions of an MAE. Nevertheless, full valid comparison across different studies is difficult, because of the differences in the variables, measurements, populations, and sometimes methods involved. Previous studies have found high rates of MAE's, particularly within IV drugs administration, and rates were highest within those administered in critical care settings.

2.7.6 Factors which influence the safety of medication administration in adult critical care settings

It has been shown that an exceptionally high prevalence of MAE's occurs in the adult critical care setting, which can reach as high as 45% (Van den Bemt et al. 2002). Such a high incidence rate of MAE's serves as a strong impetus for additional research to investigate the causes of such high incidence. Although a number of studies have attempted to explore the factors influencing the safety of medication administration in adult critical care settings, there is substantially less evidence about the causes of MAE's than there is about their frequency (Wheeler and Wheeler 2005), reflecting the difficulty of conducting qualitative research in such settings. The following discussion sheds light on the literature of the causes of MAE's in adult critical care settings.

Subsequently, discussion will seek to address the contributions of wider organizational issues towards the safety of medication administration in adult critical care settings.

Van den Bempt et al. (2002) attempted to analyze the determinant risk factors associated with the occurrence of the MAE's and near misses in two Dutch Intensive Care Units (ICU's). They reported that flaws in the drug distribution system may lead to serious MAE's. For example, MAE's are likely to occur in the floor-stock system for drug distribution, where nurses have to pick up the right drugs from a stock before preparing and administering them. A study at Wirral Hospital NHS Trust found that there was a 75% reduction in MAE's when a new re-engineered system of using patient's own drugs in the bedside lockers was implemented (Department of Health 2000a). Interestingly, it was suggested that MAE's are more likely to occur when the workload is too low. Leape (1994) has reported that a low activity index could lead to more errors. Other studies have suggested that improving system components would sharply minimize the risk of MAE's. For example, Herout and Erstad (2004) investigated the medication errors involving continuously infused medication in a Surgical Intensive Care Unit (SICU) in the US. They recommended some practical steps to reduce the incidence rate of MAE's, such as the standardization of drip concentration, standardization of infusion unit (microgram/kg/minute Vs Microgram/minute), minimization of intravenous admixture compounding on the nursing units, and in-service nursing education. Moreover, hospital and working leadership was said to have a significant contribution toward the safety of medication administration. Teaching and supporting people regarding how to speak up, and creating the environment where they can express their concerns are key factors in

establishing a safety culture (Leonard et al. 2004). Healthcare is said to be a hierarchical environment, in which it can be difficult to speak up with concerns regarding medication administration (Nembhard and Edmondson 2006). All of these issues suggest that the defects lie mostly with the system components. This assumption is echoed by the findings of other studies investigating medication safety in critical care settings (Calabrese et al. 2001; Van den Bemt et al. 2002; Kopp et al. 2006).

Reason (2000) suggested that measures designed to enhance the system safety can also bring about its destruction. This claim is supported by a Swedish traffic accident study, which revealed that both elderly female drivers and infants in backward facing seats have been killed by rapidly inflating airbags following a collision (Farquhar 1999). In the context of adult critical care settings, this argument is reflected in the controversy surrounding the benefits and risks associated with some medication administration practices, not only in the critical care setting, but also in the general hospital setting. A cross-over controlled trial conducted in three wards in an Australian geriatric assessment and rehabilitation unit found that the use of two nurses to administer medication resulted in 30% lower odds of medication errors (Kruse et al. 1992). However, a recent study in one UK adult critical care setting found that the ambiguity of the role of the second checker of medication has contributed to the unsafe medication administration in that setting (Sanghera et al. 2007). Double-checking was criticized for diffusing the responsibility of checking among the checkers, when each of the two checkers assumes that the other has checked the medication (Catlin 2004; Armitage 2007a). Therefore, some researchers argued for single checking to replace double-checking to ensure the safety of medication

administration. For example, a survey conducted 18 months after the implementation of the single checking of medication in various hospital settings, including critical care settings, indicated that nurses welcomed the single checking medication procedure, and felt more confident using single checking, and perceived that it made them more accountable for administering medications (O'Connell et al. 2007). These findings provide evidence that nurses' attitudes to single checking change remarkably in favour of its use with education and experience of using this procedure. Armitage (2007a) suggested that the benefit of medication double-checking is contestable, and he called for medication double-checking to be selective and systemic, but also to be carried out independently by two checkers in order to be effective.

In summary, critical care settings provide life saving care for many patients, but are also associated with significant risks of adverse events, including serious MAE's and near misses. Researchers have already demonstrated that assuming that all errors of drug preparation and administration originate from nursing activities would be a serious misrepresentation of the true pictures of the pathology of the unsafe medication administration practice. The wider organizational context was shown to have a significant impact on the safety of medication administration, by creating an environment and the necessary tool to jeopardise, or indeed enhance the safety of medication administration. The next section discuses how wider organizational issues can contribute to the safety of an organization, and how these issues can be investigated usefully.

2.7.7 Organizational contributions toward unsafe medication administration in adult critical care settings

Most of the studies which have investigated the safety of medication administration in adult critical care settings have tended to focus on the causes of unsafe medication administration, with less emphasis on those organizational factors which contribute towards the resilience of medication administration. For instance, Wheeler and Wheeler (2005) reviewed the literature on medication errors, including MAE's, in anaesthesia and critical care settings. They classified some published causes of the medication errors using Reason's accident causation model (1990). For example, environmental design, lack of communication, and patient factors were identified as latent conditions. However, the review did not pay adequate attention to the immediate environment (i.e. local contributing factors) and the context of each error, and it is therefore possible that it underestimated the effects of some other factors. Additionally, the review focused on the anaesthetists' perspectives of medication errors, primarily during the prescribing and administering stages (as the anaesthetists are often involved in both stages of medication use), which in many ways differs from the nursing perspectives.

More recently, Sanghera et al. (2007) conducted a study to explore the attitudes and beliefs of healthcare professionals in relation to the causes and reporting of medication errors in a UK adult intensive care unit. 13 interviews were conducted with members of staff involved with medication errors, including MAE's. A range of latent conditions leading to unsafe medication administration were identified. For example, the role of the second nurse checker prior to administration was unclear. Nurses interpreted the second checker in different ways, and did not always check the

dose prepared against the prescription, or check the patient's identity. Secondly, it was a common and accepted practice to administer medications without a complete medication order, where nurses often administered medication that had not been prescribed, or was indicated on the pre-printed drug chart but not signed, if they perceived that doses were essential for the patient. Finally, there was lack of feedback on reported medication errors, where staff did not have the opportunity to learn from previous errors. Interruption, poor staffing, lack of supervision, and not referring to medication administration protocols were identified as error-producing conditions. Because the study investigated medication errors during prescribing, dispensing and administration, it was difficult to highlight whether these latent conditions were related to medication administration or to medication management in general.

Impaired communication was often cited in the critical care literature as a driving force for unsafe medication administration. Safe medication administration practice is said to be supported when the multidisciplinary team has the ability to engage in active, constructive communication, where even the most junior nurses feel empowered to speak out in front of both higher-ranking nurses, and those from other disciplines (McBride-Henry and Foureur 2007). Evidence in the literature has emphasized the importance of open communication in creating a safe atmosphere in critical care, where team members feel they can speak up if they have any safety concerns or issues with the quality of care provided to the patient. A communication failure can emerge from junior member of team being reluctant to communicate openly with a senior member because of fear of either appearing incompetent, or fear of being rejected, embarrassed, or suffering reprisals. Research in the US indicated that ICU nurses are less likely to speak up about problems related to patient care when

compared with doctors (Miller 2001; Thomas et al. 2003). Similarly, in the UK, Reader et al. (2007) conducted a study to examine whether nurses and doctors working in ICU have differing perceptions of their interdisciplinary communication. Nurses were found to be less likely to challenge the senior or junior doctors regarding any aspects of patient care. In addition to factors such as hierarchy, gender, and different patient care responsibilities, the study cited leadership as a determinate factor for open communication among various members of the critical care team.

Traditionally, nurses were said to experience a sense of marginalization during their encounter with the doctors in discussing patient care management (Sweet and Norman 1995), and critical care settings are no exception to that. In an ethnographic study of six registered nurses in a critical care setting in Australia, Manias and Street (2001) found that nurses were reluctant to disagree with the doctors in discussing decisions related to patient care, and they also faced enormous difficulties in raising their concerns related to patient issues during the ward round. Moreover, Bucknall and Thomas (1997) conducted a survey to investigate the decision-making process of 230 Australian critical care nurses. The findings showed that while critical care nurses are expected to demonstrate a certain degree of autonomy in their decision-making process, the nurses in their study found it difficult to maintain this, particularly in initiating treatment for the patient, including medication management. In addition, although many of the nurses felt more experienced, knowledgeable, and skilled than junior doctors who were charged with the overall responsibility of patient care, at the same time, they were not always able to challenge them when they felt uncomfortable with their decisions. Nonetheless, critical care nurses seem to be more empowered to challenge the doctors than those nurses in general hospital wards, although the study

did not specify whether all nurses were adult, paediatric, or neonatal critical care nurses (Bucknall and Thomas 1997). Chaboyer et al. (2001) compared the nurses' perceptions of the doctor-nurse collaboration in critical care settings and general ward settings using a mailed survey, and found that critical care nurses are more likely to confront their doctor counterparts regarding what they perceive as unconvincing medical decision-making. One explanation suggested by the study for such perceptions was due to the very nature of critical care practice, which is seen to be more closely situated with the biomedical model by having a focus on pathophysiology, treatment, and technology, which is said to be more closely aligned with the scientific medical discourse (Taylor 1994). The previous studies which investigated the relationships between critical care nurses and their doctor were conducted in Australian hospitals, and may not be transferable to the context of NHS. Nonetheless, their findings underlie the relationship between the nurses and doctors in critical care settings, and how this relationship may influence the medication management decision.

To provide a broader understating of the relationship between nurses and doctors, it is useful to present this issue in the context of the available literature on the nursing division of labour, which has researched extensively in doctor-nurse relationships. Stein (1967) used the concept of the doctor-nurse game to describe the relationship between the doctors and nurses, whereby nurses play a "game", as they ultimately learn the art of making suggestions to the doctor without overtly doing so. It appeared that nurses believed that they could not, under any circumstances, challenge doctors' decisions, because they felt that they held a subservient role to that of doctors. However, over 20 years later, Stein himself and other colleagues (1990) revisited the

doctor-nurse game, and concluded that nurses may have stopped playing the game. In an area of increasingly specialised knowledge and experience such as critical care settings, no one can know all things about the patients (Porter 1995), and the expectations would be that doctors, particularly the junior doctors, may become increasingly dependent on the nurses' special expertise in complex settings, as nurses become more expert, knowledgeable, and skilful, as well as being within constant proximity to the patients. However, previous evidence presented in this section (above) indicates that the increased knowledge and expertise of the critical care nurse may not necessarily mean that critical care nurses have stopped playing the doctor-nurse game, and there may be some enduring elements of authority still present in the nurse-doctor relationship in critical care settings.

The trade-off between the safety and pressure for production in critical care settings and its impact on the safety of medication administration is well-addressed in the literature. A US study conducted by Carayon et al. (2005) on the relationship between nurses workload and ICU outcomes revealed a high nursing workload and negative patient outcomes, including unsafe medication management. The study suggested that this high nursing workload was imposed by managers at the macro-level of the organization, and does not consider the contextual organizational characteristics of a particular ICU, such as the unit layout, skill mix, and patient dependency, and whether these factors are adequately addressed to meet the high work load. This finding is reinforced by those of a qualitative study conducted by Waynne (2004) to investigate critical care nurses' perceptions of the organizational restructuring of the nurses' performance in the work place. Many nurses felt that decisions were made beyond their control, and driven by the incentives to meet government demands. The

study also found that when nurses in the ICU do not participate in formal policy construction, any policies produced are unlikely to be sensitive to the nurses' performance, including their medication administration practice. For that reason, the quality of nursing work place performance is compromised, which equates to reduced quality of care and patient safety. The study concluded that unless the safety and pressure of work are well-balanced, the unilateral introduction of changes to a critical care environment from the upper echelons of management have ramifications for nursing performance that may negatively impact upon the quality and safety of patient care.

Sound-alike and look-alike medication can also increase the opportunities for unsafe medication administration. Confusion about names and the mixing-up of medication account for more than one-third of medication errors reported to the US MED program, including those reported from the intensive care units (Cousins 1995). Errors involving sound-like and look-alike medication may occur when the nurse misinterprets a poorly-written prescription, or does not verify the correct drug with the prescriber, or when the person taking the verbal order or prescription does not hear the order correctly and fails to repeat the order to the prescriber (Davis and Cohen 1993; Lambert 1997). Other contributory factors are that drug names often sound and look alike, labels may contain visually confusing information, and packages may be designed for the marketplace rather than for practice conditions (Kenagy and Stein 2001). A common cause of name mix-ups is what human factor experts call "confirmation bias" (Cohen 2000), where the practitioner is presented with a poorly written prescription, a medication name, label, or packaging which they are very familiar with, and thus overlook any evidence of the contrary. The use of

electronic medication prescribing and bar-code medication administration have been suggested as strategies to avoid conformation bias in medication administration (Tuohy and Paparella 2005).

Poor reporting of adverse events has been reported as being a leading factor for not getting enough information on the potential threats to the organization. Poor reporting of medication administration errors and near misses is well-documented in the literature. The UK Government white paper *An Organization with a Memory* (Department of Health 2000a) highlighted that the mechanisms for reporting and learning from medical mishaps in the NHS were generally poor. A report by the Audit Commission (2005) suggested that this was still a problem for the NHS. Wakefield et al. (2000) suggested that accurate reporting of MAE's and near-misses is dependent on the ability of the practitioner to recognise that an error has actually occurred, to believe that the error is significant enough to warrant reporting, and to overcome the embarrassment of having committed a MAE, and the fear of punishment for reporting mistakes. Overcoming the fear of punishment and reprisal remain the most indicated barrier causing underreporting (Department of Health 2004; Mayo and Duncan 2004).

Leape (1994) criticised the training of medical professionals in the medical domain which de-emphasizes human fallibility, where it is reinforced by the unforgiving hospital blame culture, which has created strong pressure on individuals to cover up mistakes. Leape et al. (1997) argued that the system which relies on perfect performance by individuals is doomed to fail for the simple reason that humans are incapable of perfect performance. They suggested that healthcare professionals need to fundamentally change the way they think about human error. Such concerns were

echoed in the UK by Reader et al. (2006), who criticised the absence of "non-technical" skills in the training of critical care staff. In other high-risk industries, such as aviation, the pilot's skills that are not directly related to their technical expertise, but are crucial for maintaining safety, are called non-technical skills. These skills include interpersonal skills such as communication, teamwork, and leadership, as well as cognitive skills such as task management, situation awareness, and decision making (Baker and Dismukes 2002; Flin et al. 2003). The initial results of integrating such non-technical skills in the training of Operating Room (OR) nurses have demonstrated reduced errors and changed attitudes and behaviour towards team work (Powell and Hill 2006), although the benefit of such an approach in the context of critical care nurses has not yet been systematically tested, particularly given that a considerable proportion of pre-registration nursing education is delivered through student clinical supervision (Ramprogus et al. 2003). Therefore, such learning can be influential in establishing a long-term understanding of the human and system contributions towards adverse events and the influence of such non-technical skills in enhancing patient safety. In such placements, the student nurse has to shadow qualified nurses during medication administration rounds, or administering medication themselves where appropriate (in this case it would be oral medications) under the direct supervision from qualified nurses. Depending on the quality of the supervision and teaching, this experience can expose the student nurses to a rich source of knowledge about some pharmacology of the medications, but can also reinforce the implementation of good practice such as checking and adhering to policies and guidelines of medication administration, in addition to teamwork, communication and interpersonal skills (Watson 1999). Where such education and supervision are inadequate, the overall quality of education can also be lacking, so the balance of

responsibility can be said to lie with the education in the School of Nursing, and also with supervised medication administration in practice.

To address the disparity gap between the expected and realistic goals in nursing practice, Crigger (2005) called for integrating the ethic of making and dealing with clinical practice mistakes in the US nursing schools' curriculum, where one would acknowledge mistakes as an undesirable but possible event, to address the ethics of dealing with them in the event that they occur, rather than hiding them. This approach is likely to enhance disclosure of error, since the responsibility of outcome is broadened, and critical care nurses can explain actions in a much broader context. However, there is no evidence to suggest that such an approach has been systemically integrated in the nursing undergraduate training, at least in the context of the nursing training in the UK. Leape (1994) suggested that the problem of under-reporting is likely to continue until fundamental changes are brought to pre–registration education so that it reflects the human fallibility for error.

2.7.8 Organizational contributions toward resilient medication administration in adult critical care settings

Several published studies have emphasized the underlying factors for resilient medication administration in critical care settings; many of these factors have proven to be organizational. For example, the use of automation, particularly the introduction of bar-coding in administering the medication, has notably reduced the number of medication errors by 60% - 80% (Puckett 1995), and reduced MAE's by 11% in many settings, including critical care (Lawton and Shields 2005). Additionally, the use of bar-coding, although not a problem-free option, was also reported to improve the

scheduling of medications, to provide better communication between nursing and pharmacy staff, more efficient drug monitoring, and more accurate and timely billing (Cohen 2000; Neuenschwander et al. 2003). The use of a smart IV infusion systems with the decision support software has the potential to ensure that the right infusion rate and duration are used (Kelly and Rucker 2006), although no control study has identified a measurable impact of such a system of safe medication administration.

In hospital settings, a strong commitment to safety has also been found to move forward medication management safety, including medication administration. The existence of a safety culture, where nurses do not feel frightened if they report medication errors, and where learning from errors is facilitated and reflected in practice, was found to contribute greatly to safer medication use in all hospital settings, including critical care settings (Cox and Flin 1998; Cox and Cheyne 2000). Moreover, the organizational decision to incorporate the pharmacists in hospital rounds in ICU, and therefore verify the doctors' orders, has reduced preventable adverse drug events by 66-78% (Leape et al. 1999). Furthermore, the introduction of a unit-dose drug distribution system, where medications arrive in ready-to-use single dose form, has been found to enhance the safety of medication administration in wards such as critical care (Cohen 2000).

The publicity given to clinical accidents and medication errors in general, and MAE's in particular, have made them the focus of a large proportion of research conducted to explore the underlying problems leading to a bad outcome. It is important to note that the majority of medications are administered safely (Barber and Dean 1998; Department of Health 2004), yet little research has aimed to explore the factors which

contribute to such success, with the organizational factors playing a crucial role in achieving any safety success (Reason 1997; Carthey et al. 2001). This is in line with the initial expectation from the literature on safety research, which has traditionally focused on the accident causation rather than resilience success. This conclusion reinforces the need to address the balance between the two aspects of medication safety in adult critical care settings. Such a move is likely to provide a better understanding about the overall safety of medication administration in the adult critical care setting.

2.8   Discussion and implications for this study

This review of the literature has emphasized the growing awareness that adverse events in medicine are frequent events, causing harm to patients and increasing the costs to the healthcare system. Among all adverse events in medicine, a considerable proportion is associated with the use of medication. Research into medication errors and safety has been criticized for focusing on studying the rate of medication errors, but not considering the wider context in which medication errors occur (Cheek and Gibson 1996). Looking at previous studies, research into the organizational contributions towards the safety of MAE's in adult critical care settings has retrospectively reviewed previous research on this issue, which is likely to overlook the context and the immediate environmental issues (Wheeler and Wheeler 2005), or attempted to seek the perspectives of adult critical care nurses in the context of other healthcare professionals (Sanghera et al. 2007). Even the research which aimed to understand the system impact on safe medication administration has only partially addressed the wider organizational factors which enhance safe medication administration, and therefore their findings only give an incomplete picture of the

organizational contributions toward the safety of medication administration in adult critical care settings.

The Organizational Safety Space Model (OSSM) was developed to address the apparent imbalance in addressing both the positive and negative faces of organizational safety. It focuses on the contributions of the wider organizational aspects, rather than individuals, toward the safety of operations within complex socio-technical organizations (Reason 1997; 2000; Carthey et al. 2001). This thesis examines whether the OSSM can equally be utilized to investigate the safety of medication administration in adult critical care settings. The question is based on several grounds. Firstly, critical care settings can be viewed, in many ways, as complex socio-technical organizations. Friesdroft et al (2003) have outlined several reasons which support the assertion that the critical care environment has characteristics that reflect a complex socio-technical system. For example, the rapid change with the quantity of information is processed, including information about the prescribing, dispensing, and administration of medication. Furthermore, single elements of the work system, such as nurses, doctors, machines, and medications administered, are interlinked, and interact with each other in complex ways. Critical care settings have been described as a point of convergence within the system of different elements (Friesdorf, 2003). Nurses are one element among many sub-system elements, such as physicians, pharmacists, and patients, where they interact with work processes which take place within the work system within information systems, as well as organizational relationships and structures.

Another reason for using the OSSM in this research stems from the very nature of the process and operations performed in the critical care environment, such as medication administration, which are not predictable in their conduct (Backhaus and Friesdorf 2007). In other words, many of those organizational factors highlighted as influential in shaping the safety of medication administration cannot be measured or quantified directly by conventional tools, and can only be described through models. The roles of theories and the models have been increasingly acknowledged in healthcare, and have been indicated to reveal the components of the system if used explicitly (Alderson 1998). A model-driven approach is used in this study to systematically explore the range of factors contributing towards the safety of medication administration in adult critical care settings. In this study, the participants' views on this issue will be analysed based on the framework of OSSM developed by Reason (1997) and Carthey et al. (2001). This literature review has also emphasized that the OSSM has been developed to address the imbalance between the two faces of organizational safety, the negative face (i.e. organizational accidents) and the positive face (i.e. resilience against organizational accidents), but has been insufficiently utilized in the clinical context, particularly in addressing the wider organizational factors which can enhance or jeopardize the safety of medication administration in adult critical care settings. This presents a strong argument to provide a new perspective of the organizational contributions toward the safety of medication administration in adult critical care settings.

This literature review aimed to examine the contemporary debates on organizational safety since the development of OSSM, which underpins this thesis. While acknowledging the contributions of latent conditions and local contributing factors

toward the adverse events, some researchers argued that identifying such latent conditions and local environmental factors is a subjective matter and will always be open to interpretation, which compounds the difficulty of assessing the extent to which the risk is normalized. Recent debates about the contributions of the latent and local contributing factors towards organizational safety, and how the risk is perceived and communicated among individuals, makes it increasingly useful to assess the validity of such debates in the context of the findings of this study, and to examine the adequacy of the OSSM to address the organizational aspects which can enhance or jeopardize the safety of medication administration in adult critical care settings.

While doctors and pharmacists remain predominantly responsible for the first two stages of the medication management process, medication administration remains a key component of nurses duties, requiring up to 40% of their time (Armitage and Knapman 2003). The nurses' views on this issue were identified as being often overlooked (Gibson 2001). However, nurses were reported to have developed significant expertise in medication administration, and have considerable knowledge of the associated system of medication administration (McBride-Henry and Foureur 2006). This suggests that they are bound to offer unique insight into those organizational aspects which influence the safety of medication administration in adult critical care settings.

In summary, this review has identified three key areas which need further research into the wider organizational perspective of medication administration in adult critical care settings:

- The literature highlighted an imbalance in the focus of medication safety research in adult critical care settings, with more attention being devoted to the causes of unsafe medication administration practice, with less research focussing on the organizational contributions toward the resilient medication administration in adult critical care settings.

- Following Reason (1997, 2001), the OSSM was developed to address the specific organizational aspects which contribute towards the safety of organizations. The model has not been explored sufficiently in the clinical context, at least in addressing the safety of medication administration in adult critical care settings

- Nurses' views of the organizational contribution towards the safety of medication administration in adult critical care settings are largely overlooked in the medication safety literature.

Based on aforementioned gaps in the literature, this thesis aims to address the following aim and objectives:

Research aim:

To explore the adult critical care nurses' views on the organizational factors which influence the safety of medication administration in adult critical care settings.

Research Objectives:

- To utilize the organizational safety space model as a framework for investigating the factors which influence safe medication administration in adult critical care settings.

- To explore nurses' views about organizational and environmental factors which promote or jeopardize safe medication administration in adult critical care settings.

- To assess the adequacy of the organizational safety space model (OSSM) in investigating the safety of medication administration in adult critical care settings in the context of recent debates on the organizational safety.

Chapter Three

Context Setting for Medication Administration

3.1 Introduction

The purpose of this chapter is to present the reader with the foundation information on the context of medication administration, and the day-to-day practices of normal medication management in the critical care settings where this study took place. To achieve this purpose, several issues are explored. Firstly, the history and the development of critical care services at the national and international levels is explored, drawing from research on critical care settings from the UK and other countries. This information is intended to provide the reader with an idea about the organization of critical care services, and what the unique features of critical care environment are, in comparison with other hospital settings. Secondly, the structure and organization of critical care services in the Trust where this study took place are discussed. This includes a description of how the critical care services are managed, staffing issues, ward layout, and the day-to-day practices of delivering the nursing care. Such information will enable the reader to have a clear picture of the flow of work in those settings, and helps to relate it to the information generated at later stage from the data chapters. Thirdly, the chapter provides a detailed account of medication management in the critical care settings investigated, particularly regarding how medication is prescribed, dispensed, and administered on a normal day-to-day basis, and how the medication administration process is regulated and how the system of medication delivery is managed and practiced on a daily basis. This is essential to enable the reader to examine these issues in the context of the whole thesis, and to link it with the other practices, regulations, and structural issues related to the critical

care settings investigated in this chapter. In addition, a dedicated section on the individual experiences of the nurses on the day-to-day basis is presented. Specifically, the main work-related activities of the critical care nurse in the settings are investigated. The discussion in this chapter begins with an illustration of my personal experience of working in critical care settings, and how this experience assisted in gathering information on the research setting.

3.2 Personal experience

As a registered nurse, I have 8 years' experience of working in adult critical care settings, both in the UK and Jordan, before this study was conducted. I also worked as an agency nurse on average 10 to 30 hours per month over three years of the study in some of the adult critical care settings where this study was conducted. This role required me, as part of my clinical and teamwork responsibilities, to observe, interact, and ask questions about the organization of work in these wards, where I was able to access information about the context of work in these settings. Publically available information on the adult critical care settings was also accessed through the internet, and the Trust's publications and annual reports (Woodland Hospital NHS Trust 2007a; Woodland Hospital Trust 2007b). Specific information on the organization and the routine of work in adult critical care settings was also obtained during the data collection stage of this research. Other information was also gained from meetings held with the senior managers in the Trust while negotiating the access to the research settings. The implications of this role are further explained in the methodology chapter.

3.3 Critical care services

Critical care was defined as

> …the care provided to the patients who require intensive monitoring and/or the support of a failing organ (Critical Care Stakeholder Forum 2003.p.5).

The idea of critical care originated during the polio epidemic in Denmark in 1952 (Menon and Nightingale 2003). In the following 50 years, technological developments meant major advances, so that by 2009, advanced life-support machines are widely used in critical care settings. The use of life-support technology, combined with the constant attendance of experienced medical staff, has dramatically reduced the mortality rate of critically-ill patients (Department of Health 2000c). Most patients needing critical care are placed in dedicated units where they can benefit from both higher staffing levels and staff with specialist skills. For the healthcare service, centralization reduces the duplication of costly equipment (The Audit Commission 1999). In the context of UK settings, critical care can be delivered in two main settings:

> Intensive Care Unit (ICU): these are sometimes called Intensive Therapy Units (ITU's). They comprise the highest level of care a patient needs when two or more of the body's vital life organs fail.

> High Dependency Unit (HDU): where an intermediate level of critical care can be delivered for those patients who no longer need intensive care, but are not well enough to return to an ordinary general ward, or those recovering from major surgery who need close monitoring.

> (Source: The Audit Commission, 1999).

This classification of critical care settings was reformed by the publication of the Department of Health report *Comprehensive Critical Care* (2000c), which helped to

set the future vision of the critical care services in the NHS. Critical care levels are categorized on a continuum from 0 to 3, depending on the complexity of the patient' condition and the level of care needed to meet such complexity. Table 1 gives a description of the patient conditions which are admitted to each level of critical care:

Level 0	Patients whose needs can be met through normal ward care in an acute hospital.
Level 1	Patients at risk of their condition deteriorating, or those recently relocated from higher levels of care, whose needs can be met on an acute ward with additional advice and support from the critical care team.
Level 2	Patients requiring more detailed observation or intervention including support for a single failing organ system or post-operative care and those 'stepping down' from higher levels of care.
Level 3	Patients requiring advanced respiratory support alone or basic respiratory support together with support of at least two organ systems. This level includes all complex patients requiring support for multi-organ failure.

Table 1: Description of the patient conditions in each level of critical care
(Department of Health, 2000c)

The majority of level one critical care is delivered within a general ward environment (Critical Care Stakeholder Forum 2003). In the last decade, the major focus in providing critical care has been in levels 2 and 3 (Galley and O'Riordan 2003; Menon and Nightingale 2003). Patients who require level 3 critical care are usually admitted to the Intensive Care Unit (ICU) which meets the required level of care (i.e. highest level of critical care), whereas those patients who need level 2 critical care are usually admitted to the High Dependency Unit (HDU)[1]. The last census, published on 30 September 2005, showed that on 14 July 2005, there were 3,193 critical care beds in

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[1] Throughout the thesis, "adult critical care settings" refer to level 3 adult critical care setting (i.e. Intensive Care Unit) and level 2 adult critical care setting (i.e. High Dependency Unit).

England, of which 1,772 were Level 3 and 1,421 were level 2 (Department of Health 2005c).

In comparison with European countries, critical care settings in England appear to have their own distinctive profile in term of staffing, education and financial management. Depasse et al. (1998) conducted a survey to study the nursing profile in ICU's across six European countries. The study found that the UK had the highest level of nursing staffing, with 4.2 nurses per ICU bed, whereas Denmark in the lowest staffing level of 1.2 nurses per bed. One reason stated by the study for such variations in staffing were the variations in the financial budgeting as well as the different cultural and regional views on managing staffing in critical care settings. For example, the UK Royal College of Nursing (2003) recommend that the staffing levels and skill mix within critical care settings should reflect the dependency of the patients and the fast changing nature of the patient conditions. Therefore, the number of nurses per shift should allow for flexibility to respond to the unpredictable changes in patient dependency. This view may not be shared by critical care setting in other European countries. Yet, with higher levels of staffing, one might expect British nurses to be more involved with invasive procedures, but this was not the case. Depasse et al (1998) did not specify the criteria of admission for critical care patients in each county examined, which may not explain the rationale behind the staffing ratios in each country. Swedish critical care nurses appear to have had the most autonomous status in their practice. For example, all Swedish critical care nurses (100%) were able to insert a peripheral intravenous catheter for the patient, and around 80% of them were able to inject drugs into an epidural catheter, whereas only 15% of British nurses were able to insert a peripheral intravenous catheter for the patient, and less than 25% of

them were able to inject drugs into epidural catheter. Depasse et al also showed that there were variations among the European countries in terms of the training received by nurses before and after starting work in critical care settings, particularly the level 3 critical care settings (ICU), with 91% of the British nurses reporting having receiving special training in ICU *after* commencing their work there. However, in relation to the special training received prior to commencing work in ICU, only 23% of the British nurses reported receiving special training of the ICU *before* commencing their work. This was compared with other countries like Sweden, where all the nurses were reported to have undergone special training in ICU before they commenced their work there. Depasse et al. (1998) expressed their concerns that in some countries, new ICU nurses are placed in an environment where critically-ill patients are monitored and often treated with complex and technically involved equipment, with no specific training beyond that which they may have picked up during their student attachments.

Patients in critical care settings were said to have different needs from those patients in other general hospitals settings. For example, they are mostly likely to be dependent, in various degrees, on the nurses to provide almost all of the nursing care to them compared with patients from other hospital settings (Adam and Osborne 2005). Patients in general hospital settings (i.e. levels 0 and 1 of critical care) are likely to have more independence in their Activities of Daily Living (ADL's), compared with patients in critical care settings. This includes washing, dressing, and even self-medicating themselves (Covinsky et al. 2003). Due to the criticality of their conditions, patients on level 3, and to a lesser extent level 2 adult critical care, are likely to lose their independence in their activity of daily living (Chaboyer and Grace

2003), primarily because the majority are likely to be unconscious. The patients, particularly in level 3 adult critical care settings, may require advanced respiratory support, because their critical conditions do not allow them to breathe independently (Crocker 2006). For this reason, ventilators are routinely used in level 3 critical care settings to help the critically-ill patients to breathe. To do so, the patient should normally be sedated. Being unconscious means that, unlike most patients in other general hospital settings, patients in adult critical care settings, particularly level 3 adult critical care, are unlikely to communicate with whoever is looking after them. In such circumstances, the communication channel between the nurses in adult critical care and the patient's family becomes crucial, especially when considering decisions deemed vital to the patient's welfare (Ahrens et al. 2003). The patient condition in the critical care setting is critical, rapidly changing, and life-threatening compared with patients in other hospital settings. Understandably the family will be very concerned about any potential change in patient conditions, and family care is therefore often considered an integral part of critical care nursing duties.

3.4 The Woodland Hospital NHS Trust

The study took place in the Woodland Hospital NHS Trust, which is an acute Hospital Trust in the middle of England. The Trust consists of two hospital campuses. They are labelled in this research as "Beech Hospital" and "Oak Hospital." The two campuses were independent acute Hospital Trusts before merging together in 2006 into one acute teaching Trust, with a total of 2200 hospital beds across the two campuses, and an annual budget of more than £500 million at the time when this study was carried out. The Trust delivered healthcare services, including critical care services, to a local population of 650,000 people.

During the period this study was conducted many NHS Trusts across England and Wales faced increasing financial challenges. They were under pressure from the UK Government to reduce overspending and improve their financial performance (British Broadcasting Corporation 2007). The Trust where this study was carried out was no exception to that. It announced financial deficits of around £60 million during the time when this study was being carried out (Woodland Hospital NHS Trust 2007a). Consequently, in 2006 it announced a plan to cut 1200 jobs across the two campuses to balance its financial deficit. Many of these cuts affected the nursing staff as well as non-clinical staff, such as porters, cleaners, and catering staff. One way or another, this might have influenced the services that were perceived by the Trust management as less important and too expensive to sustain.

Critical care is often perceived as consuming significantly more financial resources than many other general hospital settings. Previous studies suggest an awareness of how much it costs to treat the patient in critical care settings. For example, Edbrooke et al. (1999) estimated that the average cost per patient day in 11 UK ICU's was £1,000, suggesting that a critically ill patient costs six times more per day than a non-critically ill patient on the general hospital ward. Moreover, Bennett and Bion (1999) have estimated the cost per intensive care bed day in UK to be £1,000-£1,800, with salaries accounting for over 60%, pharmacy for 10%, and disposables for a further 10% of the cost per day. When compared with spending in other European countries, the UK was shown to have the smallest proportion of acute hospital beds allocated to critical care beds (around 2.5% of the total hospital beds), with Denmark allocating the largest proportion of hospital beds toward critical care services (around 4.5% of

the total number of beds) (Menon and Nightingale 2003). However, it should be noted that the classification of critical care settings in the UK (i.e. Levels 1 to 3) may not be the same as those in other European countries, such as Denmark, and therefore, caution must be taken when interpreting and comparing these results.

The previous chapter demonstrated that the critical care settings present substantial patient safety challenges, particularly in terms of unsafe medication administration. It is fast-paced, complex, and commonly requires urgent high-risk decision-making processes, which render the patients vulnerable to unsafe clinical practice (Rothschild et al. 2005). Moreover, critically-ill patients may be particularly vulnerable to iatrogenic injury because of the severity and instability of their illnesses and their frequent need for high-risk interventions and medications (Cullen et al. 1997). The Department of Health (2004) has also acknowledged that with the increasing complexity of drug administration and the use of high technology in critical care, patients may have multiple lines accessing various sites for drug administration, therefore, increasing the risk of unsafe medication administration. In this context, the Trust where the study took place published its risk management strategy, including in critical care settings, which was based on enhancing incident reporting of Serious Untoward Incidents, such as unsafe medication administration. The strategy defined the Serious Untoward Incident as when:

> A patient, member of staff or member of the public suffers (or is exposed to the risk of) serious injury, major permanent harm, or unexpected death, actions of [Woodland Hospital Trust] staff are likely to cause significant public concern, or there might be serious impact upon the delivery of services and/or media attention and/or litigation and/or a serious breach of service standard or quality (Woodland Hospital Trust, 2007, p.7).

The strategy suggested greater emphasis on reporting unsafe practice by all healthcare professionals such doctors, nurses and pharmacists. Incident reporting has been advocated as a vital tool for managing the risk in critical care settings (Department of Health 2000a). The UK Intensive Care Society (2005) has recommended that it is essential that systems of incident identification, reporting, support and supervision, mentorship, and access are described during the induction of staff who join critical care settings. In the adult critical care settings investigated, the Trust put in place a mechanism to report incidents of unsafe practice, including the reporting of MAE's and near misses. This included filling in a paper-based form of the incident. The completed form then goes to the ward manager, or a senior member of staff, who investigates the matter. The depth of the investigations would usually depend on how serious the incident was, and degree of harm, or potential harm, that could have come to the patient.

The Trust's published risk management strategy advocates a "no blame" culture, but also promotes an "accountable culture which enables staff to raise concerns around safety issues without fear of blame or retribution through participation in incident reporting" (Woodland Hospital Trust 2007b.p.3). The Trust's policy also states that the completion of an incident report is not considered an admission of liability. Moreover, the Woodland Hospital Trust has a policy which stated that staff who make a prompt and honest report will be supported and treated fairly, and that disciplinary action was only considered as part of the response to an incident in specific circumstances. Where there was clear evidence of gross professional misconduct, the same individual being involved in a number of incidents or deliberate failure to report an incident or to co-operate with an investigation (Woodland Hospital Trust 2007b).

3.5 Adult critical care settings in the Woodland Hospital NHS Trust

This section provides a brief overview of the nature, characteristics, and organization of critical care settings in the Woodland Hospital Trust, particularly those of level 2 and level 3 adult critical care settings. Issues such as staffing, the skills mix of the staff, and the design of the critical care settings investigated are discussed.

In the Woodland Hospital NHS Trust, the number of nurses in each shift in level 3 adult critical care settings was more than the number of nurses in level 2. This was because the nurse to patient ratio varied from the level 3 and level 2 adult critical care settings. In accordance with the recommendations of the Department of Health (1996), the Intensive Care Society (Intensive Care Society 1997) and the Royal College of Nursing (2003), a one-to-one nurse to patient ratio was in place in all level 3 adult critical care settings in the Trust. However, this ratio may go down to one nurse to two or three patients in level 2, where the patient's conditions are less severe than in level 3. In the event of understaffing, the ward would ask the nurses to do overtime shifts, and if that still did not resolve the shortage of nursing staff, agency nurses were called in through external nursing agencies to provide the necessary nursing cover for the shift. As a qualified nurse, I previously worked for such external agencies and provided temporary nursing cover on several occasions for some of level 2 adult critical care settings investigated in this study. Nurses from various professional ranks usually work in each shift. Qualified nurses working in the NHS, including the hospital where this study took place, are classified into bands (band 5 to band 9) according to a predefined criteria, such as years of experience, managerial responsibilities, and the skills they exercise in their job (Royal College of Nursing

2003). For example, staff nurses start with band 5, whereas senior staff nurses fall into band 6, and ward managers (often called senior ward sister or senior charge nurses) fall into band 7 and above. In the critical care settings investigated, a senior nurse (usually from band 6 and above) takes charge of managing the shift, with duties such as overseeing patient admissions and discharges, patient emergencies, staff sickness, and providing expert advice if needed to other members of staff, particularly junior nurses. In addition, there was usually a nurse consultant, who was an expert in nursing practice (from band 8 and above) in each level 3 adult critical care setting. The role of the nurse consultant was to provide leadership, clinical expertise, and guidance on various clinical and managerial issues for the rest of team. It was the Trust policy that newly-qualified nurses who join any critical care ward would undergo a period of induction, which may last from 2 to 4 weeks, where they were not to be counted in the number of qualified nurses on the shift. They would shadow a mentor, who was usually a senior member of staff, in order to be become familiar with the atmosphere in the ward, the policies and protocols, and to get to know the other members of healthcare team in the unit (i.e. doctors and pharmacists).

The UK Intensive Care Society (2003) has suggested that a typical critical care area in the UK has six intensive care beds and may be supported by a variable number of high dependency beds. Moreover, the setting needs to be staffed 24 hours a day by consultants with responsibility for clinical care and an average of 30-50 nurses per unit so that the sickest patients have 24-hour, one-to-one nursing care. Physiotherapists, pharmacists, dieticians, microbiologists and medical physics technicians also play a role in critical care areas.

In the context of Woodland Hospital NHS Trust, adult critical care services were provided by 17 consultants and around 250 nurses for 73 critical care beds included in the setting investigated in the study. The service was divided into adult intensive care areas (i.e. level 3 adult critical care settings) which provided support for breathing through use of ventilators and support for patients with multiple organ failure, in addition to the adult high dependency areas (i.e. level 2 adult critical care settings), which allows for specialist monitoring and support for patients with one or two organ failures.

At the time when the study was carried out, the Oak Hospital campus had one level 3 adult critical care setting with 14 beds, and three settings which delivered level 2 adult critical care, with a total of 24 beds. In the Beech Hospital campus, adult critical care was divided into two sites, one of which had 18 adult critical care beds (8 level 3 adult critical care beds and 10 level 2 adult critical care beds), in addition to an extra 5 beds for the coronary care unit (level 2 adult critical care). Patients with a wide range of critical conditions were admitted to this site. The second site was attached to a dedicated operating theatre suite which provided a minimum of 15 planned theatre sessions for heart surgery per week. Therefore, only post-cardiac surgery patients were admitted to this site. The site had 16 beds (10 level 3 and 6 level 2 adult critical care). Table 2 summarizes the number of adult critical care beds across the two hospital campuses.

Adult Critical Care Level	Level 2	Level 3
The Oak Hospital	Three settings Medical HDU (8) Surgical HDU (8) Coronary Care Unit (CCU) (8) (total of 24 beds)	One setting Adult ICU (14 beds)
The Beech Hospital	Three settings Coronary Care Unit (CCU) (5) Adult (HDU) (10) Cardiac HDU (6) (Total of 21 beds)	Two settings Adult ICU (8) Cardiac ICU (10) (Total of 18 beds)
Total number of adult critical care beds in both campuses	45	32

Table 2 Summary of the number of level 2 and level 3 adult critical care beds in the Woodland Hospital (both The Oak and the Beech Hospital campuses)

Figure shows a diagram the some of the ward layout in the adult critical care settings in the Woodland Hospital NHS Trust. Most of the critical care settings in this study utilized open bay design. Patients were nursed either in one bay alone, or with other patient in one bay, with curtains between the beds to protect the patient's privacy. Most of them also had side rooms (with an average of two to three per ward), where patients who had an infection, for example, with Methicillin Resistant Staphylococcus Aureus (MRSA) and Clostridium Difficile (routinely called C-Diff), were nursed in individual rooms to minimize any risk of cross infection. All patients in level 3 critical care would be attached to screen monitors to observe their heart pulse and blood pressure. One level 3 adult critical care setting in the Beech Hospital had no central screen for monitoring the patients, and therefore viewing all of the patients

was not possible from any one point in the unit Figure 3 shows a range of ward layouts in both level 3 and level 2 adult critical care across the two hospital campuses.

Figure 3 <u>Ward layouts in the Woodland Hospital</u>

<u>Level 3 adult critical care settings (The Oak Hospital Campus)</u>

Main Entrance

| Store room | 4 | 3 | 2 | 1 | | | | 14 | 13 |
| Side Room | 5 | 6 | 7 | 8 | Nursing Station | | 9 | 10 | 11 | 12 |

<u>Level 2 adult critical care settings (The Oak Hospital Campus)</u>

Bed 1   Bed 3   Bed 5   Bed 7

Bed 2   Bed 4   Bed 6   Bed 8

Nursing station

Level 1 Bay   Level 2 Bay

Main Entrance

Bed 3   2   1   12   11   Trolley

Bed 4   Level 2 bay   Level 1 bay   Trolley

Bed 5   Trolley

Bed 6   7   8   Nursing Station   9   10   Trolley

                                              Trolley

Wall Barriers

Main Entrance

Level 3 adult critical care settings (The Beech Hospital campus)

								Main Entrance

Teaching Room | 1 | 2 | Nursing Station | 3 | 4 | | | ⇐

5 | 6 | Side Room | Side Room | 7 | 8 | Multi-purpose room

7 | 6 | 5 | 4 | 3 | 2 | 1

8

Nursing Station

Side Room 2

Side Room 1

Glass Barrier

Main Entrance

Level 2 adult critical care settings (The Beech Hospital campus)

| 5 | 4 | 3 | 2 | 1 |
Level 2 Bay (CCU)

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
Level 2 Bay (HDU)

Store Roo

Store room

Nursing Station

Multi-purpose rooms

Nursing Station

Place of medication preparation   Main Entrances

| 4 |
| 5 |
| 6 |

3

Side Room 2

Side Room 1

Nursing station

Main Entrance   Glass Barriers

A recent study of nursing activities in this unit criticized the layout of the ward, and demonstrated that the building was not purpose-built to care for critically-ill patients (Crocker 2006). However, the level 3 adult critical care setting, which treated the post-operative cardiac surgery patients in Beech Hospital, was recently built, and it utilized physical partitions rather than curtains, to separate the patient beds. In the Oak Hospital, most of the wards (whether level 3 or level 2 adult critical care) were physically identical, where each ward was arranged around a central corridor. However, some level 2 critical care settings were divided by walls, and therefore it was not possible to view patients or nurses in another bay without standing in the main corridor of the unit. This may suggest that these settings are also not purpose-built to care for critically-ill patients. The views of some nurses interviewed in this research suggest that the issue of maintaining the patients' dignity seems to prevail over other considerations, such as the easiness of visually monitoring other patients by other staff.

In regards to the staff working pattern, the vast majority of the staff participating in this study across the two hospital campuses were working shifts of approximately twelve-and-a-half hours (from around 08:00 am until 08:30 pm, and from 08:00pm until 08:30 am). This is in addition to the time taken by the nursing handover between shifts. The shifts are usually worked over three shifts per week, rotating between days and nights. In all level 3 adult critical care settings investigated, the nursing handover took place at the patient's bedside, where the handing over between nurses would usually entail the leaving nurses explaining the patients' details to the nurses beginning their shift. Information in the hand-over included information on the patient's name, age, sex, diagnosis, the medication the patient received during the

shift, was receiving, or was scheduled to receive, in addition to any information about procedures or operations that were planned for the patient. Some level 2 adult critical care settings utilized similar process for nursing handover. Others, however, carried out the nursing handover in the ward office rather than at the patient bedside.

3.6 Medication management in adult critical care settings investigated

This section discusses the management and administration of medications in the adult critical care settings investigated. It is anticipated that such information will establish the context in which the information emerging in the subsequent chapters can be understood in the context of information provided in this chapter, thereby, providing opportunities for critiquing the day-to-day practices of medication administration.

It was pointed out earlier in this chapter that most patients in critical care settings, particularly in level 3, are usually sedated. This helps them to breathe using a ventilator. One implication of this situation is that administering medication orally in such circumstances is unsafe, because it is difficult. Therefore, administering Intravenous (IV) medication is the most common route of drug administration in critical care settings (Donaldson 1999; Ghaleb et al. 2006). Evidence from the literature suggests that receiving medication intravenously makes the patient more vulnerable to unsafe medication administration. One study in UK estimated about one-half of medication errors occurred in IV medication preparations and administrations, 1% of which resulted in severe adverse events (Taxis and Barber 2003). In the context of critical care settings, patients may also be even more vulnerable for IV MAE's. One reason for that is because the patient has limited or no

ability to participate in their medical care while sedated and/or critically-ill (Moyen et al. 2008). Therefore, patients in critical care settings, particularly level 3, are unable to question and intercept any potential MAE's or near misses, as might be possible in a general hospital ward, where patients are conscious and able to discuss medication with the administering nurse. Moreover, due to the nature of the patients' conditions, preparing and administering IV medication may involve several steps, including the dissolving of powder, dilution, or transfer of injection fluid from the original vial or ampoule into a container (a syringe or an infusion bag). These processes are said to present multiple opportunities for errors (Wirtz et al. 2003).

All adult critical care settings investigated utilized the ward pharmacy system (Barber et al. 1994), where each ward was visited by a designated pharmacist during the day from Monday to Friday 9 am – 5 pm, and once on Saturday 9 am – 1 pm. The pharmacist's job was to initiate the supply of any non-stock drugs required and to order the stock drugs. Each week day, the pharmacist also checked that all prescriptions were legal, unambiguous, and clinically appropriate. The hospital dispensing pharmacy opened Monday to Friday 8:30 am until 5:30 pm and on Saturday and Sunday from 10:00 am until 13:00 pm. During outside working -hours, an on-call pharmacist could be accessed over the phone. At the ward level, most of the medications needed were kept as ward stock; the remainder were dispensed for individual patients by the hospital dispensing pharmacy. All the patients had their own bedside lockers which contained most, if not all, of their individual medications. In some level 2 adult critical care settings, the nurses administered medication using an additional drug trolley which was wheeled from bed to another during administration rounds.

The critical care settings, whether level 3 or 2, bring together high-risk patients and interventions in a complex environment. It is noteworthy that the single strongest predictor of an adverse event was found to be the patient's illness and its severity (Giraud et al. 1993), and as critical care settings care for the most critically-ill patients in the hospital, they are bound to have higher rates of adverse events compared with the general hospital settings who care for patients with less severe conditions. In the US, for example, Cullen et al. (1997) found that critically-ill patients are prescribed twice as many medications as patients in other general hospital settings, and are likely to receive more potent medications, which may result in a more serious MAE's.

The use of antibiotics in critical care settings is widespread (Gruson et al. 2000; Kollef and Fraser 2001). Critically-ill patients are said to have low immunity against infections, and are therefore vulnerable to hospital-acquired infections (Vincent 2003; Agvald-Ohman et al. 2004). In fact, hospital-acquired infections affect about 30% of patients in intensive-care units (ICU's) and are associated with substantial morbidity and mortality (Vincent 2003). Hospital-acquired infections are reported to be more common in critical care settings than in other hospital wards (Hardy et al. 2004). This may be due to the severity of illnesses of the patients there, the need for multiple interventions, such as intravascular catheterisation and intubation, and the heavy dependency of patients, where there is considerable contact with doctors, nurses and others during emergencies (Eggimann and Pittet 2001). One study in the south of England found that in adult critical care settings, MRSA infection developed in the blood of the 18% of the patients, and 47% had Methicillin-Resistant Staphylococcus Aureus (MRSA) isolated from their sputum during their stay in the ICU (Thompson

2004). Another Scottish study found a 16% incident rate of MRSA infection among the patients in level 3 adult critical care settings (Dancer et al. 2006). In contrast, a study of 10 orthopaedic wards found an MRSA incident rate of 1.3% and 3.8% among elective and trauma admission respectively (Nixon et al. 2006). Although the settings and definitions of the MRSA and the MRSA screening tools may be different in each of those studies, the findings suggest the high susceptibility of critically-ill patients to infections such as MRSA. Therefore the use of antibiotics is very common in the critical care settings for the treatment of infection, including those settings where this study was conducted.

The antibiotics, sedatives, and inotrops are frequently-administered medications to critically-ill patients in the NHS (Murdoch and Cohen 2000; Vincent 2003; Banner et al. 2008). The inotrops, such as Dopamine, Adrenaline, and Noradrenaline, are administrated to critically-ill patients to provide them with sufficient hemodynamic support to achieve adequate blood pressure and coronary perfusion (Lollgen and Drexler 1990). Sedatives and analgesics are also used to put the patient into a sleep, particularly for those receiving mechanical ventilation in level 3 critical care settings (Hansen-Flaschen et al. 1991; Sessler and Wilhelm 2008). Generally, the inotrops, sedatives, and analgesics, as well as most antibiotics, are only administered intravenously under strict monitoring in level 3 critical care settings. Other medications can be administered by less frequently-used routes of medication administration, such as subcutaneous (SC), intramuscular (IM), nasogastric (NG) and orally (PO). In the critical care setting investigated, many IV medications, including IV antibiotics, inotrops, and sedations, were usually prescribed on pre-printed charts, where the medication name, dose, route of administration, and date and time of

prescribing and administration were printed on the medication chart (see appendix L for examples of pre-printed charts used in the critical care setting investigated). The doctor has only to sign the chart authorizing the administration of that medication. In the context of level 2 adult critical care settings, some patients were able to take more medications orally, although administering the medications IV was still a predominant route of medication administration in those settings.

In all critical care settings investigated, nurses administered most medications in four medication rounds. These were 8 am (morning), 12:00 noon (lunch time), 18:00 pm (dinner time) and 22:00 (night time). However, some medications were administered at different time intervals depending on the patient's condition and the nature of medications. For example, if a continuous infusion of Dopamine finished at 11 am and the patient still needed it, the nurse would have pre-prepared another Dopamine infusion to start immediately after the previous one had finished. The Dopamine cannot be delayed until the next medication round (i.e. 12 noon), as the patient needs it urgently to maintain blood pressure within an acceptable range. The medications were usually prepared by the nurse who was going to administer them, although assistance could be sought from other colleagues.

The place where the medications were prepared for administration varied between the level 2 and level 3 critical care settings investigated. This was mainly due to two main conditions: The criticality of patients' condition and the staff number in each level of critical care settings. For example, the patient conditions in level 2 critical care wards tend to be less acute, with patients sometimes being able to walk around the bed. In addition, the nurse in level 2 critical care settings may look after two or even three

patients at the same time, which meant that some patients may not need the continuous visual attention of the nurses who look after them, as with patients in level 3 critical care settings. The fact that patients in level 2 critical care did not usually need the continuous visual attention of the nurse enabled the nurses to prepare their medications in separate rooms. These rooms were physically far from the patients, or in locations from which nurses were unable to monitor the patient while preparing the medications. In contrast, nurses in level 3 critical care settings had to continuously monitor their critically-ill patients, as recommended by the Royal College of Nursing (2003), which meant that the nurse was often unable to leave the patient visually unattended, and that meant that almost all the activities related to the patient, such as medication preparation, were carried out at the patient bedside, or in a proximity to the patient's bed.

The policy of medication administration in the investigated critical care settings dictated that all medications administered IV, IM, and SC were to be double-checked by a qualified second member of staff. However, medications administered orally and via NG tube could be single-checked prior to administration. Nurses in these settings were able to access various sources of information on medication administration. For example, in each ward, there were several copies of the British National Formula (BNF), which provides UK healthcare professionals with authoritative and practical information on the selection and the clinical use of medicines in a clear, concise, and accessible manner, as well as the latest prescribing advice (British Medical Association and Royal Pharmaceutical Society of Great Britain 2007). Nurses can also access an electronic copy of the BNF on computer terminals in their wards.

The Trust policies and protocols on medication administration were also available on printed papers in each ward investigated. Such policies and protocols were developed and updated regularly in the Trust by a multidisciplinary team of senior healthcare professionals such as doctors, nurses, and pharmacists. Because most of the medication is administered Intravenously (IV) in critical care settings, the Trust' protocol for IV medications administration was considered by many nurses as the most important reference for IV medication administration. In fact, some participants called it the "Blue Bible" (Randa, staff nurse, level 2 critical care, Beech Hospital), and it was considered the first point of referral for any information related to the medication administration. Such a document contained information on almost all of the IV medication administered in the ward, such as what diluents the medication can be diluted with, over what period of time, other routes of administration (if applicable), and whether the medication can be administered bolus (one push) or with continuous infusion.

In order for the critical care nurses to be able to administer IV medication safely, as well as delivering an appropriate level of nursing care, they need to be competent in carrying out their nursing practice, including administering medication safely (The Nursing and Midwifery Council 2004). When nurses demonstrate that they have the necessary skills and knowledge to carry out a given task, they are said to be "competent" (British Association of Critical Care Nursing 2003). The nature of the critical care environment makes such a requirement even more necessary. Critical care is a dynamic environment, with fast-changing patient conditions, and where critical care nurses have to respond immediately to any alterations in those conditions, to prevent further deteriorations or to ease the patient into the next stage of recovery

(Scholes 2006). Competency frameworks have been developed in an attempt to capture all the core elements of critical care practice for practitioners at different stages of their critical care career. This is to enable the staff to recognize the standards against which each individual can be assessed as competent (Scholes 2006).

A major competency package that critical care nurses have to achieve before they are allowed to administer any IV medication is the IV medication administration competency package. In the critical care settings where this study took place, every nurse had to undergo formal training in IV medication administration, and had to complete a competency package for IV medication administration (see appendix M for information on the IV competency package for IV medication administration). The nurse had to be assessed by another qualified member of staff before being enabled to administer IV medication. In the Woodland Hospital NHS Trust, the competency training and assessment of the IV medication administration is called *working new ways of IV medication administration*, and it is usually integrated in 2 - 6 weeks induction programme when a new member of staff joins the ward. They are taught, mentored, and assessed by experienced nurses, and then signed off to be safe for administering the IV medication. Since 2006 the Trust has introduced a drug calculations exam, where any nurse applying for a clinical job in the Trust has to set and pass this exam (particularly the IV medications calculation), before being shortlisted for interview. This measure was introduced to ensure adequate and safe medication calculation skills among nurses in the Trust, particularly for those medications which need complex calculation skills. Agency nurses have to obtain IV medication administration training before they are allowed to administer the medication intravenously in the ward they are booked to work in.

3.7 Main nursing activities in adult critical care settings investigated

This section aims to present the reader with a picture of the main nursing activities conducted on a typical working day in the adult critical care settings investigated. It was felt that presenting such information in diagram form, with sequential presentation of the events in the clinical setting, would best convey to the reader the picture of a normal working day for a critical care nurse in the investigated settings. The diagram describes the role of nurses from bands 5 and 6, where most of the participants work. Although many work routines are similar in both levels 2 and 3 of critical care, there are some differences, which only nurses who work in these settings are able to express. Appendix M presents a comparison between the main nursing activities in a normal working day for a nurse in level 2 and level 3 adult critical care settings. It will be noted, when appropriate, where the task is unique to nurses from certain bands (bands 5, 6, and 7 and above).

My previous experience as a staff nurse working in some of the adult critical care settings investigated in this study has provided me with an insight into the nature and routine complexity of nursing in these settings. I mostly worked in level 2 critical care (i.e. HDU), where I was assigned two to three patients during most of my shifts. As an agency nurse, I had no managerial responsibilities, for example, to take charge of the ward in the shift. This was usually done by a senior staff nurse (band 6), therefore, I may lack the managerial perspective of senior staff nurses or ward managers working in the level 2 adult critical care settings investigated (although I previously worked as a senior staff nurse in different level 2 adult critical care settings). Moreover, I did not have the actual experience of working as a staff nurse in level 3

adult critical care settings in the UK (having one year's experience in working in ICU in Jordan). Therefore, most of the information presented in the appendix M was extracted from the participants' narratives, although I had more input in the information presented on the routine working activities for the staff nurses in level 2 adult critical care settings.

3.8 Conclusion

The critical care environment brings together high-risk patients and interventions in a complex environment with constantly changing personnel over 24 hours care. In the UK, critical care services form a small proportion of the total beds in any NHS Trust. However, they consume a significant proportion of hospital resources. This chapter aims to provide information on the context of medication management and administration in the critical care settings investigated for two purposes. Firstly, it provided the reader with an insight into routines of adult critical care environment and the work flow in these settings, as well as gaining insight into the process of medication administration practices in the adult critical care settings investigated. This knowledge was useful later in the study when it came to interpreting the findings from the interviews. Secondly, the act of exploring the critical care environment in which medication administration took place offered an insight into the factors which would need to be considered when designing a study to examine the nurses' perspectives on the safety of medication administration. For example, the informal discussion with the modern matron of critical care settings, during the negotiation of the access to the participants, enabled me to identify how many nurses usually work on each shift and the best time to contact and interview them. Moreover, exploring the context of the settings helped me to shape the interview questions regarding some

issues of medication administration that were being practiced in the adult critical care settings investigated. This includes the nurses' views on the double-checking of medication, and how they perceived the value of such practices. In this way, the context settings proved to be an invaluable tool for self-orientation as a researcher in the environment where the nurses interviewed were working and practicing medication administration, as well as identifying the issues necessary to be taken into consideration in the study design.

Chapter Four:

Methodology and Research Methods

4.1 Introduction

This chapter presents the methodological issues related to the current thesis. Some philosophical assumptions and definitions in social sciences will first be outlined before the philosophical underpinning of the study is presented and justified. The chapter will also address the chosen research method for this study, including the data collection method, sampling issues, recruitment, and data analysis. The chapter concludes by addressing the ethical issues of this study.

4.2 The philosophical paradigms

Lack of clarity of the philosophical assumptions that underpin any research study makes it difficult for the reader to obtain a sense of how the knowledge is produced, evaluated, and used in the study (Lopez and Willis 2004). Many studies, both qualitative and quantitative, have been criticized for the absence of linkage between the methods used and a clear statement of the philosophical underpinnings (Mason 2004). Lopez (2004) pointed out that implementing methods without an examination of the philosophical basis can result in research that is ambiguous in purpose, structure and findings.

A fundamental pre-requisite to understanding the underpinning philosophy of any research is to have a reasonable awareness of the basic philosophical terminologies. The three concepts of ontology, epistemology, and methodology are routinely used

when discussing the philosophical assumptions of social science. These three concepts are closely related. Ontology refers to assumptions made about the form and nature of reality, or the study of being (Guba and Lincoln 1994). Epistemology refers to claims about how knowledge of 'reality' can be accessed (Benton and Craib 2001). There is often confusion about the terms 'research method' and 'research methodology' in the literature, and they are sometimes used interchangeably. Research methodology refers to how researchers go about finding out if their theory can be known, and to how they plan how the research should proceed (Blaikie 1993). In comparison, research method tends to refer to specific techniques of data collection and analysis available to the researcher (Blaikie 1993; Norton 1999).

Broadly speaking, quantitative and qualitative approaches are two research methodologies that are used in research studies. Quantitative methodology is routinely referred to as an approach to the conduct of social research which applies a natural science, and in particular a positivist, approach to social phenomena (Benton and Craib 2001). The positivism approach is characterized usually in the methodological literature as showing a strong tendency to use operational definitions, objectivity, replicability and causality. In this context, the social survey is seen as one method of research within this tradition. Through surveys, questions can be operationalized; objectivity is said to be maintained by the distance between observers and observed along with the possibility of external checks upon one's questionnaire; replication can be carried out by employing the same research instrument in another context. Research of this kind is frequently referred to as being positivist or empiricist (Benton and Craib 2001). The epistemological point is being made, namely that research of this type is underpinned by a distinctive theory of what should pass as warrantable

knowledge. Qualitative methodology differs in a number of ways. In particular, qualitative methodology is committed to see the social world from the point of view of the actor (Holloway and Wheeler 2002). Because of the commitment to see through the eyes of one's subjects close involvement is advocated. This is contrasted sharply with the quantitative methodology research with its emphasis upon fixed measurements, hypothesis testing, and a much less protracted form of fieldwork involvement.

Qualitative researchers see social realities as being inseparable from researchers (Benton and Craib 2001), and what makes the human a unique object for study stems from the alleged unpredictability of human behaviour. Therefore, the external relationship between the social scientist and their object of study, that is the human being, will inevitably be different from that in natural sciences. Such a relationship is value-oriented, as it is seeking an explanation for particular social phenomena, which consequently dictates the use of special methods to study such objects. Koch (1995) suggested that there is no single, timeless truth existing 'out there' which is waiting to be discovered by means of scientific procedures and because objective knowledge cannot be quantified, the product of social science then cannot be testable according to the quantitative researchers' views. Benton and Craib (2001) argued that any finite set of evidence will be vanishingly small compared with the indefinitely large class of possible, relevant evidences. This may present a challenge for the followers of the quantitative research approach due to the absence of anything which will serve as a crucial experiment, or a decisive test case, for the gained knowledge in social sciences.

4.2.1 The underpinning philosophy of the study

This study of nurses' views on medication administration stems from epistemological and ontological principles which consider people and their interpretations, perceptions, meanings and understandings as the study's primary data. This study endeavours to reveal nurses values, beliefs, perceptions, and understanding of the influential factors which impact on the safety of medication administration. Other data sources would be legitimate (e.g. text and objects), as long as the aim is to explore how a particular phenomenon is constituted in the nurse's collective and individual meaning, and how this meaning is embedded in their languages and constitutes their social reality.

As anticipated, the qualitative approach seems to be better equipped than the quantitative one to uncover the nurse's views, experiences and beliefs regarding the safety of medication administration and organizational contributions towards it. The new knowledge that the researcher will acquire by using the qualitative approach in this study is what are the nurses' views, beliefs, and opinions on the topic under investigation, that is the wider organizational factors that contribute to the safety of medication administration, and what factors influence their judgments on these organizational issues. It is important to note that this study neither aims to test or generate a universal law of medication management (as the quantitative research method might suggest), nor to emphasize an existing one. Unlike the task of the quantitative research methods, the task of the qualitative research method is to understand individual events, and explain them through the meanings that the individuals involved attach to their actions (Benton and Craib 2001).

The underlying philosophy of qualitative research is committed to seeing the world from the perspectives of the participants, and aims to generate theoretical interpretations from the information collected, rather than to examine cause and effect (Benton and Craib 2001). Utilising this approach therefore enables the researcher to get close to the nurses' experiences, and places emphasis on the importance of capturing the meaning of the participants' experiences and behaviour in their complexities, but more significantly perhaps, it examines these experiences in a wider context and would be flexible and adaptable to changing situations and experiences (Bryman 1984; Guba and Lincoln 1994). The researcher must understand and accept that complete objectivity and neutrality are impossible to achieve in any context. This is because the researcher is not divorced from the phenomena, which dictates reflexivity on their part. They must take into account their own position as they are the main research tool (Holloway and Wheeler 2002).

In summary, understanding the underpinning philosophy of the research will pave the way for selecting the most appropriate research methodology, the one that is capable of uncovering the information required to achieve the thesis' aims and objectives. In this research study, the qualitative approach provides the appropriate tool for explaining the social, cultural, and political values that underpin the nurse's views regarding the safety of medication administration practice in adult critical care settings.

4.3 Methodological considerations

The literature review and the context of the adult critical care settings provided the groundwork from which to examine the nurses' views on the safety of medication administration. To recap, the review of previous research presented in chapter one highlighted the need for research that explores the wider organizational factors which influence the safety of medication administration in adult critical care settings. Nurses are deeply involved in medication administration; therefore their views on this matter will be of particular importance for this study. This chapter started with presenting the underpinning philosophy of this research. It argues that the qualitative approach offers a useful explanation of how to understand and reflect on meaningful human actions. Furthermore, this approach considers the people and their interpretations, perceptions, meanings, and understandings as the study's primary data source. The subsequent task is to present the methodological issues that would contribute to exploring the nurse's views on the safety of medication administration. The rest of this chapter will address in detail the issues related to the chosen research method, sampling, recruitment of the participants, analysis plan, and ethical considerations.

4.3.1 Data collection method

Qualitative methodology incorporates a range of methods for collecting and analyzing research material, including interviews and observational methods (Denzin and Lincoln 1994). The review of literature has demonstrated that most of the research conducted in the field of the safety of medication administration used observational methods. These studies, which have indeed provided valuable information about the incidence and causes of medication errors, stem from a different epistemological and ontological orientation from those adopted in this study. The technique of covert

observation in particular carries a huge ethical burden, and the debate still continues on the ethical basis for the conduct of such studies (Armitage et al. 2004). It was asserted that an alternative to the observational studies would be in-depth interviews, which suggest to the participants that the researcher wants to know about their perspectives, and overtly values them (Armitage et al. 2004). The interview method is seen as an opportunity to explore how the participants themselves explain their experiences and practices that are the objects of the research (Murphy and Dingwall 2003). There is a continuum of interview situations based on the amount of control the researcher exercises over the interviewees' responses (Bernard 2000). This continuum ranges from tightly-structured questions, through semi-structured questions to totally unstructured and more flexible conversations. These different types of interview methods produce a diverse range of data; each type has its own advantages and can be more useful in certain types of research projects, depending on the nature of the research question.

Patton (2002) describes the semi-structured interview as relatively informal, thematic, and topic-centred. It involves asking open-ended questions that offer the person being interviewed the opportunity to respond in their own words and to express their own personal perspectives according to certain themes set out by the researcher. This research adopts a semi-structured interview method to acquire data from the participants. In this study, the researcher is interested in the relationship between each nurse's views on the organizational contributions toward the safety of medication administration in adult critical care settings, and the application of the Organizational Safety Space Model (OSSM). Therefore, there was a need for the interviews to explore the nurses' views on issues that matter to the research question within the

context of the OSSM. Hence, semi-structured is the ideal approach to ascertain both the nurses' views on this matter, and to be sufficiently open to ensure that responses remain, as much as possible, within the framework of the concerns being explored. The nature of the semi-structured interview gives the researcher such flexibility to exercise some degree of control over the interview, and simultaneously allows for a degree of flexibility in discussing the topic under investigation, which makes it a suitable method to collect the necessary information related to the research question.

Several issues should be addressed when conducting semi-structured interviews. The researcher must establish a rapport with the participants to augment the informality of the interview; such a relationship serves to flourish a sense of security for the participants, therefore freeing their minds (Mason 2004). Furthermore, it minimizes the participants' reactivity, where the participants may, consciously or unconsciously, react to the researcher, and modify their answers to please the researcher or to appear in a positive light (Holloway and Wheeler 2002). While this research recognizes that the influence of the presence of the researcher cannot be completely eliminated during the interview, measures were taken to minimize this effect as much as possible. For example, the interviews pursued a supportive approach, not a judgmental one, which helped to establish a sense of trust between the researcher and the researched. Moreover, the researcher gave the interviewees the opportunity to adequately present their views related to the research questions. The interview questions were also presented in a clear and organised flow. These measures were employed to promote a sense of trust and to minimize the researcher's influence on the interviewees (Tod 2006).

Another issue which should be addressed when conducting semi-structured interviews is to generate the information that is germane to the needs of the study (Mason 2004). For this reason, the interview should be guided by range of topics and themes to ensure that the same basic lines of inquiry are pursued with each person being interviewed. An important feature of the semi-structured interview is the use of the interview guide, which is a list of written questions and topics that need to be covered in a particular order (Bernard 2000.p.191).

The interview guide makes the data collection process more systematic for each participant. It also ensures the coverage of the intended topics within the time allocated for the interview. In this study, the interviewees were nurses who were very busy professionals in a critical care setting. Bernard (2000) reported that semi-structured interviews are appropriate when dealing with people who are accustomed to the efficient use of their time. Therefore, making effective and efficient use of the time they devoted to the interview is a crucial responsibility for the researcher. Moreover, the interview guide seeks to ensure that the nurse's views are tackled from different dimensions. For example, the interviewees may bring up some interesting points that the researcher has not covered or thought about in the interview guide. For this reason, the interview needs to be sufficiently open to allow novel experiences to emerge. An interview guide was developed for this study to ensure the coverage of the information related to the theoretical questions addressed by the research (see appendix A).

The interview guide covers three sections. The first section is designed to collect background demographic information on the critical care nurses involved in the study.

The second addresses the factors which promote safe medication administration, and the third part examines issues that may cause problems in drug administration in adult critical care settings. Collectively, the analysis of the interviews focused on understanding the organizational impact on the safety of medication administration. New themes which emerged during the interviews were subsequently addressed.

All of the interviews commenced with a brief introduction that outlined the purpose of the research and the ethical basis of the study. Upon concluding the interview, each interviewee was asked if they would like to add anything, and if they wanted to emphasize any particular issue. Most of the interviews lasted for 45 to 60 minutes. Some interviews lasted longer or shorter than that depending on the participant's willingness to talk further, particularly if they drew from their experiences with medication administration. The researcher sought to provide a comfortable and relaxed venue for the interview. Upon approaching the participants, the participants were asked to select the time and place that were most convenient for them. Any interviewee who had no preference in selecting the interview place was interviewed in a quiet interview room in the School of Nursing where the study was undertaken.

4.3.2 Sampling strategy

Sampling, including identification, selection, and access to the relevant social units, is a crucial strategic element of qualitative research. Silverman (2005) argues that sampling strategies should be priority-driven. The priority of the sampling strategy in this study was to select particular participants who can illustrate the phenomena that the research is trying to address.

Qualitative research sampling seeks to identify key individuals, events, or settings which are able to address the research questions and provide a rich source of data (Patton, 2002). Unlike the quantitative sampling strategy, which is concerned with statistical generalisations, qualitative research addresses diversity and variations to ensure that a range of data is identified and collected, which in turn would increase the validity of the findings (Procter and Allen 2006). To pursue this goal, the study employed two stages of sampling. In the first stage, purposive sampling strategy in selecting the participants was utilised, where nurses from pre-specified backgrounds were specifically sought out. Mason (2004) defined the purposive sample as:

> selecting a group or categories to study on the basis of their relevance to the research question, your theoretical position and analytical framework, your analytical practice and most importantly the argument or explanation you are developing (Mason 2004.p.124)

The logic and power of purposive sampling lies in selecting information-rich cases for the study, from which the researcher can learn a great deal about issues of central importance to the purpose of the inquiry (Patton 2002). The decision regarding the selection of participants was based on the need to access the views of the people who are most knowledgeable about the phenomena of medication administration in adult critical care settings. While medication administration is a multidisciplinary practice which dictates the active engagement of a range of healthcare professionals (e.g. a doctor for prescribing and a pharmacist for dispensing), nurses are crucial players in carrying out this role. In addition, the literature review demonstrated that nurses' views were often overlooked on this issue (Gibson 2001). Therefore, the decision was made to include only nurses in the research sample. The selected nurses were likely to demonstrate different experiences concerning the safety of medication administration, depending on factors such as their managerial and clinical roles. Including

participants from heterogeneous backgrounds is advisable to report a diverse and exhaustive description of behaviours in the study (Kemppainen 2000). Norwood (2000) described maximum variation sampling as one strategy for purposive sampling, where informants are selected because they represent a wide range of variations. The logic behind employing maximum-variation sampling is that common patterns that emerge from great variations capture centrally- and universally-shared aspects of the phenomenon (Patton 2002), which allows the researcher to describe themes that cut across variations in experiences (Norwood 2000). Although the selected participants were nurses by background, efforts were made to select nurses from different grades, critical care settings, and years of experience, which helped to obtain a wide range of views and perspectives.

In the second stage of sampling, the study utilized a snowball sampling technique, where those participants who agreed to be interviewed were asked to invite colleagues who met the inclusion criteria to participate in the study. The initial plan was to use snowball sampling as a contingency plan in case there were not enough participants recruited during the first sampling stage (i.e. purposive sampling). Snowball sampling, sometimes called network sampling, is defined as

> The process of asking the study's participants to identify other
> potential subjects who also meet the eligibility criteria" (Norwood
> 2000.p.435).

Bernard (2000) has suggested that snowball sampling can be an effective sampling technique when dealing with a relatively small population of people who are likely to be in contact with one another. In this study, the sampling frame from which the study sample was drawn was relatively small, around 250 nurses who were working in all

adult critical care settings. Moreover, all of the participants in this study were working in the same Hospital Trust where the study took place, and many of them work in the same critical care setting. Therefore, it was inevitable that many of them would have day-to-day contact with each other, and as a result of the social networking among the participants in their work environment, it would appear feasible for any nurse who participated in the study to invite a colleague to participate in the study. Figure 3 shows the number and backgrounds of the participants recruited for the study.

* The Total number of nurses interviewed = 33 nurses.
** SN: Self nominated first, and purposively selected thereafter (Nurses from all bands).
** SNCGN: Self nominated first, and purposively selected thereafter (Clinical Governance Nurses)
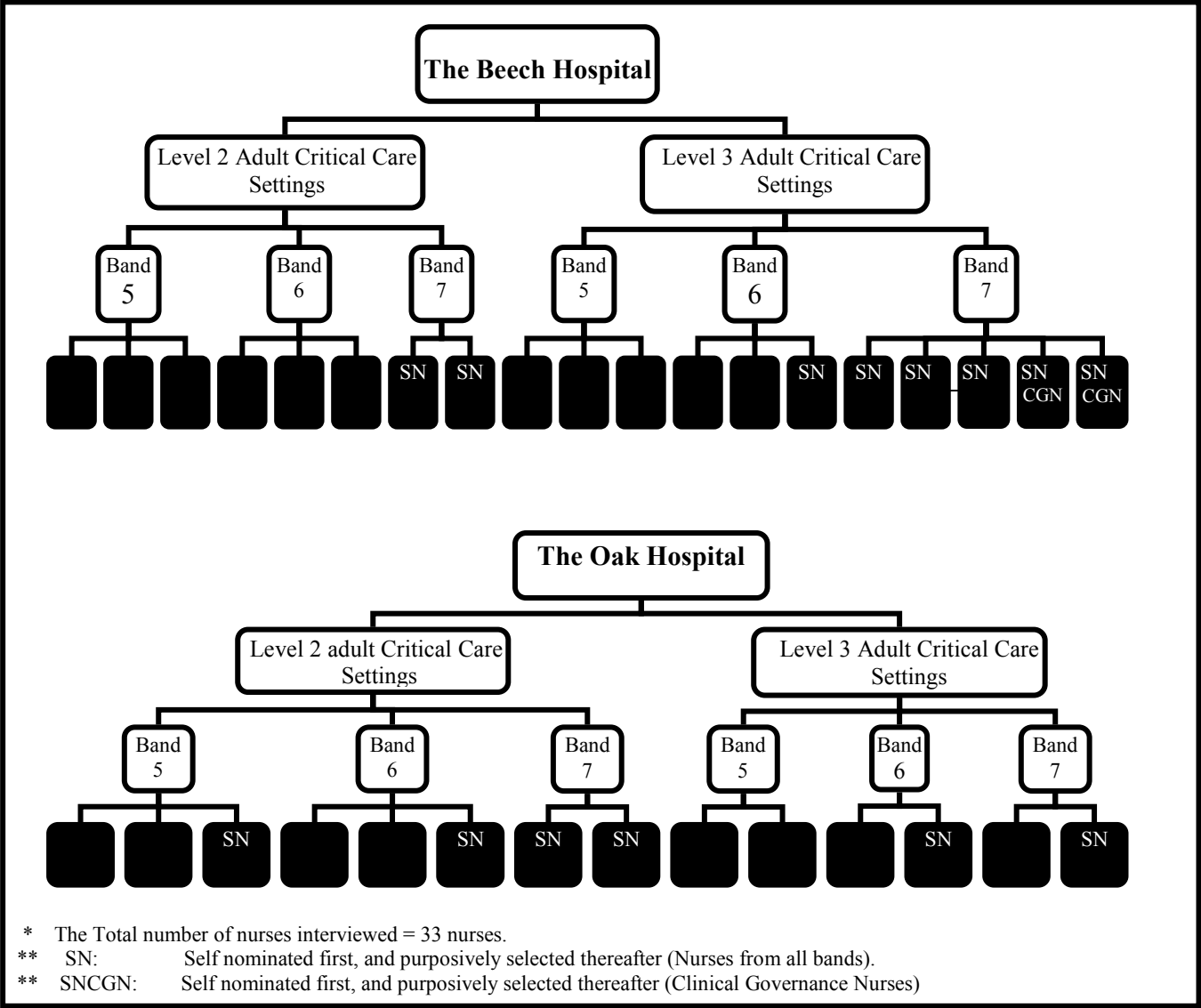
Figure 4: The number and backgrounds of the participants recruited in the study

4.3.3 Selecting the participants

In order to select the participants from different backgrounds, three stages of purposive sampling were utilized. Firstly, a Hospital Trust (The Woodland Hospital Trust), with its two hospital campuses (The Oak Hospital and The Beech Hospital) was selected. Secondly, those clinical wards which deliver level 2 and level 3 adult critical care were identified on each campus. Each campus was known to have at least four wards that deliver level 2 and level 3 adult critical care, with approximately 250 qualified nurses working in those settings in both campuses. They represent the sampling frame from which the research sample was drawn. Finally, nurses working in those settings were selected according to their professional grades (e.g. bands). To be included in the study, the participants had to satisfy the following inclusion criteria:

    A. The participant should be a registered nurse (i.e. has got NMC registration).

    B. The participant should be employed by the Woodland Hospital Trust where the study took place, in either of its two hospital campuses.

    C. The participant should be working in a ward which delivers either level 2 or level 3 adult critical care.

    D. The participant should be in bands 5, 6, or 7 and above.

4.3.4 Sample size

In qualitative research, the sample size is not determined by the need to ensure generalizability, as in quantitative research, but rather by the desire to investigate the chosen topic fully and to provide information-rich data (Mason 2004). There are no closely-defined rules for the sample size in qualitative studies, however, there are

widely-accepted considerations related to the sampling decision (Patton 2002). Determining an adequate sample size in qualitative research is ultimately a matter of judgment and experience in evaluating the quality of the information collected against the purpose to which it will be put, the particular research methods, the sampling strategy employed, and the research product intended (Sandelowski 1995). Sampling in qualitative research usually relies on a small number of participants with the aim of studying in depth. However, the sample profile has to be fully adequate to answer the qualitative research question. Generating too small a sample can make it difficult to support claims of having achieved either informational redundancy or theoretical saturation. Conversely, too large a sample may not permit a deep, case-oriented analysis, which is the core of qualitative inquiry.

According to Patton (2002), the process of deliberately selecting a heterogeneous sample of participants, and observing commonalities in their experiences, can yield up two types of data: high-quality case description, which is useful for documenting a uniqueness, and a significant shared pattern of commonalities cross the participants. Selecting nurses from diverse backgrounds can therefore produce both high quality descriptions of those factors which influence safe medication administration, and also demonstrate some shared commonalities, which if they exist, suggest significant indicators of underlying trends. To achieve such a heterogeneous selection of participants, the researcher must decide what kind of variations they want to maximize, and when to maximize each kind (Sandelowski 1995). This research aimed to achieve variations according to three main demographic factors: the hospital campuses where the participants work, the level of adult critical care delivered in their wards, and their professional bands. The nurses were selected from the two campuses

of the Woodland Hospital Trust, which helped the researcher to use the emerging themes from the scripts in the two campuses to establish comparative cases. Hospital settings which deliver level 2 and level 3 adult critical care have been in the lead in providing critical care (Department of Health 2000c), and were therefore selected for investigation in this study. Moreover, selecting nurses from different bands would ensure that nurses have a reasonable mix of skills, years of experience and managerial levels.

In this study, the final sample size included a total of 33 adult critical care nurses from various grades: 11 ward managers and clinical governance nurses (band 7 and above), 11 senior nurses (band 6) and 11 staff nurses and newly qualified nurses (band 5). The decision about this sample size was flexible from the start, and was partly guided by the desire to cover a certain degree of demographic variations among the selected participants, but also by the need to achieve data saturation. Mason (2004) has acknowledged that it may not be possible to fully specify the number of participants required at the start of the study. To decide the sample size is a dynamic process which starts at the beginning of the study, and continues during the period of emerging information. An initial number of 32 participants were sought in the beginning of the data collection stage. However, the researcher put in place some contingency steps in case the number of the participants who responded was more or less than the number of the participants needed for the study. For example, if new themes had been emerging from the participants' views after 32 participants were interviewed, then more interviews would have been sought and conducted. Recruitment of the participants only ceased when enough participants have been

recruited to fill the sampling framework, and when it was ascertained that no more new themes were emerging from the interviews.

It was decided that if the number of the participants who expressed an interest in participating in the study was more than the number needed, the researcher would interview the required number of participants from both hospital campuses whose demographic characteristics fit the sampling framework. The remaining respondents would be sent letters (see appendix E) to thank them for their willingness to participate in the study, and informing them that the researcher had enough participants for the time being, and they would be sent a second letter at a later stage of the study to notify them if their help is still needed for the study (see appendix F) (with a stamped, addressed envelope) to thank them for their interest in the study, and asking them to return the enclosed letter to the researcher indicating whether they were still willing to participate in the study. Alternatively, if the participants help was no longer needed for the study, they would be sent letters (see appendix G) notifying them that enough participants for the study had been achieved, and thanking them for their willingness to participate. If, however, more participants were still needed after they were sent the invitation letters to participate in the study (as was the case), the researcher would move on to the plan B recruitment stage (snowball sampling).

4.3.5 Collection of demographic information

Identifying a full range of possible cases or settings for purposive sampling requires the qualitative researcher to map out potential respondents or study sites before deciding who, where, or what to sample, which can be achieved using matrix multidimensional sampling (Miles and Huberman 1994; Procter and Allen 2006). To

develop this sampling matrix, detailed information must be obtained about the potential participants. The ideal method for obtaining this information is by conducting a survey of the target population (Procter and Allen 2006). The information provided by the survey will help to draw up a matrix of the participants according to predefined selection criteria. Clarke and Wilcockson (2001) used a similar approach to recruit participants who undertake practice development in one NHS region. They sent questionnaires to a population of 474 practitioners; from those who replied, 29 individuals were sampled and interviewed by the use of matrix according to predefined selection criteria.

4.3.6 Recruitment of the participants

Two plans of recruitment were used in this study to recruit the participants. In Plan A, recruitment letters were handed over directly to the participants during their attendance at a post-registration course in the School of Nursing. This was considered one way of accessing those critical care nurses who are working in the Woodland Hospital NHS Trust. The researcher was able to recruit 15 participants for the study via this approach. However, as more themes were still emerging from the participant's views, the researcher reverted to plan B, where participants recruited during plan A were asked to invite colleagues who met the study' inclusion criteria to participants in the interviews. 18 participants were recruited during plan B recruitment. The data collection stage lasted for around five months from the time when the final research approval is given by the Local Research Ethics Committee and the Trust Research and Development department in March 2007. Figure.4 shows a diagram of the recruitment strategy adopted by this research.
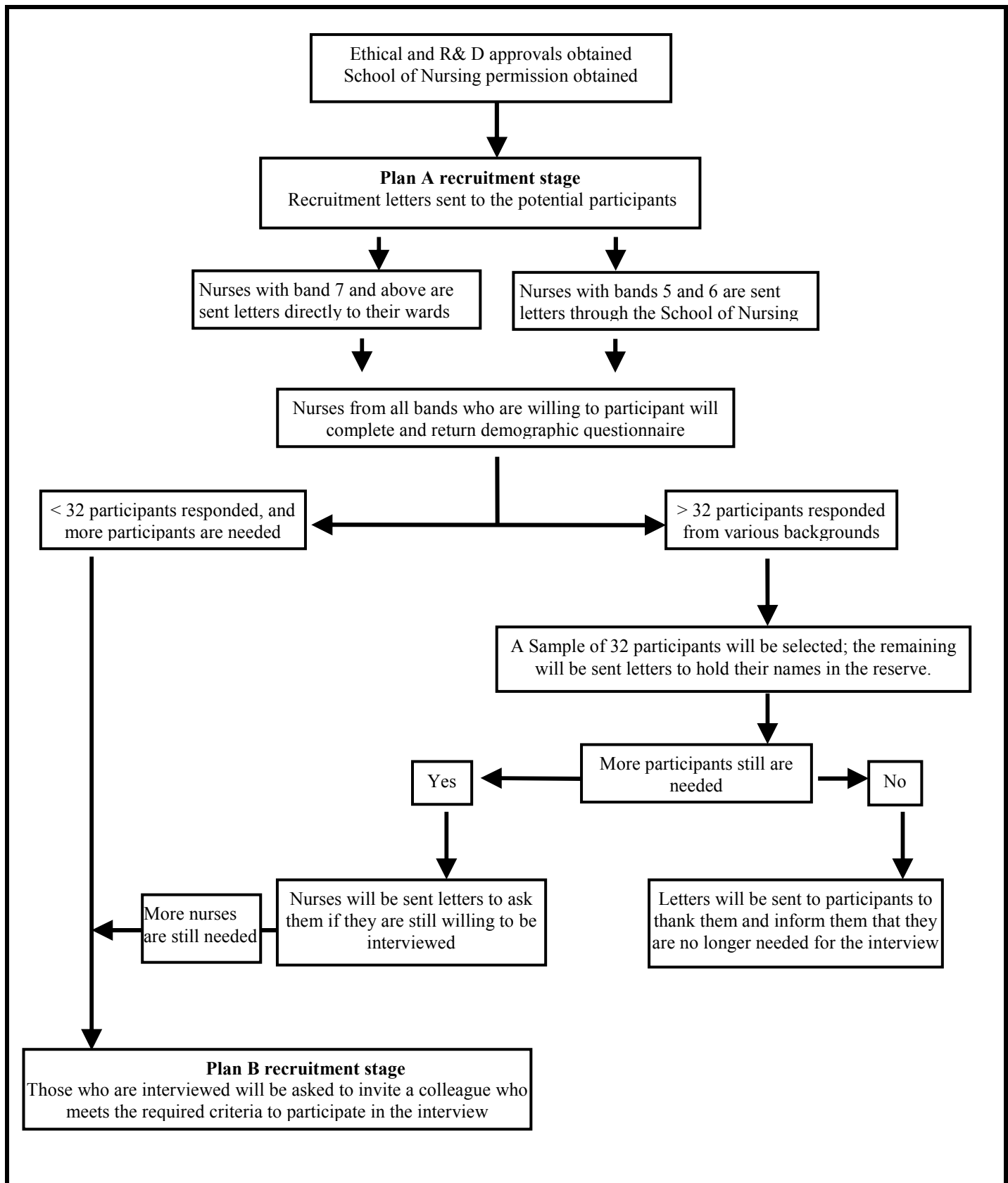
Figure 5: Recruitment plan for the participants

4.3.7 First recruitment stage (Plan A)

For the purpose of approaching the participants, nurses have been divided into two main groups: those holding band 7 and above such as the ward managers, and those holding band 5 and 6 such as newly qualified nurses and senior staff nurses. The reason for recruiting in two bandings is to ensure a breadth of recruitment without having to approach ward managers for recommendations, with the potential for bias that would be generated. Evidence from similar research suggests that this approach of recruiting the nurses ensures that the more junior nurses feel secure enough to express their views when discussing sensitive topics such as medication safety (Taxis 2001; Dyal 2005). Recruiting participants from both groups was as follows.

4.3.7.1 Group 1: Nurses holding band 7 and above

Wards which deliver level 2 and level 3 adult critical care were identified in the Oak and the Beech Hospital campuses. Recruitment letters were sent to the ward managers of these wards to invite them to participate in the study. The letters were addressed to the "Ward Manager". One extra letter addressed to the "Nurse Consultant" was sent to the level 3 adult critical care ward in the Oak Hospital campus; this was to increase the recruitment potential of nurses from this setting, as it was the only ward which delivers level 3 adult critical care in the Oak Hospital campus. Each recruitment letter included an invitation letter (Appendix C), a short demographic questionnaire (Appendix B), a participant information sheet (Appendix D), and a stamped addressed envelope. Those who were willing to participate in the study were asked to complete and return the questionnaire to the researcher in the envelope enclosed.

4.3.7.2 Group 2: Nurses holding band 5 and 6

Band 5 and 6 nurses were initially approached through courses delivered at the School of Nursing at an East Midlands University. Adult critical care nurses who were working in the selected hospital campuses were able to attend up to nine modules as part of the adult critical care pathway, delivered as part of a post-registration continuing professional development course run by the School of Nursing. Those modules were run from September until August each year. According to the School of Nursing, around 100 adult critical care nurses were attending those modules from the Woodland Hospitals Trust in the 2006/2007 academic year. Each module is attended by 5 to 15 nurses, with most of the modules being run over 4 to 8 weeks, and some modules were repeated during the year.

After gaining local research approval, R&D approval, and the permission of the School of Nursing and the lecturers who were teaching on the selected adult critical care courses, the researcher attended five minutes towards the end of one lecture in each module, explained the aims and objectives of the study, and handed over recruitment letters to those nurses who were working in adult critical care wards in both hospital campuses where the study took place. Seven courses were running between March 2007 (the start of data collection) and September 2007 (the end of the academic year), and they were attended by critical care nurses from the Woodland Hospital Trust. A total of 36 recruitment letters were distributed to the adult critical care nurses who were working in the Oak and the Beech Hospital campuses. Each recruitment letter includes an invitation letter (Appendix C), a short demographic questionnaire (Appendix B), a participant information sheet (Appendix D) and a stamped addressed envelope. Those who were willing to participate in the study were

asked to complete and return the questionnaire to the researcher in the enclosed envelope.

After completing the plan A recruitment stage, the response rates varied between the two groups of participants (Band 5 and 6 group, and band 7 and above group). For example, all of the participants but one (n=10) from band 7 and above nurses (ward managers and clinical governance nurses) completed and sent back their demographic questionnaires to the researcher during the plan A recruitment stage, indicating their willingness to participate in the study. However, this high response rate contrasted with a poor rate from the nurses from bands 5 and 6, with only 4 having self-nomination to participate in the study, out of the 36 nurses who were handed recruitment letters. To enhance the recruitment of the participants during this recruitment stage, I re-attended three of the remaining courses which I had previously attended, and reminded the nurses about the study and wanted them to consider if they would like to participate in the study by sending back their completed questionnaire to the researcher in the enclosed pre-paid envelope.

The first recruitment stage lasted from March 2007 to June 2007, and only 14 participants from different backgrounds were recruited for the study, and as new themes were emerging from the participant's interviews, it was felt that more participants were still needed. I waited almost four weeks after the last recruitment package was handed over (8th May 2007), during which no further completed demographic questionnaires were received. Previous studies have shown that if the participants did not respond within 2–3 weeks from the time of invitation, they were

unlikely to respond at all (Al-Nawafleh 2008). It was then decided that recruitment should proceed to the Plan B recruitment stage, which started on 3rd June 2008.

4.3.8 Second recruitment stage (Plan B)

During the second recruitment stage (Plan B), those nurses who had already been recruited and interviewed during first recruitment stage were asked to invite a colleague, who satisfied the required sampling criteria, to participate in the interviews. This technique, known as snowballing or networking, enables the participant to identify others from their population who could inform the research (Procter and Allen 2006). Those participants were given recruitment packs to pass to their colleagues who come from the backgrounds which were still outstanding, and who met the inclusion criteria. 19 participants were recruited during the second recruitment stage (Plan B).

In total, 33 adult critical care nurses were selected and interviewed in this study. 14 of them were recruited during the first recruitment stage (Plan A) and the rest (n=19) were recruited during the second recruitment stage (Plan B). Furthermore, 16 of the total number of the participants were recruited from the Oak Hospital, and 17 were recruited from the Beech Hospital. The research sample in this study was predominantly female (n=23). About one third of the interviewees (n=11) were nurses who were band 7 and above (ward managers and clinical governance nurses). The vast majority of them had more than 10 years of clinical nursing experience (n= 10). Another one third of the participants were nurses who were band 6 (senior staff nurses) (n=11), and most of them had a clinical experience of more than 10 years (n=7), with 3 of them having experience of between 6 and 10 years. Most of the

participants from band 7 and above and band 6 had experience of more than 10 years. This may be related to the fact that some nurses may decide to switch to work into critical care nursing at a later stage of their career, therefore, they may have significant clinical nursing experience, but may not have an equal length of experience in critical care nursing, which could be reflected in assigning them a lower rank until they develop experience in adult critical care nursing. This fact may also reflect the individual differences in personal competency and managerial skills, where two nurses might have the same years of experience, but different levels of managerial and leadership skills. The rest of the sample were nurses who came from band 5, which is a relatively junior nursing group (often comprising of newly-qualified staff nurses) (30%, n= 11). Most of them had clinical nursing experience of between 1 and 5 years.

4.4 Ethical considerations

Because the object of inquiry in interviewing is humans, reasonable care must be taken to avoid any harm to them (Holloway and Wheeler 2002). The rich and detailed character of much qualitative research may mean intimate engagement with the public and private lives of individuals. Tod (2006) stated that ethical implications should be addressed in every research stage, including protecting participants and researchers from harm, using voluntary participation, anonymity and confidentiality, as well as informed consent. The following discussion aims to address the ethical issues which arose during the conduct of this research, and how these were dealt with.

4.4.1 Harm to participants

The method of accessing participants should demonstrate both clear respect and sensitivity toward the participants, as well as ensuring the philosophy of safety and a non-threatening atmosphere and behaviour (Armitage and Knapman 2003; Department of Health 2004). The review of literature has demonstrated that most research in the field of medication safety has focused on what can jeopardize the safety of medication use, rather than what can actually enhance its safety (Dean et al. 2002b; Beso et al. 2005). In doing so, such research has first identified the "error makers", then attempted to investigate them by interview, assuming that interviewees would have the best knowledge about the causes of medication errors. However, this approach of imposing a prior assumption of the participants as "error-makers" is likely to create an unsafe and threatening atmosphere for the participants (Armitage et al. 2004). For this reason, this study aimed to make a general invitation for all nurses to participate in interviews to explore their views on the safety of medication administrations.

It was anticipated that a general invitation for nurses to participate in the study would, in many respects, initiate a safe relationship with the nurses, and encourage them to participate. Firstly, it does not assert any prior assumption about the nature of the participants, particularly when dealing with a sensitive topic like medication safety. It avoids implying that the participant is the "error-maker", therefore eliminating the stigmatization of the participants, and promoting what Murphy and Dingwall (2003) call "trustfulness and openness" with participants when dealing with a sensitive topic. This step is meant to ensure that the participants will not feel pressurized or threatened to give their own honest account. In contrast, it was anticipated that the

nurses would feel motivated to give "expert accounts" of the factors which influence the safety of medication administration. This particular point assures the participants that they can give their accounts of medication administration without necessarily linking it to their personal experiences, which may cause undue distress to them, particularly when drawing upon the factors which may cause problems in medication administration.

Another advantage of the general invitation of nurses to participate in the study is related to the fact that gaining the participants' consent as a knowledgeable person is ethically more acceptable. Critics of the previous research, which identified the "error-makers" and sought to interview them, have focused on the fact that the participants may have felt obliged to participate in the interview because they were identified as error-makers, and they may have been stigmatized by such labelling (Armitage et al. 2004). In this study, the participant's information sheet states clearly that the interview will be a general discussion about the nurse's views on the safety of medication administration. The participant was not obliged to link their views to any personal experience, although they were invited to draw on personal experiences of medication administration if they wanted to (see interview guide in appendix A). The interviewer adopted a supportive and understanding style, and avoided a judgmental or confrontational one. Vincent and Taylor-Adams (2004) have stressed that where it becomes clear that any professional shortcoming has occurred, this should be allowed to emerge naturally from the conversation, and should not be extracted by cross examination. Adverse comments and judgment were avoided in the interviews as they may have led to demoralization and defensiveness. It was anticipated that such an

approach would induce a supportive, non-threatening discussion, therefore establishing rapport and facilitating an open discussion.

It was particularly crucial for recruitment to send a clear message to participants that the focus of the research is the system, not the individuals. Evidence from previous research suggests that this message fosters a sense of security and can minimize the feeling of vulnerability among the participants, particularly if they would like to express their views where there was a problem with medication administration (Taxis 2001; Dean et al. 2002b; Beso et al. 2005). Furthermore, such assurances may have a positive impact on the response rate. In each research document sent to the participants, the researcher stressed that the discussion would focus on the system aspects of medication administration, and not on individuals.

It was anticipated that some participants may experience a degree of concern when discussing the safety of medication administration; particularly if they have witnessed an adverse event. Should this be more than transitory, the researcher planned to offer the participant the contact numbers for counselling services in the Occupational Health Department in the Woodland Hospital Trust where the study took place, where more structured help can be provided. Other ethical issues are related to the researcher's personal safety (Tod 2006). This research adhered to the Lone Researcher Guidelines at the School of Nursing which sponsored this research, and where the researcher was undertaking his PhD. The guidelines outline the measures that can be used to protect staff who undertake research activities, such as in the one-to-one interview, and reduce the risks associated with lone working.

4.4.2 Informed consent

The British Sociological Association states that "as far as possible, sociological research should be based on the freely given informed consent" (British Sociology Association 2002.p.3).

The researcher is responsible for explaining to the participants what the research is about, and who is undertaking and financing it, alongside other research aspects that the participants are entitled to know, and should take the necessary steps to address these issues.

The participant information sheet fully explained the purpose of the research study, in addition to the researcher's responsibilities, and the likely risks and benefits incurred by the researcher and participants (see appendix D). It also stated clearly that the participant has the right to withdraw from the study at any time, without giving any reason. All potential participants had the necessary information to make an informed decision about their involvement in the research study. Prior to the start of each interview, the participants were provided with the opportunity to ask any questions, then each participant completed and signed the study consent form (Appendix H). In accordance with the Research Governance Framework for Health and Social Care in England (Department of Health 2001c; Department of Health 2005b), approval for the study was obtained from the Local Research Ethical Committee (Appendix I) and the Research & Development Department at the Woodland Hospital NHS Trust (Appendix J).

4.4.3 Anonymity and confidentiality

Ethical principles incorporate the protection of privacy and avoiding deception (Bryman, 2001). The names and identity of the participants should not be revealed as a result of data collection, analysis, and reporting in the research study (Tod 2006), unless the ethical code of conduct for research governance requires their disclosure, for example when disclosing professional misconduct. Therefore, it was important to ensure that the first contact with participants about the study was via a person with a legitimate role, in order to identify the potential participants. In this study, all of the participants were approached in a legitimate manner. For example, those nurses in band 7 and above were sent letters directly to their wards. These letters were addressed to the "ward manager" of those wards in the Woodland Hospital NHS Trust where the study took place, and if they were willing to participate, they would voluntarily give their names and contact addresses to the researcher. The nurses in bands 5 and 6 were handed a letter during their attendance of courses in the School of Nursing. I did not have access to the names of those participants until they agreed to participate and return the questionnaire to the researcher, therefore consenting to reveal their names and addresses.

The participant information sheet stated clearly that the names of nurses interviewed will always be confidential, and their views will always be anonymized. However, it stated clearly that because I have a nursing background, I am obliged to adhere to the Nursing and Midwifery Council's (NMC)'s Professional Code of Conduct, whereby I am obliged to report any event of professional misconduct to the NMC. The process of protecting the participants' names entailed removing their names and ascribing them to codes during analysis, so that data could not be traced back to particular

individuals through information on the role or the type of information provided. All of the participants and the hospital names used in the study were changed to pseudonames.

4.5 Data analysis

For qualitative research, the process of analyzing the data is not linear or even predictable (Lathlean 2006). Indeed, the analytical process can start at the very beginning of the research, and can inform all aspects of the research. The following section outlines the strategies for data analysis adopted in this research, and the rationale behind adopting such strategies.

In order to analyze data from the interviews, they were recorded using a digital recorder. All of the interviews, but one, were digitally recorded and transcribed verbatim. Verbatim transcription refers to the word-for-word reproduction of verbal data, where the written words are an exact replication of the audio-recorded words (Poland 1995). The verbatim records and transcriptions of the interviews were beneficial in facilitating data analysis by bringing me closer to my data, and provided a good opportunity for me to start the process of "immersing" myself in the data. Poland (1995) advocates that researchers transcribe their own interview data, given that they have first-hand knowledge from their involvement in the interview process, in addition to the expertise in the interview subject and the advantage of having participated in both verbal and non-verbal exchanges with the participants.

I transcribed all of the interviews personally, which helped to immerse myself in the data, and consequently sharpened the data analysis. Poland (1995) suggested that the

notion of the accuracy of transcription is problematic, given the inter-subjective nature of human communications and the transcription as an interpretive activity. Moreover, he was doubtful that all errors or discrepancies of transcription interpretation can be prevented, even with well-trained transcribers working according to high-quality guidelines. On the other hand, reviewing all transcripts can be time-consuming, expensive, and may not be justified (Poland 1995). Alternatively, MacLean et al. (2004) found that the spot-checking of a sample of transcripts is a time-saving process, which can provide the researcher with the opportunity to effectively discuss any questions with the checker from the outset. For these reasons, and given the fact that the English language is the second language of theme a random sample of five interview transcripts was sent to an independent transcriber, with the English language as a first language. The spot-checking revealed minor spelling errors, which did not change the interpretation of the transcripts. Following the transcription, the interview data was uploaded to the computer software NVivo to assist in analyzing the data. NVivo is a dedicated software package for qualitative data analysis (Richards 1999; Bazeley and Richards 2000). This software serves as a tool to facilitate the analysis process. However, it is not a substitute for immersing oneself in the data, and ascertaining the nature of the data and the interrelationships between different aspects of it (Lathlean 2006).

Many strategies for qualitative data analysis have been cited in the literature. Analytical induction, grounded theory, narrative analysis, and framework analysis have all been cited as examples of qualitative data analysis (Lathlean 2006). Each type has it is own approach and rationale for analyzing data. In this research, framework analysis (Bryman & Burgess, 1994; Ritchie & Spencer, 1994) was

considered appropriate for analyzing data generated by the interviews. Framework analysis is a method for analyzing qualitative research data, and it was developed in the 1980s by the Qualitative Research Unit at the National Centre for Qualitative Research in the United Kingdom. It involves a number of stages; the first stage is familiarization with the data, by listening, reading and re-reading the interview transcripts, until the researcher is deeply familiar with the nature and entirety of the data (Green & Thorogood, 2004). The following step includes thematic analysis, whereby the transcripts are developed into a coding scheme, and the themes in the data become labels for the codes. The constant comparative method was used to generate emergent themes, an approach facilitated by a form of charting which involves rearranging the data according to thematic content, either case by case or theme by theme (Ritchie & Spencer, 1994). The final steps of the analysis involve drawing relationships between the emerging themes, which moves the frameworks analysis beyond a sophisticated thematic analysis (Bernard 2000; Green and Thorogood 2004). This crucial step is known as mapping and interpretation, where visual tables and diagrams can be used to physically explore the relationships between the concepts and typologies developed from them.

The findings were categorized into three main themes because it was felt that there are two main themes emerging from the participants' views which reflected the two main components of the OSSM. This structuring of the themes helped to allow the participants themes to be more easily analyzed according to the OSSM, therefore, providing a tool to critique the model itself. For example, one distinctive theme emerged from the participants views (i.e. The context of safe medication administration) provided a context to critique the model itself, therefore, achieving

one of the main objectives of the thesis, which is to assess the adequacy of the OSSM in investigating the safety of medication administration in adult critical care setting. The following diagram sets the main emerging themes and subthemes for the findings of the following three chapters.

Chapter 4
Building System Resilience of Meds Administration

Work Environment
Policies and Protocols

Knowledge Development and Dissemination

Critical Care: Connecting Culture

Chapter 5
Context of Safe Meds Administration

Context of Communication

Context of Practice

Context of Working Environment

Chapter 6
System Threats to Meds Administration

Impaired Communication

Meds Design & Delivery

Environmental Issues.

Figure 6: Data analysis chapters

The participants' views on the factors which contribute to the safety of medication administration in adult critical care settings were analysed using Organizational Safety Space Model (OSSM) (Reason 1997; Carthey et al. 2001). Chapter four, *Building system resilience of medication administration,* discusses the participants' views on those organizational factors which contribute to the resilience of the medication administration in those adult critical care settings investigated, particularly system navigational and intrinsic factors. Chapter five, *System threats to medication administration*, discusses the participants' views on those organizational factors which contribute to the unsafe medication administration process, particularly those latent conditions and local contribution factors. Chapter seven, *The context of safe medication administration*, focuses on the participants' views on the contextual

influence of some organizational factors, which can be a source of resilience for safety of medication administration in one context, but also a source of threats for safe medication administration in other context.

4.6 Research Rigour

There was a clear imperative for rigour and data trustworthiness to be pursued in this study so that findings can carry conviction and strength. Validity and reliability are common and are rooted in the quantitative research paradigm. Applying these measures in a qualitative research paradigm dictates redefining these concepts according to the qualitative paradigm. To establish the trustworthiness in qualitative research, Guba and Lincoln (1989) appealed to the criteria of credibility, transferability and dependability. Some strategies have also been highlighted in the literature to attain these criteria (Sandelowski 1986; Tuckett 2005). The following section aims to highlight the research strategies and operational techniques adopted in this study to enhance and maintain its research rigour.

There are many strategies mentioned in the literature that enable the researcher to improve the credibility of the qualitative research. The purposeful sampling utilized in this study contributes to the credibility of the research, because the participants were sought because they were likely to share their understandings of phenomena under investigation (Tuckett 2005). The participants in this study were selected because they are qualified nurses who are working in the adult critical care settings, and for whom medication administration was, and continues to be, a fundamental part of their duties. Therefore, it is very likely that their views reflect their beliefs and experiences regarding the safety of medication administration in those settings. Additionally, the

constant comparison of the data that emerged from the participants' interviews is another technique that was employed by this study to enhance the credibility of the research (Guba and Lincoln 1989). Both of my supervisors confirmed that their interpretations of the participants quotes included in the data analysis were consistent with my own. This particular step served to enhance the credibility of the data in the data analysis stage. Self-reflection, or reflexivity, as a means of understanding the impact of the researchers views, beliefs, and values, is increasingly seen as a valid means of adding credibility to qualitative research (Carolan 2003). I sought to maintain a friendly distance with the participants in this study. Moreover, conscious efforts were made so that I was not drawn into venturing personal opinions. Instead, where it was felt that such a situation was forthcoming, the interviewees were gently steered back to the interview to express their opinions on this matter. For example, by saying to the interviewees "What I am really interested in is your opinion on this issue ... ."

A common concern in the reporting of qualitative data is that of anecdotalism, whereby the selection of examples that support the writer's preferences is evident (Seale and Silverman 1997). The analysis of the data in the current study has highlighted some participants' views, which were not consistent with the general trends emerging from the data analysis. Those negative cases were pursued and analyzed to give impetus, strength, and rigour to the development of the argument, as suggested by Peräkylä (1997). For example, Martin, one of the participants in this study, gave distinctly different views from the majority of the participants regarding the attitude of critical care culture towards the reporting of unsafe medication administration practice (section 5.4.3). Rather than setting his views aside as aberrant,

his views were purposefully followed-up, as he provided an insight into why such views are formulated.

The issue of transferability is concerned with the conceptual generalisation of findings (Guba and Lincoln 1994). Unlike quantitative studies, the purpose of qualitative research is not to generalise the findings to other populations, but to ascertain in which context the findings from the study can be applied and shared (Malterud 2001). Therefore, this research endeavours to produce information that can be shared and applied beyond the study settings, and although some researchers claim that no study, irrespective of the method used, can provide findings that are universally transferable (Malterud 2001), the study design should demonstrate a thorough consideration of to what degree of transferability to another research context can the research claim. The participants in the research sample selected for this study are all working in adult critical care settings, and were therefore considered to represent the members of those settings. The emerging themes from the participants' views relate to other adult critical care settings. For example, the proximity in which nurses, doctors, and patients work. Therefore, it can be said that there is a conceptual generalizability in the context of research settings at this level, where any participants' experience, if well described, represents a "slice from the life world" (Denzin 1983.p.134). In qualitative research, conceptual generalizability refers to the data or settings rather than the subject *per se*, where the researcher must establish the typicality of the observed events, behaviours, or responses in the lives of the subjects (Sandelowski 1986). To achieve this aim, a thick description of the contextual background of the research settings, the participants, and the context of relationships and credible interpretations and materials is of absolute necessity (Sandelowski 1986; Miles and

Huberman 1994; Tuckett 2005). Moreover, there seems to be an agreement among the qualitative research community that it is the reader, rather than researcher, who carries the burden of claimed transferability of the research data (Guba and Lincoln 1989 ; Welcott 1994). In other words, the transferability of qualitative research ascertains in what contexts the findings can be applied (Malterud 2001). Therefore, the researcher has to provide as much information as possible on the context of the study, and it is up to the reader to evaluate this context and spot any similarities with other cultural contexts, in an efforts to share and apply the findings beyond the study settings (Koch 1994). In the context of the current study, chapter three "*context setting of medication administration*" aimed to provide as much of the "thick description" of the contextual information as possible about the settings, in addition to the methodology chapter, which provided information on the participants and how the data was collected, analyzed and interpreted.

The dependability of the research data is comparable to consistency of the qualitative research findings, which enable the reader to follow the decision trail taken by the researcher (Guba and Lincoln 1989 ; Guba and Lincoln 1994). The interview guide developed and used in this study was used by the same researchers, who also carried out all the interviews with the participants. The reliability of the data obtained is therefore fundamentally reliant on the competency and ability of the researcher's interviewing skills, and will be influenced by any research bias (Guba and Lincoln 1989 ; Appleton 1995). While such bias may not be completely neutralised, it can be minimized depending on the interview skills employed by the interviewer. In this context, two pilot interviews were carried out before the actual data collection commenced in order to enhance my interviewing skills. The use of digital recording to

record all of the interviews was said to further the reliability of the data obtained during the interviews by minimising any systematic bias (Tuckett 2005).

It should be acknowledged, however, that more than half of the participants in this study (n=19) were recruited during the second recruitment stage (Plan B), which utilised the snowball sampling technique. Snowball sampling has its own limitations which may influence the quality of data produced. For example, using snowballing to generate a sample of key participants means turning the judgment about appropriate participants over to a third party (i.e. the referring participants) (Norwood 2000). Some participants were recommended to participate in the current study by their ward colleagues, and this may have influenced their views on the organizational contributions towards the safety of medication administration, particularly when discussing those factors which precipitate unsafe medication administration, which may entitle some indirect criticism of the organization. However, the participants were reminded in the participant information sheets and during the interview, that the focus of the investigation is the system, not the individual. Moreover, the snowball sampling technique itself was only used as a second choice of recruitment, where self-nominated participants were purposefully selected during the first stage of the recruitment (plan A), and where the researcher made a regular efforts to enhance the number of self-nominating candidates by re-attending the courses in the School of Nursing, and reminding the nurses to participate in the study.

4.7 Insider researcher

One issue that needs to be considered regarding the rigour of this research is the fact that I worked in some of the adult critical care settings investigated as an agency nurse, and therefore, I probably share many similar experiences with some participants in this study. Being an insider researcher is said to make the researcher "theoretically sensitive" to the researched (Bonner and Tohurst 2002), by understanding the fundamentals and the dynamics of the critical care environment. However, there is a risk of taking for granted knowledge and bias towards the data collection and the interpretation of the findings. Gerrish (1997) warned that there is a risk that over-familiarization with the setting might lead to the researcher making assumptions in the research without necessarily seeking the rational underpinning the particular actions. On the other hand, the advantages of insider researcher include the potential to gather a greater depth of data and the possible availability of more contextual detail. In this study, efforts were made to understand when and where to gather data. I was familiar with the routine practices on critical care settings investigated. This prior knowledge enabled me to gather rich and focused data, as well as to determine easily when and why changes to those routine practices occurred. I found this to be helpful in understanding the nuances of interviewing nurses in critical care setting. Bonner (2001) suggested that insider knowledge also allows the researcher to identify subtle differences between the practice of expert and non-expert nurses. However, while this study acknowledges the advantages of being an insider researcher, I am also aware that there is potentially some degree of bias associated with this status, which could not be neutralized completely. Fetterman (1989) stated that research of any kind is subject to bias, and that making the potential biases of a study explicitly can, to some extent, mitigate against their effect on the findings.

Instead of attempting detachment, insider research should be designed to enable the researcher to strike the difficult balance between engagement in the field of inquiry and objectivity in analyzing and presenting the results of the study (Hewitt-Taylor 2002). This was demonstrated in this study by the reflecting on and identifying where events or pre-existing ideas or beliefs might have influenced my interpretation. The support of the researcher's academic supervisors proved to be valuable tool for addressing this issue.

Qualitative research stresses the importance of reflexivity, whereby the researcher recognizes that his or her social identity and background has an impact on the research process (Silverman 2005; Lathlean 2006). Reflexivity is especially relevant to this research because I was an adult critical care nurse, and I previously worked in adult critical care settings, which meant that I had to reflect carefully on the impact of being a member of the same professional group as the study participants, with potentially similar experiences with medication administration. Such reflection may have a particular impact on interpreting the findings. I recognized the potential tension between my clinical experience as a critical care nurse, and the image I was expected to portray as a researcher. For example, I was mindful that my voice was not overly-presented in the interviews, my role being limited to prompting, probing, and stimulating the interviewee's account of their experiences on the factors which influence the safety of medication administration in their wards. It is acknowledged that having a nursing background may not allow for a complete objectivity in interpreting the data. In fact, Malterud (2001) suggested that while the researcher's influence in qualitative research can be accounted, it cannot completely eliminated. In the context of the current study, I made conscious efforts to keep an open mind when

interpreting the data, and not to infer from personal experiences with medication administration by bringing them to bear upon the participants' views, and drawing links between them.

4.8 Conclusion

In conclusion, qualitative data analysis is a complex, creative process, which is ongoing, interactive, inductive and reflexive. The data analysis in this research occurs through the study from the start of data collection to the final report. This study employed several strategies to ensure its rigour. Several operational techniques were utilised in the conduct of this study to enhance the rigour of the data collection and analysis. The following three chapters set out the findings that emerged from the participants' views during the interviews.   .

Chapter Five:
Building a Resilient System of Medication Administration

5.1 Introduction

This chapter aims to present the participants' views on the aspects which contribute to establishing a safe and resilient medication administration process in the adult critical care settings investigated. To achieve this aim, system intrinsic factors described by Reason in the Organization Safety Space Model (OSSM) (1997; 2001) were used where appropriate, to identify the participants' perspectives on the main organizational issues which enhance the safety of medication administration in their wards.

The data that emerged from the participants' views were structured and contextualised to explain what contributes to building a safe and resilient system for medication administration. The emerging themes were arranged according to how they were embedded in the participants' views, and they were also organized to provide contextual information which it is hoped will help the reader to understand and pull together the information with the subsequent sections in this chapter and other chapters. Table 2 below presents the categories of data that were related to the participants' views on the theme of 'Building a Resilient System'.

Theme	Category	Sub-Category
Building a Resilient System for Medication Administration	Work environment, policies and protocols	Medication administration' policies and protocols
		Medication' double-checking
		Standardization of drug presentation
	Knowledge development and dissemination	Training and education
		Knowledge access and dissemination
	Critical care : A connecting culture	Negotiated partnership
		The role of the pharmacist
		Incident reporting

Table 3: Building a resilient system for medication administration: Themes and subthemes.

Each of these categories is discussed along with their associated sub-categories. Quotes from the interviews are used to illustrate the findings, but they were also intended to allow the reader to arbitrate for themselves something of the nature of the responses which formed the data, and to evaluate the credibility of the findings and the conclusions of the study.

5.2 Work environment, policies and protocols

In operating in the critical care environment, the organization of work is regulated by the use of policies and protocol. This was perceived by many participants as a reliable impetus for the administration of a medication in a safe, consistent and structured manner. The following sections aim to address the participants' views on the benefit of utilizing the medication administration policies and protocols, but also how the

medications checking and standardization were perceived to contribute to establishing a resilient medication administration process in their wards.

5.2.1 Medication administration' policies and protocols

The participants' views suggest that the policies and protocols for medication administration were employed in varying ways by the participants to provide them with information and to guide their clinical activities, such as medication preparation and administration. To address this issue, it is useful to discuss some important fundamental information on the policies and protocols of medication administration, before discussing the participants' views on them.

Although the terms 'policies' and 'protocol' have often been used interchangeably in the context of healthcare, there are subtle differences between the two phrases. Policies define the responsibilities of healthcare professionals, the rights of consumers, and other important issues concerning the use of a particular procedure, including the anticipated and unwanted effects (Dowling et al. 1996; Sakr et al. 1999). Protocols, on the other hand, provide the details of a specific procedure to enable the implementation of particular policies. For example, hospitals commonly have policies for the use of Control Drugs (CD's) for the management of pain associated with cancer patients. Protocols arising from such policies would detail the procedures to be undertaken by the healthcare professionals to achieve a quality standard of care, and how to administer and manage the CDs in various instances. Other policies for particular medication administration include inotrops preparations and administration policy and heparin preparation and administration policy. However, if the participants needed information on oral medication administration, such as the dose and route of

administration, they would generally consult colleagues, a pharmacist, doctors, or the British National Formula (BNF) handbook.

Many participants referred to these written policies and protocols for medication administration as vital source for medication administration practices that were deemed acceptable in their wards. Randa described the Trust policy for IV medication administration as a "Blue Bible," which she frequently referred to for checking the accepted practice for medication administration:

> I think it [IV medication administration policy] is good for the safety. We've got what we call the Blue Bible, which is your guide to drawing up intravenous drugs, and it just tells you which route the drug can be given, if it can be given by direct injection or not, and the amount of the dilution that is provided, how much you are supposed to draw to mix with…
>
> [Randa, staff nurse, level 2 critical care, the Beech Hospital].

Not only did the participants use these policies and protocols to mediate communication with other nurses and doctors, but they also appeared to employ these policies to legitimize their knowledge of medication administration, and therefore, they were more confident in discussing the treatment decisions, and reclaiming the exercise of nursing power. Reverting to safe medication administration policies and protocols appeared to have enabled some participants in this study to challenge medication orders given by doctors. For example, Jim described how the Trust' policy in his ward dictates that the doctors and nurse practitioners prescribe Noradrenalin in a certain manner, and therefore, he was willing to get the prescription rewritten if it was not written according to the Trust policy for medication management:

> …you must have guidelines, you must have a date, and you must have a signature and there must be a time, otherwise it is not properly prescribed [medication] and we can't give the drug…it is just a unit policy that this is the only way we are making it, and this is the only way the doctors or nurse practitioners are allowed to prescribe it.

[Jim, staff nurse, level 3 critical care, the Beech Hospital].

The introduction of protocols and policies is said to be one of the most common ways to manage the behaviours of the employees within the organization, which typically involves the development of written rules to specify the correct and desirable behaviour (Hopwood 1974). Furthermore, the promotion of safety is one area of organizational behaviour in which rules seem to feature heavily. Reason (1995) suggested that rules, in the form of procedures, protocols, and guidelines, are one of the principle defences to ensure the safety of organization. This notion has been acknowledged by the UK Government in its policy white paper *NHS Plan* (2000b), which specified that by 2004, the majority of NHS staff would be working under agreed protocols, and there would be a major drive to ensure that protocol-based care takes hold through the NHS.

On the international level, there has also been a move towards the use of rules to regulate the behaviour of healthcare professionals. The World Alliance for Patient Safety was formed in 2002, and has passed a resolution urging the World Health Organization (WHO) to take the lead to develop a global norms and standards to regulate the delivery a safer healthcare (Claridge et al. 2006). In this study, many participants felt that the policies and protocols for medication administration assist them in integrating new knowledge into practice and promoting effective decision-making. Furthermore, the use of policies and protocols appears to enable the

participants to examine closely how other nurses and doctors followed standardized guidelines of medication administration in critical care settings. This finding seems to be consistent with previous research, which reported that nurses recognised hospital protocols as a helpful tool to define the best practice and/or to standardize behaviour, and therefore, they are effective tools for risk management (Lawton and Parker 1999).

It is noteworthy that these medication administration policies and protocols cannot work as a means to ensure the exercise of accepted practice in the hospitals unless they are known, understood and complied with by those who are expected to use them. Merely having protocols in place is not sufficient to improve safety (Reason 1997; Claridge et al. 2006). In adhering to protocols, the socio-psychological literature distinguished three motives for obeying the rules which include: The belief by the people that the rule-maker has a legitimate authority in the area, because they feel that breaking the role would lead to negative consequences for them or because they feel that the rules are fair and are applied in fair and equitable manner (Tyler 1990). The likelihood that the rule will be obeyed is said to be more strongly linked with the later motive, where the protocols and rules are perceived as fair and just. In this context, many participants saw medication administration' protocols as a key element in providing safe, high quality care. Moreover, such protocols were perceived to provide the participants with a check that a particular practice of medication administration was acceptable, but it could also be linked to a perception of decreased likelihood of disciplinary action when adhering to these protocols, which might represent another perceived impetus for the participants in this study to adhere to the medication administration protocols. This may suggest that the participants' adherence to these policies was the common practice, and that deviation was the

exception. This conclusion is largely supported by evidence in the literature. Lawton and Parker (1999) conducted twenty-four focus group interviews with doctors, nurses, midwives, and health service managers across three hospitals. Their discussions focused on the purpose, development, and implementation of clinical protocols. The result showed that the nurses, including those working in critical care wards, were more compliant with the hospital protocols than other healthcare professionals such as doctors. Similar findings have been reported by a more recent study conducted by Wring et al. (2005), who found that nurses generally placed greater emphasis than doctors on the use of checklists and written policies, stressing the requirement to sign policies in order to provide written evidence of having read them. Furthermore, nurses were more likely to comply with the written policies than doctors, who seemed to value their professional authority and autonomy over the policies and protocols. Chapter Six will elaborate further on the contextual influence of complying with medication administration policies and protocols among the participants

5.2.2 Medications double-checking

Most of the participants in this study talked at length about the contribution of the double-checking of medication to patient safety, suggesting that it is an aspect which enhances the safety of medication administration in adult critical care settings:

> Researcher: So what do you think can contribute to the safety of medication administration in your ward?

> Samantha: I think it is checking really…checking with somebody, checking all the time … and that you have someone there to check with, and making sure that it is two of you that looking at it, to see what you are giving is correct medication.

> [Samantha, staff nurse, level 3 critical care, the Beech Hospital].

In particular, there were many comments on the double-checking of IV medication in the participants' wards. This is probably because most of the medications administered in critical care, particularly level 3 critical care settings, were administered IV (see chapter 3). Unsafe administering of any IV medication was perceived by many participants to have more acute consequences than medications administered unsafely using other routes, such as oral medication, therefore, it was perceived important to double-check IV medication prior to its administration:

> I think some of the IV drugs are dangerous, and their effects on the patient would be more acute than other medications. It is not just reading a packet, and showing the correct drug and correct dose and putting the correct number of tablets into the pot. This is slightly stricter with the IV drugs, so for that reason we ask the people to double-check it.
>
> [Steve, senior staff nurse, level 2 critical care, the Beech Hospital].

Samantha also reiterated the same views by asserting that fallibility is part of human nature, and this is why double-checking is deemed necessary:

> … we all make mistakes, and we are all human, and I've made a drug error in the past, but I think checking is good way round it. It is easy to draw something up incorrectly, and if you have got someone else there to say…well, that is not right, or you've got the wrong fluid here or whatever, this tends to stop that.
>
> [Samantha, staff nurse, level 3 critical care, the Beech Hospital].

Double-checking of medication before administering it appears to be considered as an extra security measure against miscalculating medication doses. For Leslie, it became clear that she does not always trust herself when calculating the medication infusion

rates, and this is why she double-checks the medications with her colleagues, emphasizing the fallibility for miscalculation error:

> I personally check with two people, because I don't always trust my self ... you worked the calculations out, say like you've worked your calculations, and you think it is right, and in many instances, I'm not quite sure! And I can't see it and someone else comes along and sees it. I personally think the double-checking is a safe practice.
>
> [Leslie, staff nurse, level 3 critical care, the Beech Hospital].

Some participants appear to be selective in their double-checking of medication. For example, Hannah stated that she does not check every medication she administers, such as some IV anti-biotics, because some of them are well known to her, and she would only double-check those medications which involve complex calculations, and the ones that she does not administer routinely, but she would double-check the less routinely administered ones, and the ones she considered as a dangerous medication:

> I would say drugs like the antibiotics we use every day, and I do not double-check because I have them so heavily held in my head. But there are drugs that we do not use regularly enough and those kinds of complex drugs like the Inotrops or the Anti arrhythmic. They are more risky, which we've got the blue book for and we would check with other people.
>
> [Hannah, staff nurse, level 2 critical care, the Oak Hospital].

Jim would also be selective in the type of nurses he would double-check his medications with. In particular, he would double-check the medication with a nurse who he deemed as knowledgeable and skilful in administering that particular medication, and with whom he has good working relationships:

> When I choose people to check my drugs, I will choose them from the
> staff that I get to check my drugs, because the vast majority of my
> colleagues in this unit are sound clinical people who either like
> personally or I have perfectly decent relationships with, but there are
> couple of people who I don't truly trust their clinical skills. So with
> complicated drugs, I would not ask them, I would walk another few
> meters and go and find a more competent member of staff to check
> things.

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

Contrary to previous views, there were some participants who expressed their concerns that the double-checking of medication may not be conducted genuinely when two nurses participate in the process, particularly if they were standing together checking the medication. In fact, some participants suggested that the double-checking of medication prior to administration can be counterproductive in some instances. For example, when both nurses expect each other to have checked the medication more thoroughly. Nina felt that double-checking of medications was not a flawless procedure, and it could lead to dilution of the individual responsibilities, leading to inappropriate checking process:

> If two people check drugs, I don't think they check properly, I don't
> think it is as safe as one. When two people checking, no one checks
> thoroughly because they are using the other person in doing it.

> [Nina, ward manager, level 3 critical care, the Oak Hospital].

Indeed, some participants advocated the use of single checking, as they feel more accountable when they are checking the medication themselves, because they are the only checkers for the medication, which necessitates more vigilance and

thoroughness, while still acknowledging that genuine double-checking is safer in overall:

> …although I would check my IVs with someone else, but I'm a great believer that if you are to check something in your own, you are more thorough and vigilant as suppose to be automatically thumb complacent if there was two of you ….
>
> [David, ward manager, level 3 critical care, the Oak Hospital].

The above findings suggest that, in principle, there was general support among the participants for the genuine double-checking of medication before administration, and that this practice was done on a frequent basis among the participants. In the context of the available literature, introducing checks to the organizational process was suggested by Reason (1995) as one of the effective defences to prevent organizational accidents. Acknowledging the human fallibility for the errors, and being prepared for such possibilities, have been cited as one of the main foundations for establishing system safety (Leape 1994; Reason 1997). The participants in this study seemed to acknowledge that they are human, and are therefore fallible and liable to Medication Administration Errors (MAE's) and near misses, and they sought to overcome this possibility by enforcing the practice of double-checking procedures, hence increasing the likelihood of detecting and preventing their errors.

The Department of Health (2004) has advocated the introduction of double-checking as a tool to ensure the delivery of safe medication to all patients in the NHS. Moreover, the Nursing and Midwifery Council (2004) has placed considerable emphasis on medication checking for nurses. Such legislation appears to have portrayed the double-checking of medication as a tool for some participants to defend

their professional status. However, some of the participants' views confirm evidence from the literature which suggests that problematic double-checking can potentially lead to complacence, and therefore caution must be had when interpreting the above data. Checking can become a ritualistic behaviour, shifting the emphasis from a strategy for ensuring the drug is given correctly, to a series of fixed steps that an often busy nurse must get through before he or she can finish the administration. The double-checking 'chant', where double-checking can become a repetition of the words between the two checkers without effective checking of the drug taking place, has been reported as an existent risk when double-checking the medication administration (Anderson and Webster 2001). Triple checking has been proposed (Davis and Drogasch 1997), but more of the same imperfect approach is unlikely to yield further significant safety benefits, and the extra staff required for a triple check are not typically available in many busy hospitals.

The human factor approach suggests that double-checks are more effective if checks are performed independently (Institute for Safe Medication Practices 2003). For example, an error in the concentration of a drug will be detected more often if the person checking the product performs all calculations independently, without knowledge of any prior calculations. It has been suggested that where people within the system feel always vulnerable for accidents, they seem to constantly checking the situation against any possibility for such accident, and rectifying the situation when necessary (Carthey et al. 2001). This proactive measure involves making regular checks on the organization's defences and upon its various essential processes. The fact that the participants were expecting that they are liable to err, and their extra checks on the accuracy of their medication preparation and administration could be

seen as a proactive measure to single out any potential unsafe medication administration before it happens. Whether this could be done by single or double-checking is debatable. However, there is less dispute among the participants that placing extra checks on the medication management process would inevitably contribute to a more resilient process of medication administration.

5.2.3 Standardization of drug presentation

There were considerable numbers of comments made by participants about the impact of standardization on enhancing the safety of medication administration. Some of these comments were made explicitly; others were implied by the participants' views. These comments were mainly expressed in two ways: the use of the pre-printed forms for medication prescription and administration, and the standardization of the medication concentration preparations, such as IV medications. The following section presents these findings in detail.

The use of pre-printed prescription charts appeared to be predominantly used in level 3 critical care settings in the Woodland Hospital. Their use was particularly welcomed by almost all of the participants because they save a lot of time and effort in interpreting the doctors' prescriptions, but also because they reduce the opportunity for error, particularly for those medications perceived as dangerous and which pose a serious safety threat if administered improperly. Jim stressed that standardization in the Noradrenalin prescription and preparing made things much easier and safer to administer.

> In this unit, there are a lot of very complicated and dangerous drugs.
> We standardize the prescription here; say like the Noradrenalin, so it is
> always four milligrams in one hundred mils five percent dextrose. It
> can't be prescribed any other way. We just increase the rate we give it.
> We are not changing the strength or the dilution of the Noradrenalin
> … so that helps to reduce errors because we are always making
> noradrenalin in the same way.

[Jim, staff nurse, level 3 critical care, the Beech Hospital].

John exemplified how the pre-printed charts can support safe medication administration by providing one way for prescribing the medication, and where the nurses in the ICU would raise the question when the prescription looked different:

> Pre-printed drug charts make it very clear what is being given and
> when you need to get over the doctor rule, you know, in intensive care
> the stakes are higher…if you need to give the drug, something like
> Inotrops, and you try to think what on earth is the doctor putting here
> [in the drug chart], but I need to give it. You tend to be responsible if
> that patient is suffering, yet you have got the prescription, but you just
> cannot quite understand it. So the pre-written ones are very good.

[John, ward manager, level 3 critical care, the Oak Hospital].

Several participants also expressed their admiration for the use of pre-printed medication charts which were used to decide the dose of some medications without having to go through the process of calculating the actual dose itself. This was considered by many participants as time-saving, but also a source of comfort and relief, as they do not have to calculate the dose for the medication, with the possibility of miscalculating the dose. Jennet described how she only has to know the patient's weight to ascertain the needed dose of Inotrops she needs to administer to the patients:

To prepare the Inotrops, there are different doses per weight of the patient, but we've got ready-made calculation charts for what rates for what weights for the patients, and we check it with two nurses, you will have both to get it wrong to administer the wrong doses and rates.

[Jennet, senior staff nurse, level 2 critical care, the Oak Hospital].

The participants identified the use of ready-made medication, particularly the ready-mixed intravenous solutions, as one way of avoiding the hassle to go, work out the concentration of the medication, and then have to physically mix two or more medications together, and have to double-check all the steps involved with a second checker.

…we do not now add potassium, as we used to do, to a bag of fluid. Obviously, they are pre-made in pharmacy, and then there is less work for nurses. The nurse's errors will be taken out of it as well. So when it comes up to the ward then it is a matter of making sure that you have given it to the right patients rather than mixing it all up and working out the calculations of what you are actually putting up in the bag, so that is a good idea.

[Lily, ward manager, level 2 critical care, the Oak Hospital].

The fact that many of the administered IV medications, such as the Inotrops, were prescribed on a pre-printed form, created a situation where there was a mutual agreement between nurses, doctors and the pharmacist about how the prescription should look. The doctors had limited options as to what to choose and to authorize the prescription by signing the order. Standardization of prescription would appear to take the human intervention out of writing the prescription, effectively removing one source of the errors altogether. Illegible prescription orders were cited in many studies as one of the most common causes for MAE's in all hospital settings, including

critical care (Tissot et al. 1999; Tissot et al. 2003; Department of Health 2004). By standardizing this process and eliminating the illegibility of the medication prescription, the chances of the miscommunication the medications prescriptions would logically be reduced, particularly if the nurses were familiar with the standard prescription.

Many participants suggested that they had limited choices when choosing the ready-mixed IV solutions and pre-made calculations charts, by reducing the steps needed to be taken by the participants to pick up, prepare, calculate, and administer the medications. This process is sometimes called "forcing functions", which Reason (1990) has discussed extensively in his book on H*uman Error*. Reason demonstrated this concept through the "lock and key "design. When nurses want to inject a liquid added to a syringe meant for oral use into intravenous line, if the parts from these two different systems fit, a nurse would inevitably try to inject an oral medication, but when these "oral" syringes are used for non-IV liquids, they have tips with which needles and intravenous tubing are incompatible, and cannot be attached, then the medication cannot be administered, even if a nurse tries to give it. Applying the same principle in this study on pre-printed charts, doctors are forced to choose and authorise only a limited number of medications from printed medications of the available dosages, and in the particular writing, route, and frequency that are typed in the chart. The medication prescription can not be authorized otherwise. The participants are forced to choose calculations from pre-made calculation charts, and to choose ready-mixed IV solution for administration. Using commercially prepared ready-mixed IV medications was said to reduce the risk of errors because it relegates the error-prone process of solution preparation, which includes calculating the doses

and mixing the right medications, to the manufacturer (Cohen 2000). Similar findings have also been reported by the Department of Health (2004), who advocated the use of the standardization of medication prescription, dispensing, and administration in all NHS settings.

The bottom line behind introducing and enforcing standardization is to acknowledge the human fallibility for errors. The introduction of pre-printed medication charts, pre-printed calculations charts, and ready-mixed medication preparations were perceived by the participants as effective tools to minimize the role of technical skills needed for medication administration, which leave the nurses to concentrate on more strategic decisions. A key issue suggested by the participants to the contribute toward resilient medication administration practice was the way they were allowed to access and retain a significant amount of information regarding the medication administration, such as the up-to-date information on technical skills of medication administration. The following discussion highlights some of the participants' views on this issue.

5.3 Knowledge development and dissemination

This section focuses on the participants' views on the impact of education and training towards the resilience of medication administration. It has been suggested that training, education, and the use of information technology are high leverage factors in the quality improvement process, because of their ability to lead change (Ginsburg et al. 2005). Moreover, training is acknowledged to be an integral part of risk management strategy (Cooper 1994; Orser and Oxorn 1994), and the dissemination of this tool also appears to play a vital role in this change. The following findings emerged from the data in the study regarding the impact of

participants' knowledge development and dissemination on the overall safety of medication administration and management.

5.3.1 Training and education

Training and education were identified by a number of participants in this study as major drivers for the safe, competent, and punctual administration of medication. Several participants seem to be mindful of how it was crucial for them to undertake the necessary training to keep their level of knowledge and technical skills of medication administration up-to-date. This attitude seemingly correlates with the awareness of their responsibility towards patient safety, but also towards their personal and professional development needs, as one participant commented:

> …there is a certain responsibility for the individual nurse to seek training for medication administration, as there is a responsibility for the senior staff to help them, and help them through it …

> [Toney, senior staff nurse, level 2 critical care, the Oak Hospital].

A number of participants felt that being competent and safe in administering medication is a mutual interest between the nurses and the hospital management. For the staff nurses and senior staff nurses, being competent in administering medications was perceived to be essential to safeguard their patients' safety, for which they feel personally responsible. For the hospital management, it was seen by the participants as a tool to fulfil the requirements of the clinical governance agenda, where training and education for medication administration was seen as a precursor for effective risk management. Such common interests in raising the competency of the participants in administering the medication were well-demonstrated in the participants' views on

training for the IV medication administration. Because most of the medications are administered IV in critical care settings, there is an emphasis on the nurses' competency in the nurses' training for medication administration. Nurses who join the critical care wards in the Woodland Hospital NHS Trust cannot administer any IV medication until they complete the competency package for IV medication administration. This was evident in many participants' views:

> ... when I joined the HDU…you had to do an intravenous package in order to give intravenous drugs. That would be all about how to prepare them, in what form and what adverse reaction you can have and all that kind of thing. It was very useful really.

> [Lottie, staff nurse, level 2 critical care, the Beech Hospital].

Some participants were keen to re-take such training again if possible. For example, Scott was happy to undergo another training course for IV medication administration, where he thought it would be a good opportunity to become competent in administering those new drugs that he anticipated having to administer in the ICU:

> When I first came to the ICU, I have already had my IV pack previously, but I was still required to do, like bridge that gap in term of the drugs that I was coming to contact with, which I haven't used before. So essentially things like Inotrops, morphine and that sort of things, IV administration of those sort of drugs which I wouldn't have had in my previous roles, but I have now.

> [Scott, staff nurse, level 3 critical care, the Beech Hospital].

The nurse managers from band 7 and above, from both the Oak and the Beech Hospital campuses, were also supportive of the in-house training of the IV medication administration that the participants would receive when they first join their wards:

> We have an induction book that we do for the newly qualified staff and the new joiner on day one; we also give them their IV working *new ways package* [the name of the IV training package] which we asked them to complete within the first three months. We also put them in the IV study day, which they do within two months of joining the ward, and a big part of our work is giving medication, so we do focus quite heavily on the medication' side of it. We tell them we shouldn't give drugs unsupervised until you've had your IV package done.

> [Linda, ward manager, level 3 critical care, the Beech Hospital].

The emphasis on the mandatory training in medication administration, such as the mandatory completion of the IV medication administration pack, may reflect the supportive environment which contributes to successful embedding of knowledge among the participants. It may also reflect the level of investment that the Trust places in training in terms of providing time for practice and gaining the necessary competency to put new skills into practice. This is consistent with the literature evidence, which suggests that the support of organizational leadership for training and education is critical for fostering a safety culture (Ginsburg et al. 2005). Furthermore, the use of competency-based assessment for the participants, which employs direct observation and question and answer, has proven to be more effective in acquiring knowledge and education than traditional class-oriented education. For instance, Bechtel and his colleagues (1999) gave a number of examples where competency-based education proved to be a cost-effective and efficient educational process, particularly in relation to technical skills such as medication administration and calculation. They called for shifting the nursing education from an information-driven approach assessment, which relies heavily upon the written words in order to evaluate if learning has occurred, to a process that promotes higher level of critical thinking and clinical judgment. This finding also mirrors the conclusion of Walker (2001), who

found that competency–based training and assessment for critical care nurses, including assessing their medication administration and calculation, embraced both cognitive and psychomotor skills development for the nurses.

The administering of very sensitive and highly potent medications in critical care settings meant the inevitable use of sophisticated procedures and devices to administer these medications. The participants in this study commented that they had mandatory training in how to use the medical devices to infuse the IV medication, and many of them received a yearly update on this. Also, they would usually receive training on the use of the IV medication infusion devices as part of their IV medication administration training, before being allowed to administer IV medication unsupervised:

> …part of *working new ways* IV package [the name of the IV training package], there is basically an infusion device section in it, where you have to be trained and assessed as being competent in that particular types of pumps that we use on the unit, and we have to update this training every year, and to the best of our ability

> [Jenny, ward manager, level 3 critical care, the Beech Hospital].

Sonia explained how the nurses in her ward can access and update their training on the use of the infusions pumps in her ward:

> ... there are people who are actually trained like band six nurses, they do sessions [on IV medication pumps] that you can go and update your knowledge on them to make sure that you are using them properly. They [sessions] are available all around the year, but you only need to attend them yearly.

> [Sonia, staff nurse, level 2 critical care, the Beech Hospital].

The literature suggests that the continuous development of medical devices, particularly the use of medication administration devices, has been said to be a double-edge sword (Quinn 1998), where they can be useful in one side, but also have their own inherent risks, especially when training provision is minimal. The Medical Device Agency (1997) cited inadequate training as a main contributing factor towards the yearly increase in the adverse incidents reported in the NHS. In the context of the current study, it became apparent from the participants' views that the use of advanced technology, such as IV infusion pumps, should be combined with robust training to use them, so that the staff can use them safely. These findings are consistent with those of Lilford et al. (2005), who found that neither the use of education nor the use of decision support tools is adequate by itself to prevent unsafe medication infusion, simply because education and training are not a panacea; because humans are not perfect. Even when decision aids are deployed, maximum compliance is only achieved when clinicians understand the logical underpinnings the use of these devices.

Generally, the participants in this study appeared to put a good deal of faith in their mathematical and calculation skills as precursor for safe medication administration. Many participants felt that it was essential for them to have a sufficient knowledge of mathematical skills in order to be able to calculate the dose of medication correctly, particularly when preparing and administering medications with more complex doses. In fact, there was a strong support among many participants for the new initiative which was introduced in both hospitals where the study took place, where potential nursing employees have to sit a maths exam, and they have to pass it with a mark of

100% before they are short-listed for the interview. Senior managers from band 7 and above appeared to be particularly supportive of this idea, and were thus keen to implement this initiative:

> I think it [maths exam] is a safety measure, so we can't employ people who can't work out drug calculations ... When I trained, we had an assessment, so we were assessed giving out medicines and doing calculations, but I don't know if that is incorporated in training now, so I think it [the maths test] is a good idea really.

> [Nina, ward manager, level 2 critical care, the Oak Hospital].

Nina' views imply an uncertainty about current nursing training in terms of providing sufficient calculation skills, and she thus saw the exam as a tool to overcome a previous shortcomings. The introduction of a maths test for new employees may highlight the Trust's proactive approach in delivering a safe medication administration to the patients, by ensuring that nurses have sufficient current knowledge of medication calculations. Moreover, it may add more credibility to the risk management programme in the Trust in terms of safe medication administration. Annette, a clinical governance nurse, expressed her support for the exam, and has correlated it to an effective risk management strategy:

> ... but ideally you are the first person to get it right [drug calculations], because you don't have two chances when you are giving drugs to the patients if you get the calculations wrong. So I think it [mathematical test] is a positive thing if it is used correctly, and as long as the calculations are realistic and it is like the kind of calculations you are doing in the ward. So I think it [the maths test] can proactively manage the risk of medication errors among nurses.

[Annette, band 7 clinical governance nurse, level 3 critical care, the Beech Hospital].

In this quotation, Annette appeared to suggest that a pre-requisite to the effectiveness of the maths exam is its relevance to the routine calculations that critical care nurses would usually undertake in their work place. This assumption also appeared to be supported by comments from some participants who were dissatisfied by instances where they had undergone training for which they could see no application in their current job role, or parts of this training were irrelevant to their job. Namiq criticized the IV administration package that the nurses receive in his ward, particularly in that many aspects of the medication calculations were irrelevant to the nurse's job, and he will probably never come across it, therefore, it becomes meaningless to him:

> A lot of drug calculations you just never ever do them. If you are not doing something, you don't remember it and you don't recall it. If it is something that you're going to be doing several times a week, then you will remember it, it become meaningful to you… it [the maths test] is meaningless …

> [Namiq, senior staff nurse, level 3 critical care, the Beech Hospital].

It appears from the participants' views that the Trust takes firm steps to raise the participants' awareness about the importance of the mandatory training for technical skills of medication administration, such as the IV medication administration, the use of an infusion device, and the training for the calculation test. This can be considered in many ways supportive for the safety of medication administration. This is in line with the findings of Bruce and Wong (2001), who reported that the incidence of IV dose miscalculations sharply fall when nurses undertake a mandatory learning and assessment of their mathematical skills. However, when it comes to the participants' views on the mathematical test which has recently been introduced in the Trust, it was evident that the participants have expressed mixed views regarding its effectiveness in

calibrating the mathematical skills of the newly recruited critical care nurses in their Trust. For example, some participants have expressed doubts about its credibility, and described it as insensitive to the nurses' needs; others consider it as a tool for a successful embedding of new knowledge related to medication administration, thereby contributing proactively to preventing MAE's and near misses. This debate was echoed in the literature. Ashby (1997) suggested that the medication calculation skills of nurses should be routinely tested. However, Sabin (2001) suggested that tests of mathematical ability for pre-registration nursing students (either based on standard arithmetic functions, or framed in clinical scenarios and contexts) do not seem to offer a reliable indication of future calculation errors in practice. Furthermore, there is limited evidence in the literature to suggest that those who pass these tests will retain this learning, or be able to apply it within the clinical context, or indeed that those who fail them will perform badly in clinical practice. In fact, Ludwig-Beymer et al. (1990) found that there was no change in the rate of medication errors in the period before and after an examination of nurses' pharmacology knowledge, which includes questions about the drugs and drugs administration calculation.

It is noteworthy that while the participants' views suggested an emphasis on the available training for technical skills of medication administration, such as the competency assessment of IV medication administration, their views lack any discussion on any form of training in the non-technical skills needed to ensure the safety of medication administration, whether in their pre-registration nursing training, or post-registration induction program in work settings. Evidence from the literature (see chapter two) has demonstrated that non-technical skills are crucial to ensure the safety of operation within the organization, including team working skills, effective

communication, situation awareness and interpersonal skills (Fletcher et al. 2003; Flin 2008). As there was a paucity of the participant's views on this issue, this may reflect de-emphasizing the importance of acquiring such skills, probably on the organizational levels. Later discussion (see chapter eight) aims to link this point with the overall picture of nursing education in this thesis, and to relate it to the content of pre- and post-registration nursing education.

5.3.2 Knowledge access and dissemination

Having a timely access to the necessary information germane to the process of medication administration was seen by the participants as an important aspect of feeling safe during the medication administration process. The views of the participants in this study suggest that there was usually a senior member of staff on any shift, who was perceived as a very supportive resource, who the junior member of staff, in particular, can always refer to.

> There is always a band six nurse on every shift, who is an experienced nurse…it helps a lot I think in term of providing support for the staff here, particular the junior ones.

> [Steve, senior staff nurse, level 2 critical care, the Beech Hospital].

It was suggested that many participants in the study were unable to retain knowledge about all the medication they administer, therefore, it was inevitable that some participants may become unfamiliar with certain medications, either because they have rarely, or never, encountered them during their work, and consequently become ill-informed and de-skilled in administering such medications safely. This might lead to unsafe practice, as was apparent in John's story:

> … an incident we had here on surgical high dependency unit in which as the name suggest it is a surgical high dependency, and it deals mostly with surgical cases. Medical cases tend to be dealt with in medical high dependency unit…and the drug that needed to be given was an Anti arrhythmic, and because it was not given often in the surgical high dependency unit, but also the surgeon had written it up incorrectly, and the staff at the surgical high dependency unit didn't know that it was given incorrectly. It was only when the charge nurse came next morning and said what on the earth you are giving this out for? Because he was aware of the drug. So conditions that you do not normally come across I think would lead to unsafe practice, and things that you see rarely…

[John, ward manager, level 3 critical care, the Oak Hospital].

Senior members of staff were often described by their junior colleagues as experts who achieved the various skills deemed necessary for safe medication administration, but who were also able to provide assistance to the participants to enable them to develop and maximize their learning potential. Sonia gave her verdict on the presence of senior colleagues on the ward, describing them as rich sources of information, and as influential figures in providing crucial advice:

> If you've got people who have been here ten years and they are a rich source of information and want to learn, their knowledge is unbelievable [great], so we can ask them.

[Sonia, staff nurse, level 2 critical care, the Beech Hospital].

However, there appears to be instances where accessing this source of information can be problematic, particularly when there were poor relationships with other fellow nurses. The participants' views imply that, to be an effective source of information, the presence of a senior member of staff needs to be coupled with an atmosphere of effective teamwork and trust between the nurses and their seniors. The participants

felt that a good rapport with their colleagues made it easier for them to approach and

ask them any question without intimidation. As a senior staff nurse, Toney was eager

to illustrate how the presence of a senior member of staff, like himself, was

considered a powerful asset for his ward. While supporting other members of staff, he

was also mindful of the fact that this was subject to the micro climate of the ward,

where a supportive culture prevails:

> A good thing in this ward is that there is always a senior nurse there, and usually an SHO [Senior House Officer] that you can use to get the support of the medical staff. I haven't really come across any issues with junior staff regarding administration of medicines in approaching senior staff, but any perceived support can only be exploited in the working culture which supports team working and good communication skills, and this may not be always be the case.

> [Toney, senior staff nurse, level 2 critical care, the Oak Hospital].

Also, the pharmacist presence in the ward seems to play a role in being an active port

of knowledge to disseminate valuable medication-related information for the

participants in this study. Angela accepts that the pharmacist has a great depth of

knowledge, and he will be an important source for information regarding the

medication.

> You know, the [the ward pharmacist] is experienced in his field. I accept that our pharmacist has a greater depth of knowledge about certain medication than I have. I am only dealing with one [medication], whereas he is, you know, trained for so many years, and knows a lot more about it, and if we are unsure about something, we wouldn't have any problem about going to him about it, and I think this will be the same thing of the most staff.

> [Angela, ward manger, level 2 critical care, the Beech Hospital].

Policies and protocols of medication administration were also perceived by many

participants as valuable reference information related to medication administration. In

Section 5.2.1, the participants reported how policies and protocols inform their decisions with regard to medication administration. Here, the participants' views demonstrate how such policies and protocols can be an important source for knowledge development and dissemination regarding safe medication administration. The following quote reflects the diverse methods by which the information about medications can be available and accessed in the critical care wards in this study:

> We have a BNF [British National Formula] in the ward, we also have an electronic one, and we also have an IV medications book. We also have the blue folder [Blue Bible], which tells us how to make up medication, and what at what rate it [IV medication administration] should be given at…it also tells you if the medications can be given diluted or bolus, it tells you whether you [nurse] can give it, or the doctor has to give it.

> [Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

An examination of the published literature on the area shows that the supervisory support of the senior nursing staff is beneficial for the successful transfer of knowledge and skills to the other members of the team, hence safeguarding the safety of medication use and management. John's views on the incidence of wrong medication administration (see this section, p.169) demonstrate how the absence of senior support could lead to the removal of a crucial port for information about medication, particularly for the junior staff. This finding reinforces the suggestion of Meyer et al. (2007) who evaluated barriers to successful knowledge transfer among critical care nurses. They found that the absence of the required level of supervision and guidance from senior members of staff was detrimental to the application and transfer of learning. In the context of the current study, almost all of the participants indicated that they almost always have a senior member of staff on the shift, although

this was inhibited occasionally by the poor relationships between some participants and their senior colleagues.

The fact that senior nurses were often perceived as knowledgeable and trustworthy professionals among the participants may help to initiate a valuable discussion regarding medication administration and management, hence creating learning opportunities which can be rewarding for all nurses involved in the discussion. On occasion, however, some participants in this study felt it was difficult to access this source of information where there was a troubled relationship with a senior member of staff. Nevertheless, the participants appear to have recognized that their relationships with other healthcare professionals can be influential in enhancing the safety of medication administration. The following section discusses in depth how such relationships were perceived by many participants as foundational for resilient medication administration process.

5.4 Critical care: A connection culture

The dynamic nature of the communication styles among healthcare professionals in critical care culture were cited by the participants as influential for resilient medication administration processes. This section illustrates how the participants made use of such relationships to maintain the safety of medication administration. This section provides data with regard to the critical care nurses' views of their perceived partnership with the doctors to maintain patient safety, particularly their ability to discuss, question, and sometimes challenge the doctors' prescribing decisions. Also, their attitude and perception of the pharmacist's role in the critical

care settings, and their reporting of incidents of medication administration mishaps among themselves will also be discussed.

5.4.1 Negotiated partnership

The data shows that critical care nurses perceived themselves as having a legitimate responsibility with the doctor regarding patient care management, therefore they appeared to negotiate their role in the decision-making process with the doctors when managing not only the patient' medications, but all aspects of patient care. The nurses' views on this theme appear to be related to their awareness of their strong identity and professional status among other healthcare professionals, particularly the doctors. This perceived status appears to empower many participants to identify themselves as influential members when it comes to managing patient care, by questioning the credibility of the doctors' prescribing decisions, which they feel are inconsistent with the patient safety. One participant expressed his perspective on this issue:

> … because we [critical care nurses] are able to guide them [doctors] quite a bit … so I think we are keen to be involved in our patients' management. We don't feel that we are here to keep an eye on the patient and make sure that they comfortable … I think we would like to do more than just providing the basic nursing care, we are also involved in the patient management plan as well …

> [Steve, senior staff nurse, level 2 critical care, the Beech Hospital].

This attitude of questioning doctors' decisions seems to pertain to the nurses working in the critical care settings, and does not appear to exist, at least with the same magnitude, in other hospital settings such as medical and surgical wards. This was

demonstrated in the story of Leslie, who compared her experience when she once worked as agency nurse in a general surgical ward while working in ICU:

> I was working as an agency staff on a surgical ward, and a registrar came up from A&E to do a round on the new patients that were coming to the ward. The way she [registrar] treated me was appalling. I didn't like the way she was speaking to me, and the way she was speaking to the patient as well. She was very dismissive … I didn't like it … I said to her "there is no good you clicking your finger to me", and she just looked at me and said: "huh". We carried on anyway, and that was on Sunday. On the Thursday, I was here working my normal shift [in the ICU], and then up came this particular doctor … a registrar from the A&E, and she just looked at me and came over … and she apologised to me saying: "well, I am so sorry, I wasn't very nice to you the other day … it is just I didn't realize that you are an ITU nurse … mind you, I should've guessed, because there is no other nurse would speak to me like you did" …

> [Leslie, staff nurse, level 3 critical care, the Oak Hospital].

The above story shows how the doctors may interpret the status of the critical care nurse as a legitimately challenging one. It can be deduced that the existence of a "questioning culture", at least in terms of questioning the doctors, is one way where participants were able to counter any perceived unsafe practice by doctors, which can be said to represent an intrinsic system measure to counter any threats to the safety of medication administration. The participants' attitude of questioning the doctors' order appears to stem from their appreciation of the fact that doctors are human, and are therefore fallible, as highlighted by one participant's views:

> I think the majority of the doctors realize that the nurses working in critical care are quite keen to know what is going on … and they [critical care nurses] are not just merely checking … I think they'd rather check than to give a drug in error ... at the end of the day we are human … and doctors can make a mistake.

> [Fiona, senior staff nurse, level 2 critical care. the Oak Hospital].

In the context of the available literature, Dean et al. (2002b) conducted an observational study of the doctors' prescription errors in hospital general ward. They found that the culture and power in medical teams lead to junior doctors and nurses not asking for clarification if they were unsure of exactly how to prescribe a drug. Hassan (2002) has also found similar trends among nurses in hospital wards, such as general medical or surgical wards, where their autonomy or control were said to be seriously limited by the unequal relationship with the doctors. The cases, however, seemed to be different among the participants in this study, where data indicates that they were able to question and challenge the doctors. The nursing leadership at the ward level seems to play a significant role in establishing the working culture, whereby the participants were expected to challenge the doctors for the sake of patient safety. For example, the nurses who join critical care seem to be sufficiently supported by their senior colleagues to come forward and question the doctors prescribing if they feel it is necessary. They are taught to do so from the first day they join the unit as trained nurses. Hannah described how the nurse-doctor relationships were built in the ward:

> I think in critical care, we've been taught to question, and I think any doctor who work with us understand that. They understand how we work ... often we get new SHO's [Senior House Officers] that aren't used to that …but they will get use to it ... you know it is just about learning about how we work as nurses.

> [Hannah, staff nurse, level 2 critical care, the Oak Hospital].

Many participants in this study perceived that they had a superior knowledge of the prescription of medication compared with the doctors, particularly the junior ones. This appears to play a significant role in generating the participants' attitude to

question the doctors' prescribing decisions. Many doctors who join the critical care setting in the NHS are reported to be trainee doctors (Smith and Poplett 2002). In this context, trainee doctors lack the experience and knowledge surrounding patient care and the prescribing decision, and this appears to prompt the critical care nurses to intervene proactively to guide those doctors on many aspects of patient care. This was demonstrated when Steve said in a previously cited quotation that nurses in his ward *"are able to guide them [doctors] quite a bit",* including questioning the doctors' decisions in order to prevent any wrong prescription of medication. Those doctors tend to blend themselves in with this new culture, where they get used to being questioned by the nurses not only regarding the medication, but about all aspects of patient care. This made it easier for nurses to approach the doctors and question them. Such unannounced, but mutually agreed rules between the participants in this study and their doctors served to portray the image that the participants (i.e. critical care nurses) were knowledgeable and confident in their work, and therefore their questions should be seen justifiable in this context.

The strategy of questioning any doubtful medication prescription appeared to be also influenced by the strong desire of the nurses to safeguard their own professional and legal status. Many participants were acutely conscious that they have to maintain the high standards of safe medication administration that were expected from them. For this reason, they seemed eager to avoid any poor standard of medication administration, and its consequences, such as losing their professional registration in the Nursing and Midwifery Council (NMC) in the UK. For Randa, losing the NMC registration could mean the end of her career, and this appeared to force her to be

more vigilant and cautious when administering the medication, and consequently making sure that the medication prescription is correct.

> We do actually challenge some of the prescription with the doctors. At the end of the day, it is my registration and it is my job. It took me three years to get there.

[Randa, staff nurse, level 2 critical care, the Beech Hospital].

It is apparent from the data that the participants in this study seemed to be preoccupied with the possibility of wrong prescription and potentially wrong administration of medication, and therefore, they move to ease this concern by taking a proactive measure via questioning the doctors. Their motivations to respond, whether patient safety, legal aspects, or the fear of losing their professional identity, impact positively on the safety of medication administration. This awareness of fallibility of errors represents, according to Reason (1990), a major recognition for driving the safety of the organization, by anticipating and preparing for all possibilities of errors. Moreover, Westrum (2003) suggested that many safety threats on the organizational level are likely to be removed in organizational cultures with high alignment and awareness of self-efficacy. The participants' views on their attitudes to question the doctors may reflect their self-awareness of the possibility of prescribing errors. Even evidence from the critical care literature suggests that such attitudes may pertain to critical care settings, and not only to those participants in this study. For example, an Australian study of nurses in secondary care settings demonstrated how the freedom to question and discuss prescribed medications, across disciplinary boundaries, was an essential part of keeping the medication process safe for all team members, and that safe practice was supported when the multi-

disciplinary team has the ability to communicate even on the most rudimentary level (McBride-Henry & Foureur, 2007).

The context of the nurse–doctor relationships in this study may reflect the changes in the nursing division of labour in the last few decades, as Stein (1967) suggested in the dynamics of doctor-nurse game. The participants' views indicate that they were not always subordinate to the doctors. Indeed, their relationships with the doctors, especially the junior doctors, were not homogenous, but vary according to the situational context. For example, the participants appeared keen to challenge the doctor's prescribing decision if they were uncomfortable with it, but also to offer a direct advice regarding the medication management, which can be seen in many ways as proactive steps to prevent any unsafe medication management. In other words, they do not seem to play the game as defined by Stein (1967). On contrast, their behaviours can be described as power-seeking ones, which served to reinforce a new reality of power relationships with the doctors, replacing those traditional relationships which portray the nurses as powerless figures who only exert their influence on doctors through indirect, manipulative strategies.

In areas of increasingly specialised knowledge and experience such as critical care settings, no one can know all things about all of the patients (Porter 1995). This was particularly evident in this study, where doctors, particularly the junior doctors, appeared to be increasingly dependent on the nurses' special expertise in the complex critical care settings. Such special expertise appeared to have given the participants the momentum to control their relationship with the doctors. In contrast, the following section shows that the participants may lose such momentum in their relationships

with the pharmacist, as they seem to be heavily dependent on the knowledge and expertise of the pharmacist to obtain accurate information on the medication being administered. The following section discusses this issue in detail. However, there is evidence from the literature which suggest that there still lack of nursing involvement in the decision making process , including in the critical care setting, and it is difficult to assert that the findings from this study could be the only true trend of nurses empowerment in the decision making process in the critical care setting. For example, Coombs at el (2003) conducted an ethnographic study to explore decision making process between doctors and nurses in the intensive care environment in order to examine contemporary clinical roles in this clinical speciality. Three intensive care units in England were selected as field sites and data was collected through participant observation, ethnographic interviews and documentation. The findings for the study suggest that nurses spoke positively about their role when working with doctors in intensive care. However, nurses did not feel that there were opportunities for total nursing participation in clinical decision making. Nurses ascribed this to the power held by medicine, which appeared to give rise to conflict between medicine and nursing. Moreover, nurses were persistent in their belief that clinical decisions were controlled by medicine, leaving little opportunity for influence by nurses. This was contrasted with a powerful belief from doctors about medical power in the study. For this reason, it may be difficult to ascertain that nurses can regain the momentum in challenging, at least some doctor, as some participants from this study appeared to suggest.

5.4.2 The role of the pharmacist

The participants' views suggest that there was a widespread appreciation of the role of the pharmacist in the wards, particularly in terms of checking the correct prescription, preparation, and administration of medications. Such appreciation was perceived by many participants as contributing substantially to the resilience of medication administration practice. The following extract highlights this sense of appreciation:

> She [the ward pharmacist] is excellent, because she comes every day for a few hours. I think there are probably less errors since she came along, because she checks all the charts. She will go round in every bed area, and checks every drug charts, and she might suggest for you: why don't you try this concentration, you could have it in this concentration? So she is excellent.

> [Leslie, staff nurse, level 3 critical care, the Oak Hospital].

Generally, the presence of the pharmacist in the ward seems to provide the participants with a sense of security when administering the medication. This is because the pharmacist is perceived by many participants to have substantial pharmaceutical knowledge, which gives them (the pharmacists) some type of authority over doctors regarding the medication management, for example, by altering the drug chart. Therefore, it is seen as a crucial asset for the participants not only to have pharmacists present on the ward, but also to establish good working relationships with them. Julie conveyed the idea that the pharmacists know the best, and that their judgment can be trusted:

> I feel more secure when giving the drugs when the pharmacist has already screened them. Some of the drugs that we deal with I am not familiar with, so if the pharmacist has been screening all kinds of that, that is kind of assurance really that these drugs are now OK to give, because the medical staff who clerks the patient [by examining and doing the medical paper work for the patient admission] may not know such kinds of information, while the pharmacist is an expert on that.

[Julie, staff nurse, level 2 critical care, the Beech Hospital].

This finding supports previous research into the impact of the pharmacist's role in maintaining medication safety in hospital settings, including critical care settings. A US study has shown that organizational decisions to incorporate the pharmacists in hospital rounds in ICU's, and therefore verify the doctors' orders, has reduced preventable adverse drug events by 66-78% (Leape et al. 1999). Moreover, a study conducted in a London teaching hospital found that the hospital pharmacist detected and corrected around 1.5% of the prescription errors made by doctors in the hospital, with the highest rate of error detected in ICU (Dean et al. 2002a). In their follow up study of doctors' prescription errors, Dean et al. (2002b) considered the pharmacist as a defence against potential medication errors. The system safety is said to be created through proactive measures to prevent any potential accidents, rather than through a reactive barriers and defences (Hollnagel et al. 2006). In this context, the review of literature suggested that the presence of a critical care pharmacist was shown to reduce MAE's and near misses, reduce the costs associated with improper medication use, and improve the overall patient outcomes (Kane et al. 2003).

In summary, the participants felt that the presence of the pharmacist in the ward, and their role in checking the medication chart and providing advice to the nurses, was an

important asset not only for patient safety, but also for the participants, as they were perceived as a safety net against any potential unsafe medication administration.

5.4.3 Incident Reporting

In principle, there seems to be a consensus among the participants in this study that in critical care environment the reporting of MAE's and near misses is essential. This appreciation of incident reporting stems from the participants' recognition that reporting these incidents or near misses could lead to learning from mistakes, and potentially preventing future ones. Many nurses felt very strongly and passionately about the need to report these incidents. The following quote demonstrates this feeling:

> I think we are quite good in incident reporting in our unit, we really encourage that because it is quite important. I think people now realise that if you don't report things, we can't improve practice.

> [Hannah, staff nurse, level 2 critical care, the Oak Hospital].

Some participants seemed to be more aware than others that when MAE's or near misses occur, they were almost always tracked down to system problems. For this reason, they would feel more confident to come forward and report it to their colleagues and managers. John mentioned an event when blood was ordered by mistake, and how he realized that it was a system problem, rather than an individual fault:

> … they said the nurses are to be responsible. This is not good enough … but they looked at their system and said how we can re-design the system so that it doesn't happen again, and so that where they put their efforts. I remember saying at that time why we are spending so much effort chasing one person … and that is now accepted that there is often a system failure or a combination of failure ….

> [John, ward Manager, level 3 critical care, the Oak Hospital].

John's views in the previous extract affirmed that the system is the origin of understanding unsafe medication practice. Considering that he is a ward manager and has probably overseen many investigations into the MAE's and near misses, and is therefore able to provide a better understanding for them.

Many participants emphasized the impact of a "no blame" culture on the nurses in promoting incident reporting of MAE's and near misses. The role of the punitive environment in inhibiting the reporting of errors cannot be over-emphasized, as punishments and fear of reprisal represent significant disincentives to report these errors (Department of Health 2000a). One participant made a direct link between the "no blame" culture and the overall patient and staff safety of hospitals.

> If you can make a no blame culture, that at least would mean that the patient is safe, and the organization and the person who was involved in the error is safe and can learn from what has happened ... I think it is a very dangerous situation if an organization starts threatening people with blaming.

> [Scott, staff nurse, level 3 critical care, the Beech Hospital].

There were also some participants who, however, did not agree fully with the "no blame" culture, because such approach was seen as diminishing professional accountability, as Jim suggested:

> I don't agree with a no blame culture in the NHS ... because everyone should be accountable for his actions...

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

In the context of the available literature, the reporting of incidents such as MAE's is said to be a vital attribute for safer healthcare organization, particularly by collecting the necessary information on potential threats and hazards to the system (Giles et al. 2006). Reason (1997) identified the reporting of accidents as one of four critical elements of an effective safety culture, which serve as a system *navigational aids* that function to collect information on the accidents and near misses in the system. Reports of MAE's and near misses can be assessed by the hospital management, and the aggregate of information allows the management to take countermeasures before the problem can cause failure. Moreover, successful reporting of incidents enables the individuals within the organization to feel supported, secure, and empowered to do so, and also leads to fairness in how the incidents are dealt with (Giles et al. 2006). Central to this culture is the relationship between the nurses and their colleagues and their managers. Sustained organizational leadership was said to be an important element of creating a strong safety culture (National Patient Safety Agency 2004a). The participants' desire to report any incident appears to be substantially enhanced by the existence of a climate where they are being supportive of each other, but also by the management encouraging the participants' reporting of behaviours. Sonia was encouraged by the support she saw from her colleagues and management to report errors:

> I think people do report [errors] because there is more support for that now. I saw the support to nurses in this ward. Many nurses here made a drug error, or a couple of drug errors. It was recognised, and they were not sort of dismissed and struck off. They were supported, they were interviewed and they were spoken to in a very constructive and supported way, so yeah, it does promote the reporting of it.
>
> [Sonia, staff nurse, level 2 critical care, the Beech Hospital].

The above assertion is confirmed by Walker and Lowe (1998), who found that nurses were more likely to self-report medication administration errors if the dominant working climate advocates a low blame approach, and where a punishment-free work environment exists.

Getting support from other colleagues and managers was seen by many participants as helpful behaviour from them, and where such a network of support exists, nurses seem to admit even minor mistakes in medication administration because of their desire to expose themselves to the supportive acts of colleagues and others. One of the supportive strategies that appears to have inspired some participants to report errors, particularly the junior ones, was "role modelling". This was most clearly demonstrated where there was a good relationship between the managers and the rest of the nursing team. Hazel highlighted how she was encouraged to speak about her personal errors because her ward manager admitted to her and her colleagues in the ward that she, the ward manger, had made an MAE in the past. Such an action appeared to be inspiring to Hazel:

> ... and I think the way to get rid of it [MAE's and near misses] is really by a role model. It is like senior staff may be holding their hands and saying that: "I made a drug error". Because I made a drug error, and when I made it, my ward sisters said that we had all done it, and raised her hands up and spoke about her error, but up until that point, I wouldn't have known that ....

> [Hazel, staff nurse, level 2 critical care, the Oak Hospital].

Martin has also emphasized the effect of role modelling when it comes to reporting patient safety incidents. However, he gave an account of what he perceived as negative role modelling, which can have a negative influence on the reporting of the incident, particularly on the junior nurses:

> ... if a senior member of nursing staff makes a mistake and another senior member of staff picks them up on it, they are not gonna broadcast that to the rest of the crew. However, when a junior member of staff makes a mistake, they will get well-hooked up ....

> [Martin, staff nurse, Level 3 critical care, the Oak Hospital].

Martin clearly felt intimidated by the fact that senior members of staff were not treated in the same way as junior ones. This experience of bad role modelling is likely to hinder the reporting of errors, and would inevitably hinder regaining the professional confidence that nurses would expect in a supportive environment, which seems to be dominant where Hazel works. Therefore, the experience of role model seems to be influential for the participants to report patient safety incidents that involve reporting MAE's and near misses.

5.5 Concluding Summary

This chapter discusses the participants' views on what contributes to building safe and resilient medication administration processes in their wards. There were limited selections of themes which could be addressed as important in the given context. These were the themes which emerged from the data of the present study as of foremost importance.

The policies and protocols related to medication administration were seen by many participants to have provided a structured way for participants that they can consult and refer to. This "*blue bible*", which was perceived as easily accessible, up-to-date, and well-presented, appeared to be highly regarded as a valuable source for knowledge, but also a concrete and secure information hub that facilitates a well-informed process of safe medication administration. This highlights the perceived significance of policies and protocols of medication administration among the participants, particularly in providing a structured method for regulating the practice of medication administration and ensuring medication safety.

Being pre-occupied with failure rather than success is said to be one of the most influential factors which enables a complex organization to maintain resilient performance while dealing with the unexpected (Wieck and Sutcliff 2001). In this context, there was little dispute among the participants regarding their fallibility for MAE's and near misses. For this reason, many of them have consistently expressed appreciation for the double-checking of medication, doses calculation, and other related procedures, as a tool to minimize the impact of their fallibility. Sometimes, however, the application of double-checking appeared to be problematic, particularly

when it was perceived to be a ritualistic behaviour rather than a genuinely purposeful measure. Checking the medication independently by a second checker, and even reverting to single-person checker have all been suggested by some participants as alternative checking procedures. Moreover, the standardization of the medication dose, concentration, and layout of medication preparation meant minimizing the human-system interface with the regards to medication administration with the medication calculations and dosing, and was perceived to reduce the opportunities of medication administration errors and near misses.

The route to building a safe and resilient system for medication administration in the wards investigated appeared to be the sum influence of many factors, with complex interplay, leading principally to the establishment of a safety culture. The notion of a 'safety culture' is a broad one, and in the context of critical care settings, the quality of communication between distinct, but cooperating, groups appears to be a reflection of the organization's safety culture. The participants' views suggest that effective and assertive partnership between all healthcare professionals involved in medication administration, such as nurses, doctors, and pharmacists, is a fundamental feature in establishing such safety culture. Incident reporting was advocated by the majority of the participants to identify threats and hazards to safety of medication administration in the investigated settings. Moreover, reporting of MAE's and near misses was perceived by many participants as an opportunity to learn from these incidents, rather than being a fearful and stigmatizing event. Such perceptions would seem to help to improve the healthcare organization's ability to collect information about its inherited operational hazards, such as unsafe medication administration practice. In addition, knowledge acquisition and dissemination regarding the medication being

administered, and policies and protocols to administer the medications, emerged as a safety net from participants' views, where they become familiar with the relevant issues pertaining to the process, the structure, labelling, and the therapeutic action of the administered medication.

Chapter Six:
System Threats to the safety of Medication Administration

6.1 Introduction

The previous chapter highlights the participants' views on the issues which contribute to the resilience of medication administration in the adult critical care settings investigated. However, critical care settings have been reported to sustain higher incidence rates of Medication Administration Errors (MAE's) and near misses compared with other general hospital settings (Van den Bemt et al. 2002; Ridley et al. 2004). In this context, and in order to analyze the participants' views in line with the OSSM, it was felt important to establish the elements that jeopardize the safety of medication administration causing such a serious or potential safety threats.

In the literature review chapter, the contributions of organizational threats towards safety were discussed. It distinguished between two types of errors: active errors, whose effects are felt almost immediately, and latent errors, whose adverse consequences may lie dormant within the organization for a long time, only becoming evident when they combine with other factors to breach the system defences, leading to an accident (Reason 1990). While active errors are usually associated with the performance of front line operators such as nurses and doctors, latent errors, on the other hand, are most likely to be prompted by those whose activities are removed by both time and space from the direct control interface. It was also suggested that the latent errors pose the greatest threats to the system safety, and they are almost always triggered by local contributing factors within the environment (Reason, 1990; 1997). In the context of the Organizational Safety Space Model (OSSM), they represent the

driving forces which pull the organization to the vulnerable end of the safety space model, therefore becoming more vulnerable for accidents.

In this chapter, the participants' views on those factors that contribute to unsafe medication administration will be presented, and when appropriate, will be analyzed according to the OSSM. Their views were structured to explain what contributes to jeopardizing the safety of medication administration. Table 3 presents the categories of data that were related to the participants' views on organizational contributions toward unsafe medication administration practice. Impaired communication channels, medication design and delivery, and environmental issues emerged as key latent and local contributing factors toward unsafe medication administration in the adult critical care settings investigated.

Theme	Category	Sub-Category
Medication Administration: **System Threats**	Impaired Communication Channel	Faulty communication
		Hierarchical pressure
	Issue of Medication Design and Delivery	Medication labelling and packaging
		Financial constraints
	Environmental Issues	Interruption
		Ward layout and design
		Poor staffing

Table 4 System threats to the safety of medication administration: Themes and sub themes.

6.2 Impaired communication channels

The participants in this study directed some criticism towards aspects of communication that dominate the critical care settings and the Trust culture. Criticism was conveyed mostly towards two aspects: the communication among nurses themselves, and the communication between nurses and other staff who were seen as influential in the Trust, including the top management hierarchy in the Trust, such as the Trust Board and divisional managers.

6.2.1 Faulty communication

In the previous chapter, many participants felt that their questioning attitude of the doctors' prescribing decisions contribute significantly to a resilient medication administration process. However, their views also suggest that dysfunctional communication among themselves and with Trust management hierarchy was a vital precursor to performance failures, leading to MAE's and near misses. This failure was mostly evident in handing-over patient information, including exchanging information related to patient's medication among the participants when changing the shifts, in addition to the perceived failure of the Trust' management and pharmacy staff to consult the participants regarding the safety issues of administering medications.

The handover process involved a complex network of dialogue that impacted in different ways on nursing interactions. According to many participants, the exchange of patient information during the nursing change of shifts, and during the work time, appear to be one of the most common and influential event in delivering the patient care. Handing over the patient at the end of the shifts is considered one of the most critical times where necessary information related to the patient's medications are

passed to other nurses (Strange 1996; Manias and Street 2000). However, evidence in this study suggests that some participants appeared to consider the patient handover as a routine task that can be performed with minimal attention to the content, length, details, and the quality of information being passed. For instance, Ann implied that the handover was a burden on her, particularly at a time when it conflicted with other events which she perceived to be more important, such as the desire to go home quickly at the end of the shift:

> We normally tend to just handover only your patients, that is it really … it is a task you've got to do, you are in hurry, you're gonna go home, we just take it in turns to handover our patients really.

> [Ann, senior staff nurse, level 2 critical care, the Beech Hospital].

So the value of this nurse-to-nurse communication may not have been adequately appreciated by some participants. It seemed that the handover often becomes a routine, ritualistic behaviour, performed in unstructured way, where accounts of the handover as a process of communication tend to be of a descriptive in nature, which lacks critical depth. Inevitably, much important information is likely to be missed. On occasions, some participants start working and administering medication without having a proper handover from the nurses on the previous shift, which may suggest a lack of appreciation of importance of receiving a patient handover. This seemed to be an acceptable practice in some critical care settings, although it was most obvious in level 2 critical care settings:

> ….it [handover] could be done later on, but then you've got staff who are coming at quarter past twelve and will be expected to work in the ward without having a handover for the sake of giving the drugs.

> [Randa, staff nurse, level 2 critical care, the Beech Hospital].

When she was asked would she rather do handover in the patient bedside, Julie emphasized that it is safer to hand over next to the patient and to check all the infusions, but she appeared unenthusiastic about it:

> I do think it is safer [to do bedside patient handover], because if there is an issue later on your shift, and you noticed that actually it is not what the patient should be having. But some time you have less amount of time, so I just do it in the office.

> [Julie, staff nurse, level 2 critical care, the Beech Hospital].

What appeared to fuel the risk of missing information during nursing handover was the existence of a culture where some participants felt reluctant to question their colleagues about things that they were not fully satisfied with. The participants' attitude in this context seems to contrast sharply with their attitude of questioning the doctors' prescribing decision, which was highlighted in their views in the previous chapter. Such an imbalance in communication styles may have been influenced by the power relations between participants from different ranks, but also by the culture where such an imbalance in power seemed to override the overall patient safety. Some participants were eager to avoid the uncomfortable feeling of someone else scrutinizing their clinical practice by asking questions during the handover, which was seen to threaten their personal integrity. The following extract by Martin illustrates his reluctance to question his senior colleague's handover, despite his concerns regarding some of the information he received:

If you are a junior member of staff, when you first come here, you will be scared to death from the person who is gonna come after you. Are they senior members of staff? Or band six members of staff? And they might say to you: "why have you done that? Why this is like this? That is wrong, why didn't you add up your fluid chart?" All this, and you just feel about that big [gesturing to indicate being extremely small]. Once I wasn't quite sure that what I was told by my senior colleague, it wasn't very clear, but sometimes if you ask a question, you will be in trouble. They may think that you are picking up on them. It seemed to be the case any way. I've had this happen to me, and I think it happens for everybody.

[Martin, staff nurse, level 3 critical care, the Beech Hospital].

Scott has also indicated that this type of feeling exists in his unit, and that it could hinder a proper exchange of information about the patient medications. However, he was adamant that he would question whoever was handing-over to him if it was necessary, but he acknowledged that it is not always easy to do so, and he may lose some friendships:

I always check who has given what. I expect them to tell me what drugs they've given, and to take me through the drugs they have given, because how many times you come across a drug that hasn't been signed for? So has that been given? Or has it not been given? Obviously you don't want to be in this situation really, because you are likely to lose friends, aren't you? Because when I first come in, people said, you don't trust me. People don't understand that feeling, you are not trying to question their experience, and you do not trust their judgment. It is the question for the sake of patient safety, and it is there for reason, and it was developed presumably because of medication errors which were occurring.

[Scott, staff nurse, level 3 critical care, the Beech Hospital].

In addition to the perceived imbalance of communication among the participants themselves, many participants felt that the Trust's management failed to communicate with them regarding the efficacy and safety of administering medication in the wards.

For example, when a new brand of medication is delivered to the unit by the hospital pharmacy, many participants felt that they were hardly informed about it, and even when they were meant to be informed, communicating this information to them seems to be patchy, and inconsistent. Many participants considered themselves as the front-line professionals who were responsible for the task of medication administration, and therefore, they have the right to have their opinions heard and acted upon when introducing new brands of medication to the ward.

The participants' views suggest that the decision to bring a new brand of medications to the ward was influenced by many considerations, such as financial ones, but not those considerations which were seen as sensitive to their opinions and the safety of medication administration. In this context, Reason (1990; 1997) has made it very clear that those fallible decisions taken by individuals at the top of the management structure are not sensitive to the work and safety needs for those front-line operators (i.e. nurses), and are bound to have a negative influence on the safety of operations. From the participants' perspectives, the decisions of the pharmacy management staff to bring new brands of medications to the critical care setting was suggested by several participants to be taken without sufficient consultation with them. This, according to them, leads to bringing new medications that have unsafe safety designs and labels. The communication channel between the participants in the wards and the pharmacy department staff was also perceived by some participants to be a unilateral one, in the sense that the participants are expected to consult the pharmacist on issues related to the medications, such as how to make up an intravenous infusion, but not vica versa. This situation appeared to cause much frustration to the participants who are administering the medications. Jenny, a ward manager, appeared frustrated by the

fact that neither she nor her staff were consulted about any new brand of medications being introduced to the unit, and if there were any issues related to the safety of administration, she appeared to be powerless to do anything to change the situation:

> Nobody consulted us, it [medication] arrives in the pharmacy box, and we just conclude that they've changed manufacturers, and usually we make a flippant statement. They must've found something cheaper… you know those sort if things. I mean we know the driving of the whole process, but what can we do, there are many considerations that have to be taken into account when buying new medications.
>
> [Jenny, ward manager, level 3 critical care, the Beech Hospital].

Even when the pharmacy department wants to advise the nursing staff on the introduction of a new medication to the wards, communicating this message seems to face many obstacles, and often such messages do not get through properly:

> When they order it [medication] from a different company, it looks different, and sometimes what happens is that the concentration has changed as well. So we get a little flimsy piece of paper saying that the concentration has changed, you've got to bend up somewhere to see it. It is not very obvious.
>
> [Hannah, staff nurse, level 2 critical care, the Oak Hospital].

Looking at the data in the context of the available literature, it becomes clear that the absence of established structures for exchanging information during the nursing handover, and what constitutes an acceptable way for communicating patient information during handover, represents an error-producing circumstance which apparently leads to variations in the handover techniques across the critical care settings in this study. These variations were mostly visible in level 2 critical care, where the participants conveyed very different ways of handover compared to level 3

critical care settings, where the nursing care is usually one-to-one, and the nurses would usually have a relatively similar, structured approach for handing-over.

The data suggests that fluctuations in the way information related to medication administration was passed on made it very likely that some of this information would be missed, which puts the medication administration process at risk. Similar findings were reported by Taxis and Barber (2003), who found that medication was omitted because of failures in communication in 16% of the intravenous medication errors observed in their study. These errors mostly occurred when patients were transferred between wards, including adult critical care units, and information on drug administration was not communicated. A study conducted by McFetridge et al. (2007), who conducted a qualitative study to explore the nature of nursing handover in critical care settings such as ICU and Emergency Department (ED). The study revealed that there was no structured and consistent approach to how handovers actually occurred. Moreover, nurses from both ED and ICU lacked clarity as to when the actual handover process began, and what it should look like, although more senior nurses were often able to provide a more structured exchanged of information during the handover. The study recommended that nurses from both departments would benefit from a structured framework to guide the handover process. The lack of sharing of patient information among nurses involved in the patients' care has been identified by the current study as an important potential precursor for unsafe practice.

The perceived inadequacy of the communication between the participants and the decision makers, which was seen to be controlled by the Trust hierarchy, may suggest that the safety needs for medication administration may have received a low priority

by the Trust, compared with other demanding needs, such as the financial goals. The participants' views implied that this situation was likely to create a cultural context for unsafe medication use. In particular, the participants were not directly involved in the decisions about which medication brand was the safest to administer, although they were the ones who were going to administer it. This finding is in line with those from a study conducted by Vincent, Taylor-Adams et al.(1998), who found that incompatible goals, such as conflict between financial and clinical goals, provided the conditions in which unsafe clinical practices can occur in hospital settings, including critical care. The finding from the current study also confirms earlier concerns about lack of communication among nurses and other healthcare professionals (Taxis and Barber 2003). The participants' views on this issue, however, should be looked at in the context of other organizational priorities. For example, the Trust management is likely to have a competing agenda to minimize the spending of public money on purchasing medication. Moreover, it may not be always feasible from the Trust management's perspective to consult as many nurses as would like on the issues of purchasing safe medication for administration. So there is likely to be a tension between the Trust's desire to keep the safety of medication of patients as a top priority, and the drive to keep its spending within acceptable limits, which may be reflected in the Trust's overall performance rating. A discussion between me and a former acute NHS chief executive confirmed that while the nature of the nurses' role in administering the medications on a daily basis places them in a good position to recognize and address the safety needs for medications administration, the financial constraints and the impracticality of consulting the nurses means that it is not always feasible to engage the nurses in the decision-making process on the Trust level (Williams 2008).

6.2.2 Hierarchical Pressure

This section addresses the participants' views on the influence of pressure exerted by the higher management echelon on many participants in this study, and how such pressure was perceived to have contributed to creating opportunities for MAE's and near misses. Particularly, it highlights the participants' views of their perceived time constraints that were seen to be created by the decisions of high ranking management in the Trust to meet certain goals, and the way these goals appeared to be communicated to the front-line nurses.

Many participants conveyed a sense of detachment between the Trust's top management from one side, and other healthcare professionals, such as nurses, on the other. This is produced by their comments on how the managers in the Trust take decisions that influence the clinical practice, (regarding the staffing levels on the ward, and the availability of resources which aid safe completion of tasks), without taking into consideration issues and concerns of the front-line workers. Such management pressure was often perceived to result from the creation of a target culture in some of the critical care settings where the study took place. For example, one of the level 3 critical care settings has to receive four patients for heart surgery per day from operating theatre to meet the target for the waiting time which the Trust has set up for this critical care setting. This target was sanctioned by a higher authority outside the Trust (i.e. Strategic Health Authority). In this equation, the patient safety, according to Hani, is set to receive a lower priority in favour of what is perceived by Trust management as more a demanding issue:

I think patient safety used to be more of a priority some years ago. I think now there are some sort constraints. You've got to get the patient through, even if that means not doing things as they should be done, because we all got target to meet, so it is not to sort out the patient when he is ready, but rather nearly ready.

[Hani, senior staff nurse, level 3 critical care, the Beech Hospital].

John also talked about the Trust balancing its books in terms of keeping the financial spending within the nationally-agreed limits set up by the Government. On occasions, the cut in spending was translated into a freeze on recruitment, and sometimes redeploying senior staff. According to John, this situation could lead to insufficient supervision for junior staff, which may potentially put patient safety at risk:

The problem we've had at the moment is that we've not been able to fill vacancies. We've had quite few staff leaving and we've not been able to replace them, and because they are waiting to deploy people who have lost their jobs from practice development and other senior nurses, junior nurses were left without adequate supervision, particularly when preparing and administering highly potent and dangerous medications … this has certainly made its marks on patient safety.

[John, ward manager, level 3 critical care, the Oak Hospital].

This disenchantment from the loss of staff was also echoed by Linda, who expressed her frustration of the way the managers in her Trust were dealing with issue of meeting their own goals of saving money to balance their books, while ignoring the needs to achieve safe nursing practice on the wards:

I sometimes get very frustrated … we are trying to promote good practice, safe practice, improve patient care, but all the time we've been told to cut back on this and cut back on that, and the staffing levels are sometimes dreadful. I really do feel that people in government are under pressure to save money in the NHS. It is just dreadful that they are expecting so much, with no reward really, no support. On a typical day when you want to care for your patient, you would have a handover, and then the co-ordinator, the sister or charge nurse, would come round and look at your charts, look at your patient and say to you "why is this happening, why is that happening?" And they would encourage you to think "what is the matter, what is your plan for today? What you are hoping to achieve for this patient? Have you tried this? Have you tried that?" There is no time for that any more. It is the case we need this bed, get this patient out, get this patient in. You would have to double up here [one nurse looking after two patients]. It has changed completely, and the senior staff feel that stressed by it. But as I said, there was eight ward managers, there is two now, and we've got eighteen beds now.

[Linda, ward manager, level 3 critical care, the Beech Hospital].

So Linda was suggesting that some nurses had to "double up" by looking after two patients in her setting, which was level 3 critical care. This contradicts the normal patient/nurse ratio mentioned in chapter three, where the norm in these settings is a one-to-one patient/nurse ratio. Many participants in this study felt that in order for the Trust to meet its performance targets, decisions were taken and implemented by the Trust's management to achieve such goals, in terms of reducing staff and cuts on the equipment and training courses, which have diminished the support for them on the wards. However, the participants' views suggest that they have to satisfy unrealistic expectations by coping with an intolerable working environment to meet the Trust's targets. This seemed to reinforce the feeling among many participants in this study that this all serves the agenda of the Trust's managers of meeting their performance targets, but not the overall patient safety agenda, in addition to what was perceived by

some participants as a disregard of their own views on this issue, which inevitably helped to fuel stress and dissatisfaction among them.

The issue of meeting the Government targets in the NHS has long been controversial in the literature. The Government defended its policy to create performance indicators, so that more measurable progress could be achieved and perceived by the public (Department of Health 2002). However, while the records show an increase in the financial investment in the NHS since 2002, this investment is coupled with a centralization strategy that is clearly highlighted by the setting of rigid targets for all Trusts in England. This includes achieving foundation hospital status, reducing patient waiting time, and maintaining financial spending within certain limits (Emmerson et al. 2000). It can be deduced from the participants' views that such a strategy did not appear to have given enough consideration to the unique situation of each Trust and its ability to achieve these targets. This assumption is echoed in the context of UK literature, where Government-initiated targets in the NHS have sometimes been described as counter-productive for the modernization agenda in the NHS (Dixon 2001), and have also been criticised for skewing priorities and encouraging short-termism (Jackson 2003). According to the participants' views, meeting these targets could conflict with the overall goal of the NHS that was set out in the *Patient Charter* (Department of Health 1996; 2001b), which outlines the government's commitment to providing a quality health service which is safe, reliable, and free at the point of access.

The analysis of the participants' views indicates that the proliferation of performance targets in the NHS may be regarded as an example of changing priorities in the NHS,

particularly where decisions taken at the top of the hierarchy structure are being made far from the front-line operators. The issue of setting priorities that are distant to patient safety appears to act as a latent condition, whereby unsafe practices can become more likely down the line. In the context of the participants' views, this appeared to produce polarised management and communication styles which adopt a directive attitude, which challenge the prevailing traditional norms and values of the participants in safeguarding the patients' welfare. Some participants expressed their dissatisfaction that they have to put up with the managers' wishes of meeting the Trust targets in a way which may put the patient at risk:

> People do whatever is necessary to meet the targets rather than doing whatever is necessary to ensure that everything is being run for the patient's interest. Basically in hospitals, they [Trust management] do their best to make sure that they meet those Governmental targets, but those targets are met at the expense of other areas, but we've been asked to do it ….

> [Hani, senior staff nurse, level 3 critical care, the Beech Hospital].

Such participant views are in line with those reported by Marshall et al. (2003) who found that the target culture in the NHS has produced managers who are driven principally by the imperative to deliver a political agenda, which is often insensitive to the local needs of the patients and clinicians. Such a management style can put pressure, stress, and time constraints on the frontline professionals and services in such a way that they are unable to deliver safe practice. This management attitude allows, or perhaps forces the nurses, to engage in high-risk activities such as medication administration, with less focus on the task of administering medication safely, but more focus on achieving the Government objectives. Yet again, these findings need to be seen in the context that managers also have their own performance

targets to achieve. Therefore, the conflict is perhaps inevitable between their objectives in achieving their goals, which their jobs dictate them to do, and those of the concerns of patient safety. Their jobs become more difficult in trying to balance the tension between the two legitimate concerns: those of maximizing the agenda for patient safety, but also ensuring performance and financial viability of their Trust.

6.3 Issues of medication design and delivery

Issues related to medication design, structure, and the distribution of medications was a significant concern to many participants. In particular, the labelling and packaging of the medication were commented on by participants in relation to the system of medication identification and delivery. The data also suggests that there are some issues which may have helped to shape the system of labelling, packaging, delivering, and distribution of medications in the critical care settings investigated. Often these factors were far in time and place from those related to the immediate human-system interface. The following sections explain the participants views on the many issues related to medication delivery, and its impact on the overall safety of medication administration.

6.3.1 Medication labelling and packaging

Many aspects of medication labelling and packaging were criticised by the participants in this study. In particular, confusing drug names, labels, and designs were cited as important sources of MAE's and near misses. Drug names often sound and look alike, labels contain visually confusing information, and packages may be designed for the marketplace rather than for practice conditions. The problem of look-alike and sound-like medication does not seem to be uncommon in most of settings

investigated. For instance, David described how the fluid bags of Adrenaline, Noradrenaline, and Dobutamine can be vulnerable to confusion because their packaging is very similar:

> If you just went to drug cupboard to pick up a bag, you would have Adrenaline bag, Noradrenaline bag, Dobutamine bag and various other bags. They would all look very similar because they all will be in a hundred mls of saline or dextrose bags, it would be far too easy to just actually sling up another bag, and it is the wrong bag.

> [David, ward manager, level 3 critical care, the Beech Hospital].

Not only a range of medications in critical care settings were said by the participants to be virtually identical to each other, but they were also stored beside each other in the cupboard, which makes them even more vulnerable for mix-up:

> … at the moment, we've got medications where the packaging of Digoxin looks like the packaging of Dehydrocodeine, and because they are alphabetically ordered, they actually set side by side in the cupboard. Now that is a risk. There are definitely issues with packaging looking the same.

> [Jenny, ward manger, level 3 critical care, the Beech Hospital].

Some participants found it very difficult to read some medication labels, because either the texts were very small or poorly written. Namiq felt very strongly about the poor text of some medication labels. In particular, where the medication's name and expiry date were considered unclear, and located in a difficult location on the bottom of the vials, making them difficult to find:

Researcher: Do you think the labelling and packaging of the drugs in this unit can make a difference in terms of the safety of drug administration?

Namiq: Terrible, absolutely terrible. It is actually appalling that there are many drugs that you really have to look, even to the point of holding a white piece of paper behind the vial. For example, the intravenous drugs sometimes. I have my sight one hundred percent. I have no problem with my sight, but you find yourself holding ampoules against a white piece of paper because you can't read the writing because it is so small. Noradrenalin is one of these drugs that are very difficult to read the name on the ampoule. The ampoule is very tiny, it is not very clear how many milligrams in the ampoule, and this is unnecessary because other drugs are labelled very well. The manufacturers who made the drug should be making the drug so that you can look at the drug and see the expiry date, and not just put it on the little tiny bottom or the top. The same thing for the oral drug … well, any drug, the expiry date is little tiny figures in a very sort of difficult area where they shouldn't be. They should be in a very clear, easy to see area because it just makes life very difficult.

[Namiq, senior staff nurse, level 3 critical care, the Beech Hospital].

The way the Trust purchases medication brands from the manufacturers seems to be an underlying factor for the existence of large number of look-alike and sound-alike medications. Some participants pointed out to the frequent changing of the suppliers of medications to their wards. According to many participants, this may lead to the delivery of a huge number of different medications, often with similar packaging and labelling designs in the ward. The data suggest that the participants were under pressure not only from their Trust, but also from their own professional body, to make sure that the medications were administered correctly. However, this pressure seemed to be coupled with the lack of appreciation of human imperfection, which can be worsened by unhelpful medication labelling and packaging. A repeated concern from many participants was that the decision-making process of purchasing medication was ill-thought out, centralized, and did not take into consideration the complex aspects of

human factors (i.e. human fallibility for error, particularly for the look-alike and sound-alike medications). Namiq hinted that purchasing medications for the Trust was perceived to be receptive to more competing priorities than the safe administration of medication:

> They are always changing the supplier, so it can be a bit confusing, can't it? They might be getting the drugs from different manufacturers not because it is safer to administer, but for other more demanding reasons. Recently, a lot of the drugs seem to be very similar in the packaging. I think there was some Frusemide and something like Digoxin or something came up from pharmacy recently, the boxes were identical.

> [Namiq, senior staff nurse, level 3 critical care, the Beech Hospital].

The issue of poor medication labelling and packaging has been widely debated in the literature. Each year, the Institute of Safe Medication Practice (ISMP) in the United States receives 1200-1500 reports of serious medication errors. Approximately 25% of these errors are related to name confusion, and 25% to labelling and packaging issues (Kenagy and Stein 2001). There are no comparable data for UK, but the incidence of such errors is likely to be similar (Department of Health 2004). Look-alike and sound-alike errors are often induced by familiarity with the procedures and materials, coupled with the innate tendency of humans to perceive confirming evidence more readily than disconfirming evidence. This phenomena is often called "confirmation bias" (Cohen 2000). If a drug has a distinctive packaging, the risk for potential mix up is slight. If similar drug products have a similar packaging, or if the labels are hard to read, the potential for mix up increases. Medication look-alike, especially when combined with suboptimal working conditions, can cause health

professionals to overlook important information (Berman 2004). The following extract highlights this problem:

> …for example intravenous Gentamicine, it is not labelled as Clindamicine, but it is very similar, the first word you see begins with C and it is not Gentamicine, then Gentamicine is very small, and then you got out of the cupboard, and you gonna give somebody Clindamicine, then you realise that I've actually got the wrong drugs in my hands so easily. I mean it is different colour, but you even sometimes under the impression you are giving the right drug

> [Lily, ward manager, level 2 critical care, The Oak Hospital]

In the context of the available literature, Taxis and Barber (2003) have reported that the design of the medication itself, such as complicated drug vial presentations, was the second most common error producing condition leading to IV MAE's. The Government' white paper *Building safer NHS for patient: Improving medication safety* (2004) has also advocated that inappropriate labelling or packaging can be latent conditions that predispose to dispensing and administration error. The paper has recommended removing hazards by designing system to avoid look-alike containers, names, computer abbreviations and poor labelling.

In this study, many participants, like Namiq, expressed their frustration at the lack of communication between them and the manufacturers when it comes to manufacturing a safe and effective packaging and design for the medication. This is consistent with the views of Cohen (2000), who suggested that nurses, physicians, and pharmacists should be able to review the actual label and packaging in an environment similar to that in which the product will actually be used, because the practitioners are much more likely to discover potential problems than the designers. The Government has

also advocated that manufacturers should share the responsibility for the safe use of drugs commonly used in the NHS (Department of Health 2004).

In summary, the existing medication-use system appears to have some flaws, because its safety depends largely on human perfection. Simplicity, differentiation, and unambiguous communication are human factor concepts that are relevant to the medication-use process. The analysis of participants' views suggests that such principles have often been ignored in drug naming, labelling, and packaging in the settings investigated. Instead, current methods for ordering and delivering medications to the wards are seen by many participants to be based on more demanding priorities, commercial considerations, and bureaucratic procedures that are not adequately sensitive to the needs of the overall safety of medication administration in clinical settings. The following section explores some of these priorities and their impact on the overall safety of medication administration.

6.3.2 Financial constraints

Evidence emerged from the participants' views that the financial status of the Trust was an influential factor which appeared to be seen by some the participants to control the overall commitment of the healthcare organization towards the concept of patient safety. In other words, the financial performance of the Trust was considered by many participants as a sign of performance indicators in this study, which has been favoured over other less popular quality indicators, such as patient safety.

As indicated in chapter three, the Trust where this study took place was going through some financial difficulties at the time. Almost all of the participants pointed out the

current financial crisis that that Trust was going through. Many of them implied that this situation would have inevitable consequences in one way or another on the patient safety:

> I would like to think that the patient safety is paramount, and they always say it is, but with current financial climate, I personally think at the moment they are more focused on trying to sort out their financial deficits, rather than sorting out the patient safety.

> [Angela, ward manager, level 2 critical care, the Beech Hospital].

The financial crisis that the Trust was going through during the period of the study was perceived by many participants to have impacted on the delivery of safe nursing care to the patients, although to varying degrees. In particular, many of them criticized the cuts on essential services, which were deemed vital for the safety of medication administration in their wards. For example, the Trust was said by some participants to have frozen recruitment of permanent nursing staff in a bid to reduce costs. This meant an intensive dependence on non–permanent staff to maintain the staffing level, and nurses on the shift were left to cope with whatever staff available. Collectively, the staff seemed to be left vulnerable to problems associated with being understaffed:

> Yeah…there is pressure at the moment from the government to cut back and save money in the NHS, and there are cut backs in lots of areas. One of them is the staff, and sometimes we are forced to look after two level three patients because the numbers are so bad. We've got a lot of sickness, we've got people on maternity leave, and we've got people that have left and we can't replace them at the moment because all that have to go through the Human Resources and all the hierarchy to say can we bring our staffing level back up to what it should be.

> [Linda, ward manager, level 3 critical care, the Beech Hospital].

The way medications were purchased and delivered to the critical care wards was another area where many participants highlighted the impact of the financial crisis. Tom expressed a sense of frustration that what seems to take priority for the Trust in terms of medication purchases was the cost, not safety:

> I think it is all down to the pricing of it [medication]. They get the cheaper ones, and then you save the Trust money by doing it in that way, so they will not consider that two drugs could be similar because they are not concerned too much about safety.

> [Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

Some participants expressed appreciation of the fact that commercial goals, financial constraints, and patient safety issues can inevitably come into conflict. However, they were critical about the lack of a mechanism in the Trust to identify and resolve such conflicts in an effective and transparent manner. Particularly, by addressing the current difficult financial situation, but also devoting enough attention to the impact of any potential financial cuts on patient safety, and medication safety in particular. This assumption is reflected in one participant's views, which appeared to be defensive of the Trust's stance on managing its financial crisis:

> The Trust's main priority at the moment is that of financial priority. I don't think for a minute that this comes at the expense of patient safety, but I do feel that it perhaps put it under pressure, to do more for less. But obviously, there are other issues involved as well, and you should be able to know how to sort things in such situation, and get the balance right ….

> [Jenny, ward manager, level 3 critical care, the Beech Hospital].

For other participants, the way the Trust was perceived to manage its financial situation made them doubtful about its overall commitment to patient safety. Some participants appeared deeply sceptical about this notion. Hani appeared suspicious about the Trust's true purpose from cutting the resources on account of the overall patient safety:

> I think patient safety used to be more of a priority some years ago. I think now there are some sort of financial constraints ….

> [Hani, senior staff nurse, level 3 critical care, the Beech Hospital].

The available evidence from the literature suggests that the greatest threat to the healthcare organizations' commitment to patient safety is the necessity to remain economically viable (West 2000). Financial goals vary for different healthcare organizations, depending on the nature of the system to which they belong. Individual behaviours, team behaviours, and the immediate work environment are said to be influenced by policies, procedures, and decisions made at higher levels of the organization, that govern the allocation and management of the financial resources, people, equipment, space, and time (Joint Commission on Accreditation of Healthcare Organizations 2000). In this context, it became clear from the participants' views that the wider economic pressures on their Trust, through what they think is under-resourced areas they considered as being vital to complete their safety tasks, contributed in many ways to their views of jeopardizing the safety of medication administration. Such contributions were seen to materialize by being part of a complex chain of events that lead to unsafe medication administration. A study in the US suggested that as a result of cost containment pressures from public and other stakeholders, many hospitals have reduced the numbers of registered nurses and

substituted lower-paid nursing staff with less training (Pronovost et al. 2002). Such actions were found to have a significant influence on the work environment, particularly in compromising the quality of many nursing tasks in the ICU, including medication management and use.

While some participants appeared to question the Trust's commitment towards patient safety, it may be difficult to ascertain this assumption in practice. As noted in the literature review chapter, Reason (1990) advocated that many decisions that are taken by senior managers in the organization are taken in response to wider organizational constraints. These constraints are not often controlled by the individuals immediately involved in the accidents. Moreover, these decisions by senior managers are usually subject to economic, political, and operation constraints, and their decisions may come as a compromise. It has long been understood that rising public expectations are one of the main cost pressures on the NHS (Rankin 2006). Therefore, it is probably impossible to produce decisions without unforeseen negative impacts. Moreover, it may not be wise to pursue allocation of blame, but simply recognizing the fact that even in the best-run organization, a significant number of influential decisions will subsequently prove to be mistaken.

All organizations have to allocate resources to two distinct goals: production and safety (Reason 1997). In the long term, these are clearly compatible goals, and given the fact that all resources are finite, there are likely to be occasions in which there is a short term conflict of interest. For example, resources allocated to the pursuit of production could diminish those available for safety. In the context of this study, fallible decisions were said to be an inevitable part of the design and management

process (Leape 1994; Reason 1997). The question is perhaps not so much how to prevent the financial constraints from occurring, as how to ensure that their adverse consequences are speedily detected, recovered and minimized. Reason (2004) advocated that a pre-requisite for an organizational accident is the absence within the system of multiple controls, safeguards, and barriers designed to prevent known dangers from coming into effect. It may be foreseeable for the Trust managers in this study that allocating less financial support could put the patient care at risk. However, it may be impossible to anticipate all the possible hazardous scenarios that may result from the diminished financial resources of the Trust. Therefore, it would be logical to be proactively prepared for any potential eventuality. The analysis of the participants' views suggests that there was no contingency plan in the Trust to try to neutralize, or perhaps minimize, any subsequent hazards resulting from issues arising as a consequence of the lack of financial resources. Even short-term solutions, such as relying on agency nurses to relieve understaffing, appeared to be reactive and counterproductive sometimes. Many participants perceived that such strategic failures have paved the way to introducing pathogens into the system, and have created error-producing conditions where the system becomes vulnerable to unsafe medication practice.

6.4 Environmental Issues

The participants' accounts in this study suggest that several environmental factors and work conditions appeared to open up opportunities for unsafe medication administration. Such elements were said to provoke, or be part of a sequence of events, that may eventually trigger MAE's or near misses. Due to the complex interactions between these factors, the way and the extent to which these

environmental factors contribute to such an eventuality vary considerably. This section discusses the contributions of three environmental issues that have chiefly been ascribed by the participants to the creation of an unsafe medication administration practice, namely interruption, ward layout and design, and poor staffing.

6.4.1 Interruption

Interruption, distraction, lack of focus, and lack of concentration were all phrases cited by many to contribute to unsafe medication administration. The participants in this study appeared to be exposed to multitudes of interruptions and distractions that affect their working memory and their ability to focus on critical steps of medication preparation and administration process.

> I think there are always numerous distractions. I think this is the biggest threat when you are doing drugs. If you get distracted, you go away and come back, and then you are likely to make an error.

> [Sonia, staff nurse, level 2 critical care, the Beech Hospital].

The reasons stated for interruption vary among the participants. For example, many participants said that they often perform more than one task at a time in order to maintain medication administration schedules. Excessive input (i.e. information overload) and distractions may compete for their attention and fill their working memory where information is temporarily stored, thus affecting their ability to concentrate. For example, they often take phone calls while obtaining or preparing medications:

… it is distracting to be in the middle of the ward drawing up infusions. You can get distracted by the patient condition. They [the patients] can deteriorate rapidly, they could disconnect from the ventilator, and there can also be phone calls, the nurses can be called for phone in the middle of doing a drug procedure, all of which can interrupt ….

[Sheila, ward manager, level 3 critical care, the Oak Hospital].

The summoning of nurses by patients has also been mentioned as a source of distraction. Particularly, the patients ask for assistance while the participants are preparing or administering the medication, or while providing nursing care to other patients. Such situations were more evident in level 2 critical care, where the patients tend to be conscious and actively seek the nurses' help:

Telephone is one [distraction], but it is usually instances when the patient buzzes. There is nobody at that time to answer the buzzers. You obviously can't leave the patients buzzing all the time, because they might have an emergency, and you need to check on them. If there is no one gonna answer it in couple of minutes, then you gonna have to drop everything and go and answer the buzzer.

[Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

Some participants have ascribed interruption to the lack of adequate staffing to help to take other responsibilities from them, such as answering phone calls or answering the patient's call, therefore making them less focused on the task of administering the medications safely. Randa considered lack of staffing to be one reason for getting interrupted during a medication round:

You could be in the half of your drug round and then you will be asked to come and assess somebody because there is lack of staff, or staff members are busy, and then you stop doing your drugs round to go and do what you need to do really.

[Randa, staff nurse, level 2 critical care, the Beech Hospital].

Some participants within level 3 critical care settings appeared to be particularly conscious of this problem (interruption), and consequently they were trying to avoid being interrupted during what they perceived as a critical task, including medication administration. In doing so, they appeared to utilize certain tactics to discourage interruption while carrying out vital tasks, and therefore tackling the interruption:

> … often a lot of drugs we give are very dangerous, like Adrenaline and Noradrenalin. You give them, and stand there like an oak and you inform the other member of your team that you gonna start Adrenaline or Noradrenalin. They will not ask you to do anything, or go and help them. You will be alone, because they know that you have to stand there and watch the blood pressure.

> [Martine, staff nurse, level 3 critical care, the Oak Hospital].

Linda has also revealed another tactic to minimize interruption during medication administration, by encouraging the nurses to be assertive by asking the people not to interrupt them during their medication administration:

> I think what we have to do is we have to step back and tell people how important it is to concentrate to make time for medications. While you are doing medications tell people not to interrupt you. It is OK to say hold on, or to ask for advice or to say I've not given this drug which was due at nine o'clock.

> [Linda, ward manger, level 3 critical care, the Beech Hospital].

Drawing on previous studies, many researchers have associated interruption and distraction with the increased opportunities for MAE's (Tissot et al. 2003), particularly in critical care settings (Tissot et al. 1999). Taxis, et al (2003) also found

that distraction by patients and colleagues was a main local contributing factor towards IV MAE's in various hospital settings, including critical care.

On many occasions, the participants linked their distraction when they administer medication to the lack of nursing staff available to alleviate such sources of distraction (see Tom views on page 219). This suggestion is consistent with that of Professor Wood, who commissioned a report to the Chief Medical Officer on human factors and prevention of Intrathecal Medication Errors. In his report, *The Prevention of Intrathecal Medication Errors* (2001), Wood suggested that distraction will remain endemic to NHS practice at least until capacity and manpower problems have been alleviated by the measures now being implemented under the NHS Plan. However, other factors that could lead to distraction cannot be underestimated. McKeon (2004) studied the psychological factors influencing unsafe behaviour during medication administration, and found that distraction was induced by organizational issues such as poor workload planning, which demanded too much concentration when administering medications. For example, competing priorities create a situation where nurses are left with the dilemma of pursuing many tasks at once, leading to task overload and then task failure. This situation was said to occur where failures of social and organizational levels lead to the organization not creating a safety-conscious culture (Reason 1997; Rasmussen 2003), although there were two exceptions in this study where the actions of some participants may indicate that such a safety-conscious culture may exist in some settings. For instance, when Martin, a staff nurse in level 3 critical care, shouts to everyone that he is administering the Noradrenalin, so that no one would interrupt him, and as Linda, a ward manager in level 3 critical care, encourages nurses in her ward to speak up for themselves to

discourage unwanted interruptions and conversation while they are administering medications. However, such actions seem to be one-off situations, and there is no consistent evidence from other participants to suggest a prevailing trend in other critical care settings.

6.4.2 Ward layout and design

The environmental factors, in terms of ward design and the location where the medication is prepared, assembled, and administered, have been cited as key factors to creating opportunities for unsafe medication administration in this study. In one level 2 critical care setting, one nurse criticized the lack of a dedicated room for medication preparation. Instead, medications were being prepared and assembled in the ward office, which was also used by many other individuals as well as nurses for various purposes. Such crowded area can, according to Ann, interfere with the nurse's role of preparing medications, consequently inducing unsafe medication administration:

> We haven't got a clinic room where we prepare medications, so it is just the office, and all of our drugs are in there, like IV drugs and oral drugs. I think there is room for error, because if you've got a couple of nurses doing different tablets in one time, or different IV's, it doesn't take too much to produce an error. I think the nurse's office should be separate from the clinic room, because everything happens in that office: doctors are in there, pharmacists are in there, somebody is on the phone, nurses are doing their writing, and they are drawing up drugs.

> [Ann, senior staff nurse, level 2 critical care, the Beech Hospital].

On several occasions the participants reiterated various problems associated with sharing the venues of medications preparation between nurses and other health

professionals. Problems such as poor cleanliness and interruption can result from other ongoing activities by other individuals, and became an apparent source of irritation for many participants:

> We haven't really got an area like a separate room for drug preparation and storage and stuff like that. Ours is just within the office, which I wouldn't say was particularly the cleanest environment. I think for cleanliness, you probably need a separate room for drugs and for a drawing up area, which we haven't got.
>
> [Angela, ward manager, level 2 critical care, the Beech Hospital].

While some participants preferred to have a separate room for preparing the medications, other preferred to prepare the medications next to the patient's bed. This is because this was perceived to reduce the opportunities for administering medication to the wrong patient, and it keeps the nurses focused on the other activities with the patient. However, this preference (i.e. preparing medications at the bedside) was often unachievable, due to the perceived lack of adequate space around the bed area, and they were therefore forced to prepare the medication somewhere else that was not designed for the preparation of the medication:

> It would be better if you could have space around the patient's bed, especially at the back, where you could take all of your medications and prepare them back there with the appropriate charts, so that you are not mixing anybody's medication with another's, and you know exactly which patient the drug is for, and you haven't got a big row of medications that you are preparing.
>
> [Lottie, staff nurse, level 2 critical care, the Oak Hospital].

One participant believed that preparing the medication infusions around the bed area may lead to promoting infection, as the patient's area may not be very clean.

However, this, in his opinion, is outweighed by the risk of leaving the patient without visual attention even for very short time:

> It [preparing medication next to the patient's bedside] could lead to promoting an infection because of the slough and garbage that hits around the bed space. But then you can't stand twenty meters away from your ventilated patient whilst you draw up the infusion, especially with our type of patients who are not ventilated for very long. So they could be weaned off their anaesthetic drugs, they could wake up and pull the tube [endtracheal tube] up.
>
> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

To overcome the issue of poor visual contacts with the patient while preparing the medication, some participants argued for the need of an open-ward area, where nurses can prepare the medication in a dedicated clean room or next to the patients' beds, while simultaneously monitoring their patients from a distance, and also to supervise other fellow colleagues. The absence of such an area sometimes meant that it was difficult for a senior nurses, like Fiona, to support and supervise inexperienced nurses and agency nurses during their critical task, such as medication administration:

> I think it should be very open plan [ward lay out], so you can see the patient and nurses, because often you find if you are in one bay, you can't see what is going on in the other bay, and you can't see how other less experienced nurses and agency nurses prepare medications
>
> [Fiona, senior staff nurse, level 2 critical care, the Beech Hospital].

Annette, a clinical governance nurse, was not surprised if the numbers of medication errors have gone up since the ward moved to a new building with partitions between each bed space, compared with the old unit where they had an open area. She related this possibility of errors to the fact that nurses cannot afford to leave the patient

physically to go and double-check someone else's medications; therefore many

medications might not be properly double-checked prior to administration:

> I think when you are in open area, it is less hard to get people to check things with you, because we've got more partition areas. So it is harder to get the people to check with you medications and in the same time keep an eye on their patient. We used to have an open area in the old intensive care unit, but here it is less opened now. We have more partitions in each bed space, and also four side rooms, but I think the errors actually have gone up, not down.

> [Annette, clinical governance nurse, level 3 critical care, the Beech Hospital].

The analysis of the participants' views suggests that there were issues which

competed fiercely with medication safety when it came to considering the ward

design and layout. According to one participant, the presence of barriers between

patient beds, or the use of single rooms, may reduce the cross infections between

patients, however, this seems to disadvantage the safety of medication use and

management, because the separation walls, according to some participants, do not

only reduce the visibility between nurses and patients, but also block the sound of

infusion pump' alarms. Furthermore, the room barriers can reduce the nurses' ability

to double-check other medications prior to administration. In this context, some

participants argued that controlling the infection seems to prevail over the safety of

medication administration, such as Jim:

> You just can't hear some pump when there is a trouble alarming away, and these walls were built to separate patients to help control infection, so the infection control always lives in every argument.

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

The participants' views also suggest that the ward layout and the design of the critical care unit could be considered as latent conditions, precipitating significantly unsafe administration of medication. The undesirable influence of this latent condition seemed to be triggered by many factors. For example, the fact that the participants have often nursed patients in separate rooms has reduced their visibility to other patients, but also made it difficult for them to go and help other nurses with vital tasks related to the medication administration, such as medication double-checking. On many occasions, this problem appeared to be compounded by the staff shortage in the unit. This finding is very much in line with recent findings of a study conducted by Sanghera et al. (2007), who interviewed 12 nurses from intensive care (level 3 critical care) and high dependency care units (level 2 critical care) in one NHS Trust in London. They analyzed their findings according to Reason's classification of latent and local contributing factors. One of the latent conditions identified in their study was that it was difficult for the nurses working in isolation rooms to get other members of staff to check the medication, whereas nurses had no choice but to administer the medication without being double-checked. This problem was aggravated by the shortage of staff and being rushed.

Some participants in this study appeared to work in a busy, multi-use area, which was being used by a variety of people. This may suggest the existence of a cultural context in some wards for unsafe medication practice where interruption and poor cleanliness were common, routinely-accepted realities among the participants. Similar findings were noted by Taxis and Barber (2003), who conducted an observational study to identify the causes of IV MAE's in hospital settings, including critical care settings, and reported that most wards had no separate room or dedicated areas for drug

preparation. Moreover, IV medications were prepared in the middle of a busy ward, and nurses were frequently interrupted and distracted during the process, which provided a latent condition for unsafe medication behaviour. The study has also suggested that the safe handling of IV drugs has a low priority among staff.

It can be concluded from many participants' views that the need for safe medication management and use did not seem to be incorporated sufficiently in the building and design of the ward layout, at least compared with other safety priorities such as infection control. This appeared to have resulted in designing a work place that was less sensitive to the needs of medication safety, evidenced by factors such as inadequate space around bed area and the unavailability of dedicated venues for medication preparation. These findings confirm those of Ball and McElligot (2003), who suggested that poor visibility and inadequate facilities to undertake essential tasks for critical care nurses took a considerable amount of time and interfered with the execution of the patients' management tasks, such as medication management. Another study conducted in UK by Seeley (1982) studied the relationships between wards divided into small bedrooms or bays and nursing staffing level. The study concluded that two measures of ward layout were significantly related to effective and efficient nursing care and patient safety. These were short travel distance for nurses, and ward features which facilitate the maximum contact between nurses and patients. The latter has been emphasized by the findings of the recent UK critical care study (Ball and McElligot 2003), which suggested that the use of side rooms and geographically distant sections of a critical care area limits supervision, observation and communication. One participant in the current study, Fiona, a senior staff nurse in

level 2 critical care settings, clearly implicated this issue in the safety of the administering of medication.

The sequence of events whereby poor ward design and layout can lead to unsafe medication administration appeared to be triggered by many error-provoking conditions, one of which includes the staffing level in the critical care settings. It has been suggested by the Royal College of Nursing (2003) that the complex layout of the critical care settings that include single side rooms and bays may lead to lower visibility for observing patients, hence more qualified nursing staff may be required to overcome this problem. While low staffing levels were cited in this study as an existing reality, its impact on the safe medication administration can be manifested when it combines with latent issues such as the perceived poor ward design and layout, which create highly likely opportunities to jeopardize the safety of medication administration. The following section sheds more light on this issue.

6.4.3 Poor staffing

Sometimes, the level of nursing staffing in the critical care settings investigated appeared to represent significant concerns for the participants. Their views were chiefly directed towards highlighting the knock-on effects of having an inadequate number of staff on the shifts, as Sally explained:

> … if you are short of staff, then you've got less time to do things, because you've got more things to do and it gives you less time to sort out your drugs. So yes, you probably gonna be more rushed, more stressed, and have less time to check things.

> [Sally, senior staff nurse, level 3 critical care, the Oak Hospital].

On occasions, the lack of adequate nursing staff on the shift appeared to force some participants in the study to increase their sphere of workload to an unrealistic level that could not be achieved safely, given the limited number of nursing staff. Jim indicated how the managers in his unit often tried to push the edges of what he perceived as unsafe practice to be acceptable and safe among nurses. For example, when double-checking of IV medications might not be conducted properly prior to administration:

> If we are understaffed, then there is always the continued pressure to achieve the caseload that we are supposed to achieve every day. So the mangers will try to push the boundaries on what is achievable, and sometimes you can see that patient safety is perhaps a little bit compromised by inexperienced members of staff, and sometimes, checks aren't done quite as well.

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

Several participants highlighted staff sickness as another likely outcome that can result from understaffing. Nurses become very stressed by inadequate staffing levels resulting from the mismatch between the high workload and facing them, and the insufficient number of nurses who were able to accomplish these tasks safely. Therefore, they were forced to take sickness leave due to the mounting pressure on them, which further escalates the pressure on the remaining staff in the ward:

> I can be short staffed and there is nothing you can do about it. In my opinion, the staff will be stressed and more likely to be off for sickness and such things, that is an issue besides the safety and drug administration. There are gonna be people who make errors when they are tired, or they are stressed up because of the work or whatever.

> [Toney, senior staff nurse, level 2 critical care, the Oak Hospital].

On occasions, some participants were allowed to book extra nurses to cover the shortage of nursing staff. Those booked nurses could be nurses from the same ward working overtime, but they could also be agency nurses who were doing a one-off shift on the ward. Some participants criticized the Trust's decision not to recruit nurses on a permanent basis, but to rely on agency nurses to provide temporary nursing cover, which Fiona implied was short-sighted:

> We've been short staffed and we've not been able to recruit when somebody has left. We still have the same number of nurses on shift sometimes. It has just been sort of agency staff, but you can't actually employ new staff, so it is very short sighted, it is like we will cover it for this week, and will see what happens next week, it doesn't seem that they are looking at a long-term solution for the problem.

> [Fiona, senior staff nurse, level 2 critical care, the Oak Hospital].

Working with external agency nurses has sometimes been a difficult experience for many participants. Lottie expressed her frustration because she often had to work with agency nurses who were not high-dependency trained (i.e. not able to safely look after patients in level 2 critical care settings). According to some participants, this was because the Trust seems to employ agency nurses who were not suitably trained to work in level 2 critical care settings, because they were less expensive than those trained to work in these settings. This solution was seen to be problematic by some participants, particularly when the agency nurses were unfamiliar with the work environment in terms of routine, policies, and protocols for the ward, including those for medication administration. Such a situation brings additional work for the permanent nurses on the ward, as they have to explain a lot of things for the agency nurses, and to help them in looking after the patient, which lays another burden on the

permanent staff. This trend appeared to be more predominant in level 2 than in level 3

critical care settings:

> You might have two high dependency nurses on. They may have a third nurse who is an agency nurse who is then unfamiliar with the environment and with the kind of the patients we've got and haven't got the skills and experience to nurse those patients. So this had its impact really on the safety of the patients.
>
> [Lily, ward manager, level 2 critical care, the Oak Hospital].

Lottie has also highlighted the problems associated with working with agency nurses

in high dependency wards:

> If you are on a shift with two of your normal nurses, and an agency nurse, and the agency nurse can't work in the high dependency area, because they are not high dependency trained, you are then putting pressure on yourself and you are thinking: if you haven't worked with this person before, you don't know their skills and what things they are gonna be picking up on. So you are then effectively looking after extra couple of patients, because you will then be chasing up what they [agency nurses] do, you may not be comfortable letting them do IV antibiotics for the patients. So you are picking up their drug rounds as well, and you are taking on a lot of extra work.
>
> [Lottie, staff nurse, level 2 critical care, the Oak Hospital].

Interestingly, the participants' views suggest that the situation in level 3 critical care

settings seem to be less acute than in level 2 wards in term of understaffing, although

they still suffer from understaffing. This was partly because the Trust would only

employ suitably trained nurses to work in level 3 critical care when short staffed,

which might put less pressure and workload on nurses in these settings compared with

those working in level 2. However, the shortage of nurses in these settings seemed to

be managed by diverting mangers and senior educational nurses towards undertaking clinical duties at the expenses of their managerial times.

> … We had a sort of special nurse educator, who was in charge of nurse education, that was primarily her job, and she was responsible for running it. She is still here, but she does it less than before, because we are short of staff, there are a lot of staff cuts, and she has to take some more clinical duties.
>
> [Martin, staff nurse, level 3 critical care, the Oak Hospital].

Diverting the time allocated for mangers and the nurse educators towards clinical practice appeared to have provided a short-term solution. Equally, however, it appeared to have also halted long-term development plans and policies that were supposed to be developed by senior staff in a secured management time. Such a strategy to alleviate shortages of nursing staffing was perceived by some participants to have marginalized the roles of managers and other senior policy makers in the settings, and enforced the feeling among those highly-experienced professionals that their roles sometimes became meaningless:

> I would say that here it [diverting the role of senior nurses toward clinical practice] is definitely beginning to affect patient care. All of their management time has been taken away from them. They will have to be clinical all the time to keep the staffing levels up to achieve the cases. So there is no real time left for them to follow through incidents with the infusions or drugs, that kind of problem. So the new policies aren't being developed, we've been waiting for two years now for the new drug chart, the current chart is right mess.
>
> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

It became clear from the participants' views that inappropriate staffing has been considered as a contributory factor towards unsafe medication administration. In the

context of the available literature, there is a growing body of research that clearly highlights the negative impact of understaffing on the overall patient safety, particularly medication safety. For example, Taxis (2003) analyzed the causes of IV MAE's in many hospital settings, including critical care, and found that the shortage of nursing staff was a leading error-producing condition which leads to increased workload and MAE's. In this study, there was a recurrent feeling among the participants that the Trust managements' preoccupation with meeting efficiency targets, such as spending targets, meant that warnings about the long-term effects of the understaffing were often ignored, and not acted upon. Moreover, the participants expressed their frustration of the lack of communication between the Trust management and the front line nursing staff on how to develop effective coping strategies to deal with the issue of understaffing, and how to prevent, or at least minimize its influence in the future. All of this seemed to have created situations experienced by many participants, where understaffing become a chronic, and often accepted reality, although it may lead to staff dissatisfaction and sickness, which may in turn worsen the situation and negatively impact on the quality of care provided to the patient.

In chapter three, it was mentioned that the Trust where the study took place has been experiencing challenging financial pressures brought about by Government policies to reduce financial overspending of more than £60 million (Woodland Hospital NHS Trust 2007a). While it is difficult to speculate on how this pressure affected the Trust's organizational priorities and long-term goals, the participants' views suggest that understaffing staffing seems to have reached such a magnitude that it precluded the ability of Trust to deliver patient care safely in some wards. It was clear that

preventing understaffing was beyond the capabilities of the nurses operating on the front line. For example, putting limits on recruiting permanent nurses and booking insufficiently-trained nurses seem to be one way to alleviate this pressure, and this, according to the many participants, impacted differently on the staffing levels in level 2 and 3 critical care settings. For example, level 2 appeared to suffer from over-reliance on agency nurses, whereas level 3 seemed to suffer mostly from diverting much of the management and educational times toward overcoming understaffing, which indirectly affected the long-term education and training goals for nurses in the wards. These findings are consistent with those of Reason et al. (2001), which suggested that over-reliance on agency nurses led to decreased nursing experience in the wards, where agency nurses were unfamiliar with the institution's policies, culture, communication interfaces, and team practices, therefore putting patient safety at risk.

The literature provides conflicting evidence of the correlation between the nursing staffing and the quality of patient care, including the safety of medication administration. For example, one study in the US founds a significant inverse relationships between the nursing staffing levels and the rate of MAE's in the ICU (Whitman et al. 2002). However, the study findings of Mark, Harless et al. (2004) provided limited support for the notion that improving registered nurses staffing in hospital settings, including critical care settings, would unconditionally improve predictors of quality of care, such as the rate of MAE's. The literature on nurse staffing is mostly reliant on American sources, and due the differences between US and UK health systems, caution must be had in generalizing from these results to the UK settings.

In conclusion, the participants' views suggest that understaffing among critical care nurses appears to be a contributing factor to unsafe medication administration practice. In the cultural context, in terms of meeting the Trust's established targets, a lack of direct nurse involvement in a long-term strategy to overcome this problem was perceived by many participants to have contributed to developing and sustaining it.

6.5 Concluding summary

This chapter outlined the participants' perspectives on the aspects which contribute to unsafe medication administration in the critical care settings where this study took place. The analysis of the participants' views has sought to identify the organizational factors which predispose the settings to such unsafe practice. In this context, opportunities for MAE's and near misses appear to be opened, due to a number of varying and often interacting factors that mostly originate from organizational practices and working environments. Where appropriate, the analysis of the participants' views in this chapter aimed to highlight the contributions of the latent and local contributing factors according to the Organizational Safety Space Model (OSSM). Many of these issues have been already implicated in the literature as contributors toward unsafe medication administration practice.

The latent conditions identified in this study for unsafe medication administration can be presented in three main groups: poor communication, environmental issues, and design failure. The participants' views suggest that communication failures across the organization appear to have decisive influence on the occurrence of MAE's and near misses. For example, the absence of a structured method of exchanging the information during the nursing handover appears to make it more likely that some

vital information about patient medication will be missed. In some critical care settings, this reality was often compounded with the existence of culture where some participants were reluctant to express their concerns about inadequate exchange of information.

The perceived influence of a target culture among the participants in the Trust cannot be underestimated. The data suggest that there were efforts being made to meet what many participants considered to be a politically and economically-driven agenda, rather than a patient safety agenda, in the Trust. This was seen by a number of participants as a strong driver for compromising the safety of medication administration in their wards. In particular, their views suggests that strategic decisions in the Trust were made by the managerial hierarchy in response to the pressure from outside organizations, rather than from within the organization, according to the patient safety needs on the ground. A big majority of the participants in this study considered some of their working conditions, such as understaffing, use of agency nurses, and perceived inadequate design of medication packs as an accepted reality in work environment, and as manifestations of external pressure on the Trust to meet certain bed occupancy targets, and to reduce the financial deficit within the Trust. Working within these constraints, rather than attempting to contribute to changing the system, appeared to be the norm amongst the participants in this study. The analysis of the many participants' views also suggests that most attempts to solve these conditions were often local and short-lived. This was largely ascribed to the perceived decision-making process to manage the situation which seemed to be divorced from involving the views of key individuals, such as nurses. Therefore, it became difficult to reach a consensus between those on the top management hierarchy

in the Trust and the front line professionals on how to meet these targets without compromising patient safety, or at least minimizing any risk to it, although this may not always be feasible in practice. This creates a climate where many participants expressed deep scepticism about the Trust's overall commitment to patient safety, particularly when this commitment conflict with other more publicised priorities.

The issue of perceived poor ward design among many participants, in terms of inadequate ward layout and inadequate labelling and packaging, seems to be an inevitable outcome of the failure to incorporate human-factors principles in planning and designing the Trust's facilities and procedures. The participants implied that many of the critical care settings in this study have designed with the explicit goal of enhancing medication safety through facility design, although other patient safety aspects may have been considered. For example, the lack of dedicated rooms for medication preparations in some wards was linked to the creation of a crowded environment, where the interruption of nurses while preparing medications becomes an inevitable outcome. In some wards, some participants appeared to convey the message that other competing priorities supersede the medication safety ones. For instance, the argument for infection control, which is still about safeguarding patient safety, seemed to be manifested in the ward design by separating patient beds by partitions in one newly-built ward. This was perceived by some participants, however, to conflict with much needed nurse-to-nurse and nurse-to-patient visibility in a highly-complex environment such as critical care. Lack of communication in the Trust between healthcare professionals such as nurses, and the manufacturers of medications, was also considered to be an underlying problem related to poor labelling and packaging. Consequently, some of the simple, but crucial human factors

components and specific key environmental elements seemed to be overlooked in the system design.

Ranges of error-producing conditions and violation-producing conditions for unsafe medication practice were also identified from the participant's accounts. These factors seem to be working collaboratively in reducing the medication safety margin. Understaffing, interruptions, and lack of supervision were addressed as error-producing conditions and violation-producing conditions. However, it is important to look at the context where these conditions were created, and what led to unsafe medication practice. Reason (1990; 2000) suggested that any accident outcome is the result of a sequence of events that line up together to produce an undesirable outcome. The latent conditions within the organization, in the form of decisions and actions taken by top management structure, interact with the local environmental factors to proceed for accident occurrence. There is strong evidence from the data analysis in this study which suggests that the undesirable outcome of MAE's and near misses is the result of a complex interaction between those organizational underlying problems (i.e. latent factors), and the local triggering factors in critical care settings under investigation. The sequence of events may start with poor ward design, which causes poor nurse-to-nurse and patient-to-nurse visibility. The risk of unsafe medication administration may then materialize, precipitated by understaffing and perhaps interruption, as when there were not enough staff to answer the patients' calls. This situation may lead to nurses being unable to accommodate some of the basic safety rules, such as the double-checking of medications with their colleagues, thereby violating the rule of double-checking. This violation may cause a sequence of events culminating in medication not being checked properly, and potentially opening up

opportunities for medication administration errors or near misses. This can be caused by a multiplicity of interacting factors, many of which have environmental and design implications.

An important lesson that can be concluded from the participants' views in this chapter was that the competition between the organizational priorities means inevitable tradeoffs among these priorities. For example, the participants' views suggest that the argument for infection control has out-weighted the one for ensuring medication safety in designing the ward layout. While both arguments carry important ethical considerations for patient safety, it may be difficult to accommodate both of them in the ward design simultaneously; hence, a trade off between them is inevitable, and presumably unavoidable.

Chapter Seven:

The Context of Safe Medication Administration:

The Ongoing Encounter

7.1 Introduction

This chapter aims to explore how the interaction between diverse organizational aspects may influence the safety of medication administration in adult critical care settings investigated. The discussion in this chapter seeks to explore the participants' views on what appear to be polarized issues within the system of medication administration. In particular, the discussion will focus on those issues which can enhance the safety of medication administration in one context, while also jeopardizing safety in other context. The discussion recognizes that the influence of such factors on the overall medication safety is not absolute, and remains relative to the context in which each factor operates. For this reason, attempts to quantify the extent to which each factor drives overall safety may be inconclusive, simply due to the complexity of the interplay between the many diverse aspects which can influence the safety of medication administration within the healthcare organization.

A central issue which emerged from the participants' views is how the interaction between system components augments, or perhaps diminishes, the engineering of a safety culture. Building a safety culture is said to be much more challenging than having the sum of its parts in the organization. Reason (1997) suggested that:

> … assembling the parts of a machine is not the same thing as making it work. And the same thing is even more true of social engineering than for its more mechanical counterparts (Reason, 1997, p. 219).

In particular, accident genesis according to Reason (1990) was shown to be inadequate in particular that the model cannot account for the indirect, non-linear, and feedback relationships characteristic of accidents in complex systems (Marais et al. 2004; Qureshi et al. 2007). The analysis of the data in this chapter suggests that there are some aspects in the participants' work settings that can arguably be fundamental to safety culture. Some of these aspects can be exemplified by having incident reporting systems in place, and the existence of medication administration policies and protocols to guide the medication administration practice. However, such elements can only be viewed as pre-requisite system components for building a safety culture of medication administration, and it is up to the *organizational chemistry,* as described by Reason (1997, p. 2200) to decide whether such system components are fully exploited. In other words, the context in which organizational elements interact appears to be influential in determining the ultimate safety margin of the organization. In doing so, there are wider considerations for the context in which the individual operates within the organization. For example, the analysis of the participants' views suggests that having an incident reporting system in place does not necessarily mean that nurses will always report instances of unsafe medication administration. Moreover, the existence of medication administration policies and protocols, while proven to be useful, does not necessarily mean that nurses will always adhere to them in their medication administration practice. These issues will be examined, through the participants' perspectives, in the context of the driving and resisting forces which contribute towards the safety of medication administration in the critical care settings investigated.

It is important to point out that in addressing the context of safe medication administration in critical care settings, only those factors which are predominantly highlighted in the participants' views will be discussed in this chapter. The emerging themes in this chapter are discussed in an order that it is felt clearly reflects the participants' views. For example, the contextual influence of communication was felt to be the most strongly-indicated of the participants' views, followed by the contextual influence of medication administration practice. Finally, the participants' views on the contextual influence of environment are also discussed. Table 5 presents the categories of data that are related to the participants' views on aspects that contribute to the context of safe working.

Theme	Category	Sub- Category
Context of Safe Working: The Ongoing Encounter	Medication Safety: Context of Safe Communication	Selective Querying
		Incident Reporting: The Tension of Disclosure
	Medication Safety: Context of Safe Practice	Medication checking: Resisting the Norms
		Policies and Protocols: The Story of Compliance
	Medication Safety: Context of Safe Environment:	The Search for Perfection
		Competing with Patient Safety

Table 5: Context of safe medication administration: Themes and sub themes.

7.2 Medication Safety: The Context of Safe Communication

The extent to which information is shared among the participants and other healthcare professionals was perceived by many participants to be an important factor in shaping the safety of medication administration. Communication style, however, seems to depend on several factors which militate against or support effective information exchange. Two issues were prominent in the participants' views relating to their communication behaviours: the selective pattern of communication with healthcare professionals, particularly the doctors and the pharmacist, and the reporting behaviour of MAE's and near misses.

7.2.1 Selective querying

This section on selective querying highlights the different communication patterns that most participants appear to utilize to communicate with other healthcare professionals, such as doctors and pharmacists. In previous discussion (section 5.4.1), it was demonstrated that many participants felt empowered to question, and sometimes to challenge the doctors' prescribing decision when they felt uncomfortable about it, in terms of medication writing, dosing, or even in judging the suitability of the medication prescribed for the patient's condition. This assertion can be re emphasized by the following account:

> Because we are the one who is giving it [medication] at the end of the day and if we are uncertain we would question the doctor and query it: Is this the right dose? Is this written up and prescribed correctly? I think we have got the power to do so, because they are our patients at the end of the day, and we are the patients' advocates.

> [Akua, senior staff nurse, level 3 critical care, the Beech Hospital].

These styles of communication appear to stem from the fact that many participants were conscious of a doctor's fallibility for prescription errors. This can arguably enhance the system resilience against unsafe medication administration practice by placing extra system checks on the process of prescribing and administrating the medication. In contrast, the participants' accounts appear to suggest a distinctively different perception of the pharmacists' role from the doctors'. Significantly, they appear to be less cautious in taking the pharmacist's instructions and advice, almost always taking the pharmacist's advice for granted.

> I think the nurses would usually say "woohoo, I don't have to look at it [medication chart] now, because it has been checked by the pharmacist", so there is an awful lot of trust really between us and the pharmacists.

> [Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

The role of the pharmacist on the ward has often been described as a crucial one for the safety of medication management. Indeed, evidence from the literature gives strong support for the presence of the pharmacists in the critical care environment, on the grounds that the pharmacist's role involves checking the doctor's prescription and making sure that combinations of medication administered are compatible (Dean et al. 2002b). However, many participants appear to regard the pharmacist as an infallible person who does not make mistakes. Pharmacists were perhaps perceived as the most knowledgeable professionals to ask when querying the prescription, dispensing, or administration of medication. This can arguably be viewed as a system flaw at the same time. The participants' views suggest that they were able to question the doctors' prescriptions because they have sufficient knowledge and experience of what the medication prescription should look, which enables them to question what they

may perceive as an incorrect prescribing decision. However, they do not seem to have a similar level of knowledge regarding the pharmacology and therapeutics of the medication, such as the consequence of medication interaction and compatibility, and the safest route for medication administration. For this reason, many participants did not seem able to have a useful discussion with the pharmacist about any problems associated with the medication, particularly for those medications with which they are unfamiliar. Some participants signalled that their lack of pharmacological knowledge means that the pharmacist's dispensing decision and advice will almost always go unchallenged:

> Obviously, we [critical care nurses] know the area and we know what medicines we use, but we don't have the broader knowledge of how things will interact with each other. I don't think we always know one hundred percent how clear things are … whether to give them or not … and this is where the pharmacist's job comes in.

> [Lily, ward manager, level 2 critical care, the Oak Hospital].

However, there is well-documented evidence in the literature which suggests that dispensing medication from the hospital pharmacy is not a problem-free process. Pharmacists are human beings and are prone to err. Indeed, dispensing errors have been reported with varying rates across hospital settings (Beso et al. 2005; Poon et al. 2006). Therefore, the pharmacists' perfection should not be presumed. The fact that the nursing participants have expressed a lack of knowledge regarding the pharmacology of many medications, and their veneration of the role of the pharmacists, may provide false sense of security regarding these issues, which in turn render them less empowered to query medication that is dispended by the pharmacy.

This is most notable for those medications with which some participants are not familiar:

> … our pharmacist has a greater depth of knowledge about certain medications than I have. He is trained for so many years, and knows a lot more about it. He knows his job very well, and we are not expert in his field.

[Angela, ward manager, level 2 critical care, the Beech Hospital].

Some participants signalled that the pharmacists are doing a favour for the nurses, by helping them understand some complex interactions between medications and their potential consequences. Thus, from the participants' perspective, it is important for the nurses to have a good working relationship with the pharmacist, and questioning the pharmacist about any of their decisions may therefore seem unhelpful for nurses in the long term, and could make their job more difficult. Even the ward manager acknowledged that:

> I think the pharmacist's role is prominent in the unit; everyone knows that, and what she [the pharmacist] does and the way they [the nurses] interact with her. It could be some pharmacists may have some hiccups, but I think the pharmacist is known to be the right person knowing how to administer the drugs; therefore it is important not to mess with her.

[Nadia, ward manager, level 2 critical care, the Oak Hospital].

When they were asked why they felt their pharmacological knowledge was inadequate, many participants pointed to the poor pharmacological education they received during their pre-registration nursing training, but also to the lack of the continuous learning for nurses in post-registration in the ward:

> You have some sessions [on medication related issues] in the School
> of Nursing towards the end of your training in your last month or so
> before you finish the course. But to be honest, it [the information
> taught to the student nurses] will just get out one way or another,
> because they [School of Nursing' staff] do it [medication teaching
> sessions] a month or two months before you leave, and you just forget
> about it, and then you come to your place of work and you can then
> remember parts, but you can't fully remember everything.

[Randa, staff nurse, level 2 critical care, the Beech Hospital].

The previous participants' views in this chapter suggest that there are paradoxical microclimates in the wards investigated, where some participants appear to co-host trust and mistrust at the same time, but with different members of healthcare professionals, that is doctors and pharmacists. However, in order to establish a positive safety culture in the organization, communication among all members of the organization should be founded on mutual trust and openness (Nieva and Sorra 2003). Moreover, the recognition of the inevitability of errors from all members should prevail (Kirk et al. 2006). In this context, dispensing errors are existent problems in critical care wards. An American study by Cullen et al. (1997) classified medication errors according to the stage of the medication use process in three intensive care units. The study found that around 10% of medication errors originated from the dispensing stage, far less than those errors originating from the prescribing stage (28 to 48%), and while dispensing errors may be less frequent than errors originating at other stages of medication use process, they can potentially cause harm for patients if undetected (Beso et al. 2005).

The participant's views appear to point to the fallibility of the doctors' prescribing decisions, but disregard the pharmacists' checking and dispensing ones. This

assumption is inconsistent with one of the main principles of system approach, which emphasizes human fallibility for error (Reason 1990; Leape 1994). Therefore, to accept that professionals within one discipline are infallible is simply not conductive to safe medication administration. Furthermore, being preoccupied with the possibility of error, and being prepared for these possibilities, has been highlighted as one aspect of establishing system resilience (Reason 2000). Where organizations develop alignment, awareness, and empowerment among their workforces, they are likely to be better at removing the latent conditions that lead to systemic failures. In this context, improving medication safety is said to be improved by having a "culture of conscious enquiry", where all individuals involved recognize the potentialities for dangerous situations, and compensate for dangers by added vigilance and additional checks (Patterson et al. 2004). However, many of the views of the participants in this study imply that such a culture may not be fully utilized, at least by some. It is also often discouraged by other inhibitory factors, such as the participants' lack of knowledge about the medication dispensing process and medication therapeutics.

The participants' views suggest that inadequate pre-registration nursing training, in relation to the medication administration and pharmacology, was an important factor in their lack of pharmacological knowledge. This was perceived to have precluded their ability to ascertain and even question whether the pharmacist has given the right advice or dispensed the right medication, at the right time, with the right dose, and has recommended the right method of administration. In the context of the available literature, there have been concerns about the adequacy of pharmacology teaching being included in nursing training curricula. For example, a study in Australia by Manias et al. (2002) found that nursing lecturers and students have expressed

dissatisfaction with current pharmacological education, and strongly indicated that there is a need for further educational initiatives in this area. Similar findings were also reported in the UK by King (2004).

To summarize, the participants appear to be selective in utilizing the culture of conscious enquiry, by being more likely to question the doctors' prescribing decisions, but more receptive to the pharmacists' advice and dispensing decisions. The level of knowledge and experience appear to be an influential determinant for the selection process. The participants' views suggest that they are less likely to question the pharmacist about their medication and dispensing process, particularly for those medications they were not familiar with. This situation in turn could make the nurses more vulnerable to errors committed by the pharmacist compared those committed by the doctors.

7.2.2 Incident Reporting: The Tension for Disclosure

This section addresses the participants' views about the factors which influence their decisions to report MAE's and near misses. In particular, it discusses their views on the perceived driving and resisting factors for the successful reporting of unsafe medication administration, and the context in which these factors interact and impact on the overall medication administration safety in the critical care settings investigated.

One of the driving forces for successful incident reporting identified from the participants' views was the endorsing of shared beliefs among many participants, that it is important to report incidents involving unsafe medication administration. There

seems to be a consensus among the participants on the organizational contributions toward unsafe medication administration practice, where they emphasize the importance of incident reporting for tackling the system flaws:

> If you never ever wanted it [MAE's and near misses] to happen again, then obviously, it is extremely unsafe not to report it. If an error has occurred, then it needs to be reported so that the patients are safe. If that hasn't been reported, then that can't be improved.
>
> [Scott, staff nurse, level 3 critical care, the Beech Hospital].

While many participants emphasized the importance of reporting MAE's and near misses, and the contributions of such behaviour towards improving the safety of medication administration, some of their comments cast a shadow on the actual reporting behaviour, and whether it exists in the way it is perceived to be one problem which appears to have been repeatedly mentioned in many interviews was the impact of a blame culture on the reporting behaviour of the participants. This seems to have resulted in feelings of intimidation among some participants as a result of being blamed for any unsafe medication administration, but it also indicates how reporting MAE's may undermine the image of those involved in the incident among themselves and their colleagues. Inevitably, such a situation could render some participants reluctant to report some medication safety incidents:

> I feel perhaps, just talking to other staff, that sometimes you are not necessarily doing yourself any favours by reporting drug errors to your immediate boss. I guess there is less blame culture than there used to be, but I think it is still there.
>
> [Toney, senior staff nurse, level 2 critical care, the Oak Hospital].

The participants' views suggest that despite efforts to eliminate the notion of blame following the reporting of incidents in their working culture, there seems to be some degree of stigma still attached to reporting. On occasions, their perceived fear and apprehension from reporting MAE's and near misses was evident when they talked about having to deal with the managers and nursing hierarchy. This may have come from a negative experience they experienced themselves, or had heard about:

> It [incident report] may get back to the modern matron, and that is bad enough. You will end up in the matron's office, so it almost feels like a disciplinary really, which sends mixed messages given its purpose really.

> [Martin, staff nurse, level 3 critical care, the Oak Hospital].

There was inconsistency among many participants in their support of no blame culture in their work environment. While some of them expressed strong support for this notion, others were more cautious, and appeared clearly doubtful about whether a no blame culture could lead to the erosion of nursing accountability. On occasions, being blameless was associated with being complacent in dealing with those who are "sloppy" in their mistakes:

> If you have a no blame culture, then how do you point the finger to someone who is just lazy? Sloppy? Not necessarily malicious, just sloppy, someone who does not bother to read a little bit of research once in a blue moon.

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

Akua was more explicit in her disagreement with a "no blame culture". She rather advocated a "low–blame" approach, because for her, being accountable means accepting responsibility and the consequences for one's own errors:

I don't agree with a no blame culture. Does that mean that nobody gets the blame? I mean somebody has to be blamed if they make mistakes? Because everyone has to be accountable for their mistakes.

[Akua, senior staff nurse, level 3 critical care, the Beech Hospital].

Many participants have also pointed to the lack of feedback on the incident reported as a substantial reason which weakens their intention to report incident involving MAE's and near misses. One participant expressed his frustration that the nursing staff do not usually get to know what happened with their incident reports. The only instance where they receive feedback is when a disciplinary action seems imminent against those involved:

…No, No [no feedback received], it is very much down to consequence of it. It goes to one nurse who looks into all the investigations, I think it is the ward managers who may find out what really has happened. If it is a serious error which dictates a disciplinary action, we may find out, but other errors we don't seem to find out what has happened at all.

[Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

One participant also acknowledged that there are no perceived rewards from reporting patient safety incidents. She also recognized that efforts were needed to make the rewards of reporting more tangible for nurses:

I mean their [ward managers] feedback hasn't been always that good, because they are only interested in correlating statistics. So they don't always feedback, and staff see no benefits from reporting. I think they could be better in feeding back to the staff in the unit. That something needs to be improved so they know in a way that it was worth filling them in.

[Annette, clinical governance nurse, level 3 critical care, the Beech Hospital].

In the context of the available literature, incident reporting systems are emerging as a major tool to help identify patient safety problems and to provide data for organizational and system learning (Giles et al. 2006). Reason (1997; 2000) pointed to the *navigational aids* within the organization which, collectively, allow the organization to collect information about its performance and to identify its current safety threats. These measures can be reactive in nature, such as reporting the incident after it occurs, but also proactive ones, by analyzing the gathered data and identifying in advance those factors which are likely to contribute to future accidents. Effective safety management in the organization requires the use of both reactive and proactive measures. Those requirements together provide essential information about the system resilience; hence its position within the safety space (Carthey et al. 2001).

The aforementioned views of the participants on incident reporting suggest that participants' decisions to unsafe medication administration are subject to various incentives and disincentives from within their work environment. When the participants consider reporting MAE's and near misses, they appear to weigh the benefits of reporting against the potential risks. For example, there seems to be awareness among many participants that the reporting of incidents has substantial links to improving patient safety. Furthermore, role modelling appears to a have a conspicuous impact on improving the reporting behaviour. Some participants, particularly the junior ones, indicated that they felt inspired by other senior colleagues being open in admitting mistakes and reporting them:

Role modelling, definitely, because I made a drug error when I was on haematology ward, and my ward sister said that we all done it, and holding their hands up. But up until that point, you know, I wouldn't have known that. So it is still behind closed doors that she told me, but yeah…I definitely think for people to say…it happens and this is how it may not happen again in the future

[Hazel, staff nurse, level 2 critical care, the Oak Hospital].

However, this awareness seems to co-exist with awareness of the negative repercussions being associated with medication safety incidents, but also with lack of feedback and perceived rewards from reporting behaviour. This assumption is consistent with the findings of Barach et al. (2000), who reported that management attitudes and the institutional climates can greatly influence the success or failure of incident reporting efforts. Moreover, the sum of the barriers and incentives to incident reporting can be considered in terms of their impacts on individuals, organizations, and society. Organizational incentives to reporting include confidentiality, that incident reporting systems should be prophylactic (provide some degree of immunity), philanthropic (reporters identify with injured patients and other healthcare providers that could benefit from data), and therapeutic (reporters learn from reporting about adverse events) (Billings 1998). On the other hand, powerful disincentives to reporting are said to be dependent on the organizational culture, including scepticism, lack of trust, and fear of reprisals (Westrum 1992; Reason 1997). Understanding the balance between such barriers and incentives to reporting was advocated as the first step in transforming the organizational culture of blame and resistance to one of learning and increasing safety (Barach and Small 2000).

An interesting finding that emerged from the participants' accounts is the dynamics of their willingness to trade off being vulnerable to criticism for the good of society. Barach et al. (2000) described how some healthcare professionals appear to negotiate moral hazards in choosing between the good of society (i.e. improving patient safety) with the needs of the individual, (i.e. self-protection from stigma), but also the need to change the bureaucratic culture (i.e. lack of feedback), which seems to be perceived by many participants in this study as critical to sustain ongoing reporting. On many occasions the outcomes of negotiating these moral hazards for the participants in this study appear to depend crucially on the sum influence of those incentives and disincentives to communicating medication safety incidents:

> I don't think it is as fearful now. I think people now realise that if you don't report it, then you can't improve practice, but the negative side of that, I think that people will think well, I will fill an incident form, then I don't see what happens.

> [Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

Some participants in this study appeared to be reluctant to endorse the notion of a "no blame culture". They would rather advocate a "low blame" one, where personal accountability will always be paramount. There is an ongoing debate in the literature whether a "no blame culture" is achievable in reality in healthcare settings (Wyatt and Walton 1995). Building a "Just Culture" in the organization is said to be an important component of safety culture (Marx 2001). However, a wholly "Just Culture" is said to be almost certainly an unattainable idea. Reason (1997) has strongly emphasized the situational and systematic factors leading to the catastrophic breakdown of the hazardous technologies. However, he has also suggested that it would be naïve to give blanket immunity from sanctions to all actions that could, or did, contribute to

organizational accidents, because on some relatively rare occasions, preventable accidents may happen as a result of reckless or negligent or even a malevolent behaviour of particular individuals. The participants' views on the need for "low blame" or "no blame" culture may therefore reflect the difficulties in discriminating between these truly "bad behaviour" from those reckless individuals, and the vast majority of unsafe acts to which the attribution of blame is neither appropriate, nor useful.

7.3   Medication Safety: The Context of Safe Practice

Evidence from the participants' views suggests that the contextual practice of medication administration appears to influence the way and the manner in which medications are administered, and consequently, impacting in one way or another on the safety of medication administration. For example, the paradoxical influence of medication checking can be viewed on the basis that it has been asserted by many participants to be an effective safety measure against unsafe medication administration practice. However, staff shortages, the impact of hierarchical pressure, and the dilution of responsibility can make such practices meaningless. Furthermore, conflicting protocols and policies for medication administration, which are meant to help standardize medication administration practice, can cause confusion among the nurses, and therefore, adherence to those policies and protocols becomes difficult if not impossible.

7.3.1 Medication Checking: Resisting the Norms

This section discusses how medication double-checking appears to be, on occasions, a contested procedure from the participants' perspective. For instance, the most common route of medication administration in critical care settings is Intravenous (IV) (see chapter 3). The views of many participants on this issue (section 5.2.2) suggest they routinely check some medications with one of their colleagues prior to administering them to patients. This procedure appears to be perceived as an established component of the safety of medication administration among those nurses interviewed:

> I would double check everything because I know that if you check everything you can, there will be far less chance of making a mistake.

> [Scott, staff nurse, level 3 critical care, the Beech Hospital].

While some participants have clearly endorsed the double-checking of medications as a safety check, a number of them appeared less certain as to whether such practices are always genuinely carried out. This is because they believe that nurses come together to double-check medications, resulting in a social exchange which may dilute the individual responsibility for the whole process. Jenny argued that the current double-checking procedures are often performed as a routine task and do not observe the principle of performing the double-check as an independent cognitive activity:

> I would like to think that double-checking actually aids the elimination of drug administration errors. But in theory, the double-checking is a good idea really, because you feel that two persons having to check the medications reduces the error, but I don't know in practice whether that is truly the case, and whether there is a possibility that one may not check them properly.

> [Jenny, ward manager, level 3 critical care, the Beech Hospital].

One reason for asserting this assumption appears to be related to the perception of authority and hierarchical issues (Armitage 2007a). It seems that the nurses, particularly the junior ones, would be less thorough when double-checking a medication which has already been prepared and checked by a senior member of staff. This could be due to the superior professional image that the junior nurses may hold of their senior colleagues, signalling that they are infallible to error:

> Also there is a lot of interplay between the two checkers; they are not often from the same rank. If I have asked a staff nurse to check something, he or she knows that I'm a charge nurse and he or she might not check it ... they may say I'm not going to argue with them, and I had that as act of mistakes that happened to me.
>
> [John, ward manager, level 3 critical care, the Oak Hospital].

In contrast, the influence of hierarchal differences among the participants appears to be less problematic when the there is no perceived difference in professional ranking between the two checkers, particularly among the junior nurses, for example, when a junior nurse comes to double-check a medication with another junior nurse. Both nurses, including the second checker, appear to be more thorough and vigilant in checking the medication:

> I mean we have to look through it [medication being checked] for the IV package thing. So yeah, it is important especially for me and my other junior colleagues like me, who just started giving IV's, we always check vigorously with each other. I always check that, you know, because we are quite new to it.
>
> [Hazel, staff nurse, level 2 critical care, the Oak Hospital].

The interpretation of this finding suggests that the perceived image and seniority of the other checking nurse could have an influence on the credibility of the medication double-checking process, although this appears to be more germane for the junior nurses in this study. This may suggest that problematic double-checking may be an important attribute of the ward subculture and professional norms, which encompass bowing to those with a greater perceived knowledge and experience, which in turn may encourage the phenomena of giving answers before conducting the actual checking (Leape and Berwick 2005). Such traditions could spread through the hospital culture and militate against it becoming a high reliability organization which advocates a checking procedure, because humans are liable to errors regardless of their perceived status (Leape and Berwick 2005). Moreover, this may lead to an erosion of accountability among the checkers. John has been mindful of the potential loss of accountability when double-checking medication by the second checker. For this reason, he seems to favour the single checking procedure:

> I'm also interested that it [medication checking process] is now changed to primary check and secondary check, often both from different ranks. But I think it [single checking] is a much safer system, because the primary checker knows they are taking the primary responsibility

> [John, ward manger, level 3 critical care, the Oak Hospital].

Even when the practice of double-checking medication is upheld by the majority of nurses in the wards, there appears to be situational and environmental conditions which preclude the conduction of correct, timely, and consistent double-checking of medications. One of these factors is poor ward design, where there are partitions between the patient beds in some wards. These, according to some participants,

disadvantage the staffing level available on the shift, because nurses cannot afford to

be visually away from their patients to go and make themselves available to double-

check medications for other patients. This is especially true of level 3 critical care

settings, where the patient may need continuous visual attention from the nurse:

> We always have the people to check the drugs with others. It means you are stuck in that room, in the clinical room to double-checking drugs with your colleagues, and everything else is left and you are rushing, trying to get out of the room, and you know that you've got a stuff on the unit, and you've not got enough people to cover every area, but you've got to do your drugs.

> [Samantha, staff nurse, level 3 critical care, the Beech Hospital].

Such constraints on the participant's availability to double-check their medications

and someone else's medications are likely to force them to revert to single checking

of medication, or to be selective in their double-checking practice. In this context,

double-checking those medications which are perceived to be unfamiliar or dangerous

appears to take priority for the selective double-checking. However, it seems to be an

acceptable practice among many participants to single check other medications to

compensate for other more demanding needs, such as the need to administer the

medication on time.

> If it [medication] is unfamiliar drugs, or something we don't use on a daily basis, then most of my colleagues would double-check it, but sometimes you just can't double-check everything you suppose to double-check…it takes long time to find another checker, and you need to give medication on time.

> [Jim, staff nurse, level 2 critical care, the Beech Hospital].

In the context of the available literature, the practice of medication double-checking has been controversial. While some researchers described double-checking as a sacred cow which wastes time (Leape 2000b), others reported that ceasing double-checking in challenging circumstances may be counterproductive (Catlin 2004). The views of many participants suggest that the double-checking procedure is generally bolstering the safety of medication administration, yet the notion of the diffuse responsibility of double-checking is also a viable argument: that nurses meet to double-check the medication to ensure the correct medication is administered, but this can also provoke a social exchange which may lead to diluting responsibility and improper checking procedure. This finding is in line with those of Sanghera et al. (2007), that ambiguity about the role of the second nurse checker is one of the latent conditions leading to MAE's in level 2 and level 3 critical care wards. Another study revealed that double-checking of medication was perceived by some nurses as a questionable defence against unsafe medication administration. This is because it can reduce the responsibility for both the primary and secondary checkers, and therefore asserting a false sense of security (Armitage 2007a). The double-check system was also said to suffer from what is known as the halo effect (Stokowski 2007), where professionals inherently shy away from questioning the integrity of other professionals. If someone has the reputation of being a good nurse, other nurses are unlikely to look closely at or question their medication calculations or how they have set their intravenous pumps. For this reason, Tamuz et al. (2006) reported that double-checking could undermine risk awareness when contaminated by hierarchical differences or misplaced trust.

Some participants appear to address these concerns by reverting to single checking, which, according to them, avoids the drawback of being physically present when

double-checking medications. Jarman et al. (2002) found that most nurses who changed from double to single checking developed an increased level of responsibility, checked their prescriptions more thoroughly, and some of them indicated that their sense of accountability has also risen. In this context, a number of the participants in this study offered their own solutions which appear to stem from reflecting on their criticism of the imperative social exchange during the double-checking. Such a solution is in recognition of the inclination of some staff to avoid responsibilities. One participant suggested reinforcing the time and distance between the two checkers of medication calculations, therefore encouraging critical thinking while checking, and defining the roles of each checker:

> I think one way to do it [double-checking] is to do the calculation separately. I think as long as there are two people work it out separately and come up with the same answer …I think that's it…

> [Fiona, senior staff nurse, level 2 critical care, the Oak Hospital].

The lack of time and staff to carry out the proper checking of medication was a recurrent theme which contextualised many participants' views. This appeared to have forced some nurses to abandon the double-checking of medication, or at least to be selective of what needs to be double-checked, in a compromise measure intended to save time when there is shortage of time or qualified nurses, but also when the ward design precludes the social and physical attendance of nurses to complete the double-checking process, although this may not be a problem-free interaction either, as it was pointed out earlier. Sanghera et al. (2007) found that nurses working in isolated rooms in critical care wards felt it was difficult to get another member of staff

to check the medication, often had no choice but to administer the medication without double-checking it.

In summary, the participants' views suggest that, in principle, double-checking is an established feature to ensure the safety of medication administration. However, such a process can also harbour undue risks, particularly when double-checking is not carried out genuinely. In such instances, single checking is perceived to be safer and to enhance accountability. The interpretation of the participants' views on the issue of checking the medication suggests that double-checking medication is perceived as the norm, and to single check is the exception. However, according to some participants, there are many factors, including organizational ones, which may create opportunities where single checking becomes the norm, and double-checking becomes a selective procedure rather than an established one. The analysis of the data also suggests that these organizational forces exert pressure in various extents. What is less clear, however, is the degree to which each factor can impact on the overall safety of medication administration. The influence of such factors therefore may not be absolute, and remains relative to the context of the other interacting factors.

7.3.2 The Blue Bible: The Story of Compliance

The issue of compliance with the medication administration protocols and guidelines has been a recurrent theme in many participants' views. For example, many participants have, on many occasions, praised the existence of IV medication administration protocols and guidelines in their wards, which were dubbed the "blue

bibles" that everyone could refer to, to check any information related to the

medication administration process, such as the appropriate route of administration:

> I do always check with the blue book. It just gives me confidence in
> the minute. I know, for instance, Vancomycin five hundreds is done in
> so and so mls of water for injection. Now I know that, but I still check
> to make sure it is still the case, it is just for my own piece of mind …
> to be fair, I don't know any nurse really in this ward and in [name of
> another level 2 critical care ward] who does not look at the book blue,
> the blue bible.

> [Randa, staff nurse, level 2 critical care, the Beech Hospital].

It also appears that the importance of the medication administration policies and

guidelines has been communicated among many participants themselves. This is

exemplified by passing on this recognition to other nurses, particularly to those who

have joined the wards recently, or those students' nurses who are doing placement in

the wards where this study took place:

> If I'm checking the drug with a newly qualified nurse, then I will bring
> the book so she knows exactly what she is checking, so she is not just
> taking my words, and she realizes that it is what is in front of her, she
> has always got the book in front of her …

> [Randa, staff nurse, level 2 critical care, the Beech Hospital].

In developing and implementing medication administration rules, many participants

tend to assume that these rules are effective ones for patient safety, and they need to

be followed. However, their views also suggest that having medication administration

protocols and guidelines in place does not necessarily mean that these written rules

will always be observed and adhered to in practice. In fact, some of the participants

acknowledged that one of the precipitating factors for MAE's and near misses is non-

compliance with the established medication administration protocols in their wards. Annette, a clinical governance nurse, was resolute in implicating non-compliance with hospital protocols as one of the main factors for unsafe medication administration practice reported to her in the wards:

> Researcher: So what do you think can really jeopardize the safety of medication administration in critical care wards … such as your ward?
>
> Annette: well, the main issue is the non-compliance with policies and procedures for medication administration, in term of actually checking of everything ... If the people did comply with those policies, then we wouldn't have any drug errors, because you wouldn't be able to go that far without detecting any error.
>
> [Annette, clinical governance nurse, level 3 critical care, the Beech Hospital].

One issue that appears to cause non-compliance with the established protocols and guidelines for medication administration is the existence of conflicting protocols that oversee the practice of medication administration. Leslie explained that, on occasion, there are many contradictions between the ward policies on some of the IV medication administration policies, as well as those mentioned in the British National Formula (BNF), which is another reference book used by her colleagues in the ward to provide information about the medications administration:

> We have a local one [IV drug administration book] for the unit as well as the Trust one. So if you've got a drug that goes in an infusion, you look it up, and it tells you exactly how much, what the doses are, what it can be mixed with, and what it can't be mixed with, and that is principally prepared for ITU, but some of the drugs that we use we have it in a different level to what the BNF [British National Formula] says, so which one you would follow?
>
> [Leslie, staff nurse, level 3 critical care, the Oak Hospital].

Jim has also highlighted discrepancies in some exiting protocols for medication preparation in his ward. He drew on his experience in preparing one medication - Sodium Nitorprussid - and how he found contradictory information about how to prepare and administration this medication in the ward:

> The medication information leaflet is just rubbish. We end up with five hand written instructions kicking around the unit; it [Sodium Nitorprussid] is quite a dangerous drug. So it has to be wrapped up in a foil, and the information leaflet says that it should be prepared in one way, whereas the way that it has always been given here and in another unit in this hospital is different, and so I find myself often going to that the leaflet which says this, but the management staff say do this.

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

Jim expressed a sense of frustration when he faces similar situations due to the lack of instructions as to how to prepare and administer Sodium Nitorprussid, but also due to the lack of decisive action to resolve this issue, despite the fact that he has highlighted many of these problems to the management team in his ward. The whole situation appears to be begging for the standardization of the information related to medication preparation and administration. Yet again, the lack of feedback on incidents reported is demonstrated when Jim described his efforts to seek solution for the inconsistency in the Sodium Nitorprussid preparation and administration guideline:

> I did an incident form a couple of years ago, because I was concerned of the different piece of information about the correct way to assemble it [Sodium Nitorprussid]. Nothing really happened. I highlighted it for the management, so what else you can do?

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

There is evidence from the participants' views that they were trying to discipline themselves in terms of adhering to those policies and protocols to inform their medication administration knowledge and skills. This was evident in Jim's views when he stated that he would reluctantly follow the Trust's protocol if it conflicts with other guidance on preparing and administering the medications, such as the BNF:

> I would follow the Trust IV guide; if it says that, then that would be the way we do it. It is the Trust policy, isn't it? It is hard to ignore the Trust's policy on drugs ….

> [Jim, staff nurse, level 3 critical care, the Beech Hospital].

Although the positive attitudes of staff toward these policies and protocols may suggest a trend where the participants' adherence to these policies is the common practice, and deviation is an exception, a number of participants were critical of some aspects of these protocols, which may in turn lead to low-compliance Therefore, it can be concluded that full compliance with the protocols of medication administration among the participants may not be assumed in this study. This is in line with previous accident analysis which has shown that rule-breaking behaviour is a common problem in the context of organizational safety (McDonald et al. 2000b). Moreover, the participants' views in the current study suggest that non–compliance with medication administration rules is mostly a result of violation rather than genuine error, according to Reason's 'taxonomy of human error' (Reason 1990). In other words, not to adhere with the Trust's guidelines on medication management was a deliberate decision on the part of some participants. However, it is important to consider the context in which such a violation occurred, and whether there are factors which may precipitate such risk-taking behaviour among participants. For example, some participants felt

confused in deciding which protocols to follow, because some of the existing protocols and guidelines seemingly provided contradictory guidance on how to prepare and administer some medication, therefore, violating some protocols would seem inevitable. In these instances, system flaws rather than individual shortcomings led to some procedural violations of the medication administration guidelines.

There is evidence from the literature which suggests that the proliferation of different rules has led to a confusion among healthcare professionals about the status and the functions of the rules, protocols and guidelines (Parker et al. 2005). Conflicting goals and information provided to healthcare professionals have also been found to hinder compliance with the established organizational rules advocated by such goals and information (Reason et al. 1998). In the context of this study, conflicting protocols may reduce the efficiency of the expected benefits of the established rules which govern the process of medications preparation and administration. The effectiveness of any established protocols and guidance of medication administration can credibly be assumed in the context of the environment which facilitates the staff compliance to these protocols.

In summary, medication administration policies and protocols have been endorsed by many participants as an influential feature of resilient medication administration. Adhering to these protocols appears to be more challenging than establishing them. The participants' views suggest that nurses are faced with huge expectations from the organization to comply with such rules and regulations. However, it seems much of attention was devoted to establishing and writing up these medication administration policies and guidelines, and less attention was devoted to defining the ways to

facilitate the nurses' compliance with such rules, particularly where the system and work environment are not designed and prepared to facilitate such compliance. This was perceived to put the participants under pressure to be fully compliant with those guidelines, which they feel is not always feasible.

7.4 Medication Safety: the Context of a Safe Working Environment

The following discussion examines the participants' views on the context of safe medication administration in a critical care ward, and how the contradiction between various work subcultures can impact on the perceived safety outcomes of medication administration. This was demonstrated in the participants' views on the mixed message they received from two subcultures on the need for error-free practice, but also their confusion regarding the position of patient safety priority in the wider organizational scale.

7.4.1 The Search for Perfection

This section examines the participants' views on establishing the notion of human fallibility in pre-registration nursing training from one side, and in actual working culture in the other one. A number of participants criticized the content of pre-registration nursing training. Such criticism stems partly from the lack of adequate education relating to the medications' pharmacology and dose calculation. This was evident in one participants account:

We didn't have sufficient drug calculations; we didn't look at the individual drug. We didn't do any pharmacology course … none … none … any at all.

[Sally, senior staff nurse, level 3 critical care, the Oak Hospital].

The participants' views suggest that the learning process that is initiated in the pre-registration training appears to have enforced a "fearful" image among many participants from being involved in MAE's and near misses. This is often associated with the fact that the knowledge and skills that nurses have acquired during their pre-registration training appears to carry the notion of perfectionism. One nurse spoke of how the tutor has emphasized the need for nurses to be flawless when it comes to calculating the medication doses; otherwise the nurses have to face the consequences:

I think the School of Nursing made such a fear in you, saying that it [medication administration error] has happened in the past and they are telling you stories about things that have happened to previous newly-qualified nurses who have made this mistake and they have been struck off, which does scare you and makes you nervous when you doing drug calculations. So you think OK, I need to make sure that I get it right.

[Sonia, staff nurse, level 2 critical care, the Beech Hospital].

It was not surprising that many participants complained of the enormous pressure placed on them to "get it right" when it comes to calculating the doses of medications to be administered. Alternatively, not being faultless would lead to the nurses being "struck off" the professional register; in addition to the perceived destruction of public image among the nurses should they make a medication error, and therefore breaking this perceived perfection obligation. This appears to represent a strong impetus for the *then* student nurses to avoid being faulty in calculating the correct medication dosage,

but also suggests that the problem, if it happens, is pertaining to the individual nurse for being personally inadequate in their medication administration practice. Moreover, the previous quotes may also suggest the low integration of what Reader et al. (2006) called the "non-technical skills" which are crucial for safety, which advocate the importance of effective team work and communication related to the establishing of a safety culture. Similar views were echoed by a ward manager, who appeared to question the quality of the nursing training that advocated the ceaseless strive for perfection, whereby nurses should never make any mistake:

> I think that we need to change people's philosophy and their sort of attitude towards giving medications, and take people back down to basics that we are all human, and we make mistakes. As far as the safety things are concerned, I do wonder sometimes whether how much input students get from their training as far as the medications is concern, and giving medications as an extended role with other thing. I do wonder whether there could be more input as a student nurse to being prone for error as part of their training and being fit for purpose if you would like. It does concern me that, and whether they are properly or adequately prepared enough for what the expectations are really at the end of the day.

> [Jenny, ward manager, level 3 critical care, the Beech Hospital].

The participants' experience in the clinical environment where the study took place appeared to be more sensitive to the context in which unsafe medication administration occur. Furthermore, their criticisms toward lack of their human factor education may suggest awareness of the inevitable influence of such issues as the safety of medication administration. They appear to be more receptive to the idea of human fallibility for error, and that making errors is considered an inevitable by-product of working in a complex organization such as a hospital, where even senior members of staff are not immune from mistakes. The views of some participants do

suggest that some degree of fear of punishment may still be expected in their work environment, their views nevertheless imply that their pre-registration training had an important role to play in accepting the un-attainability of human perfection, and that the process of medication administration is not problem-free:

> …if you were taught well from the School and also from your mentors, and you've shown a good examples, then you're gonna follow that through into your practice, and then as a nurse, when you practicing yourself in the ward, you then realise that mistakes happen and will always happen…. I think this can contribute to a good drug administration.

> [Lottie, staff nurse, level 2 critical care, the Oak Hospital].

The maturity of working culture in dealing with aspects of safety issues can be seen from the some participants' perceived shift of focus towards the system, rather than the individual nurse. This was exemplified in this study by the role-modelling strategy employed in some of the critical care settings investigated. For example, when junior nurses are inspired by the fact that a senior member of staff admits publically that they were involved in unsafe medication administration. Such behaviour is likely to dispel the perfection myth among nurses, particularly the newly-qualified ones:

> I think at the end of the day we are there to set the role models and to set the examples. I'd far rather that somebody, I mean I don't sort of confront with other people eagerly, but I'd rather somebody follow my example if I made a drug error and admit it. I think you see a growing trend for accepting error when it comes to drug administration.

> [John, ward manager, level 3 critical care, the Beech Hospital].

It is important to point out that while the participants' views may suggest more maturity in understating human fallibility and other issues related to the establishment of safety culture, their views appear to lack any discussion of any formal post-registration training to address and manage the issue of unsafe medication administration, although such a problem - the MAE's and near misses - are well-documented problems in the literature and in the high-risk environment of critical care. The views of Jenny, a ward manager in level 3 critical care settings (see p. 270) appear to direct the criticism towards the pre-registration training education, but there was hardly anything about any strategies utilized in her working culture to challenge the lack of human factor education in pre-registration education, and the influence of non-technical skills on the safety of medication administration, for example, the lack of any induction program which incorporates these issues.

The participants' views have highlighted the inevitable clash between two contrasting cultures upon their transition from being student nurses in the School of Nursing, where a number of the participants suggested that some aspects of the pre-registration nursing education appeared to have focused on the perfection of task execution and the need to "get it right", to being fully-qualified nurses in hospital settings, such as critical care settings, where there seem to be a growing degree of latitude towards asserting unsafe medication administration behaviour toward the system, rather than the individuals, although such a culture does not seem to hold unanimous conviction among the all the participants. However, it is useful to point out that moving from one status to another (i.e. moving from being student nurses to being fully-qualified nurses) does not necessarily mean that nurses would automatically change their perceived conceptions about their liability to MAE's and near misses. Randa

acknowledged that it will take time for the people to change their perceptions about human perfection when it comes to medication calculations. Furthermore, whether newly-qualified nurses retain their ideas taught in their pre-registration training (whether in practice or university), or accept the new culture as it appears, seems to be largely reliant on the extent to which safety culture is endorsed in the new environment, and whether it fosters greater understanding for this concept:

> I mean the way you are supposed to work out your drug calculations is exactly the same in practice as what they give you in the School of Nursing. But I think a lot of the newly-qualified nurses have said that during that transition from being a student to staff nurse … You are not necessarily trained in the School of Nursing to accept doing mistakes, but you will be introduced to the concept of it at work.

> [Sally, senior staff nurse, level 3 critical care, the Oak Hospital].

Reason (1990) suggested that most errors take systematic forms that are generally rooted in adaptive cognitive processes. They are intrinsic parts of mental functioning, and cannot be eliminated by training no matter how extensive or effective the program may be. For this reason, it is now widely-held among human reliability specialists that the most productive strategy for dealing with active errors is to focus upon controlling their consequences rather than striving for their elimination. Leap et al. (1997) argued that a system which relies on the perfect performance of the individuals is doomed to fail for the simple reason that humans are incapable of perfect performance. They suggested that healthcare professionals need to fundamentally change the way they think about human errors.

The sense of human perfection that some participants appeared to have received from their pre-registration training, whether in theory or practice, and sometimes in their

practice at post registration level, was suggested by some participants to fuel their desire to appear competent, suggesting that it leads to covering-up any mistakes which can damage this image. In his landmark article *Error in Medicine* (1994), Lucian Leape voiced a criticism of the training of healthcare professionals which emphasizes the need for error-free practice. Such practice was said to undermine the reliability of the medical domain, and contrasts sharply with the open and fair culture that dominates high-reliability organizations. Other industries that place safety in a paramount position, such as nuclear power plants and aviation, have incorporated these human factor topics into both the training curriculum and continuing professional development programmes (Helmreich and Merritt 1998). He also suggested that this practice in medical domain has been reinforced by the unforgiving, censuring hospital practice and blame culture, which has created strong pressure on individuals to cover-up mistakes. While his latter claim may be true in some circumstances in the current study, some participants' views do suggest a growing hospital culture which accepts human fallibility, and that "mistakes will happen and will always happen". What is less clear, however, is the extent to which this culture can accept the notion for human fallibility, and the threshold of unsafe medication administration practices which can be regarded as a system problems, rather than individual ones.

There is evidence from the UK literature which suggests that basic concepts such as the causes of human error and the limitations of human performance could effectively be taught at an undergraduate level. Documents relating to medical undergraduate education, such as *Tomorrow's Doctors* (General Medical Council 200*2)* and *Outcome Based Learning* (Harden et al. 1999) all include reference to some aspects of

human factor content, and an increasing importance being placed on aspects of patient safety. Glavin et al. (2003) found an increasing number of courses, addressing various aspects of the human factor, which are beginning to appear in hospitals around the UK and beyond. However, they suggested that these efforts would have little benefit if they are not reinforced either directly or indirectly via role models in the real clinical settings. This may explain the growing trend indicated by some participants, which suggests that hospital culture could be ahead of the academic one in terms of addressing the human factor in the in-house education and practice for the healthcare professionals. This was evident in the views of Jenny (see p. 269), when she criticized the quality of pre-registration nursing education, and exhibited at least an awareness of such problems on the ward level.

The potential safety impact of teaching non-technical skills for post-registration education has also been highlighted in staff education in the critical care settings. Reader et al. (2006) found that a large proportion of the contributory factors underlying critical incidents in ITU could be attributed to non-technical causes. Previous research in the importance of non-technical skills among the anaesthetists (Fletcher et al. 2003; Flin et al. 2003), and scrub nurses (Flin 2008). The findings from this research dictate the need to conduct similar research to explore the types and nature of non-technical skills on the safety of medication administration in adult critical care settings.

In summary, the participants' views appear to criticize the pre-registration nursing training in terms of focusing on individual perfection, while at the same time suggesting that hospital culture is better equipped to incorporate the human factor

principles among critical care nurses in the current study. The clash between the two cultures seems to be reflected in the way the participants expressed their views on the transition from being student nurses, to becoming fully-qualified nurses thereafter. Evidence from the literature suggests that pre-registration nurse training, as well as other health professionals training, is beginning to incorporate lessons from human factor disciplines, but they have yet to do so in a systematic and organized manner.

7.4.2 Competing with Patient Safety

According to many participants, there were many priorities at the Trust level that were competing with patient safety. This was reflected on two main levels. Firstly, the location of patient safety on the macro level, as regards how much attention is given to patient safety from the Trust's organization and management, and secondly, the level of attention given at the micro level by those on the front line (i.e. nurses). This section aims to assess the participants' perceptions of the location of the patient safety priority at the Trust level, but also among themselves and fellow colleagues in the critical care settings where the study took place.

Participants described how much attention was devoted to the concept of patient safety by the hospital management. Some of them expressed seemingly positive views about the Trust's commitment towards improving patient safety. Most of these positive views have come from senior nursing staff, who appeared protective of the Trust and the top management position on this issue:

… over the years, I think the patient safety has got a higher profile, not less profile … actually it isn't cheap to let people to compromise the standard … there are incentives to improve patient safety. Because if you can be good in risk management, the Trust can actually get more money … we also get other things like foundation status. Therefore, patient safety has to stay in the high profile really, and I think it will always be in this Trust.

[Annette, clinical governance nurse, level 3 critical care, the Beech Hospital].

However, some participants expressed some pessimistic views regarding the way the top managers are taking the issue of patient safety in the Trust. They appear to indirectly convey this pessimism to Government policy, rather than the Trust they are employed by, as a precursor for such shifts in the patient safety agenda:

I think patient safety used to be more of a priority some years ago. I think now there are some sort of financial constraints, you've got to get the patient through, even if that means not doing things as they should be done, trying to speed things up ...

[Hani, senior staff nurse, level 3 critical care, the Beech Hospital].

These views were also echoed by Fiona, who expressed that the only way the Trust would seriously take notice of the patient safety issue would be when an incident happens:

I think if it [patient safety] becomes an issue, then they take more notice. I think if an incident form is filled in, or if actually, something happened, they would probably take more of a proactive approach, they will say "Ok fill in a risk assessment". Otherwise, I don't know really what will happen without incident taking place.

[Fiona, senior staff nurse, level 2 critical care, the Oak Hospital].

So some participants' views may suggest a mismatch between their perceived priority of protecting patient safety, and those with the Trust management which are seen to be skewed towards achieving the financial targets and limiting the cost of providing healthcare to the patient. Some participants, however, acknowledged that competing priorities at the Trust level may make it difficult to accommodate all the patient safety agenda:

> … They've got to balance the books for one, which is a legitimate concern, but they are also looking at the patient safety, but they do compromise it in other ways, and we are concerned with protecting the patient, but we cannot do that without adequate support from the Trust. … so it is a dilemma.

> [Tom, senior staff nurse, level 2 critical care, the Beech Hospital].

Such contrasting realities appeared to produce polarised views among some participants. One participant expressed his concerns that Trust management is preoccupied with achieving a politically and economically-driven agenda more than developing and sustaining patient safety. Instead, he called for making the NHS independent from the Government influence, such as the Bank of England, where the priorities are set according to the local needs on the ground:

> I think the NHS on the whole needs to be taken out of the political arena. It has been used as a political football by all the major parties for a long time. It is a right that it needs to be run by a whole new commission … a bit like the Bank of England now, it is under it is own control. The NHS needs to be under the control of the NHS, not the politicians in charge of running the health service. We should be an independent body who is just solely interested in healthcare of the nation, not which politicians and which party is in power ….

> [Hani, senior staff nurse, Level 3 critical care, the Beech Hospital].

When discussing their commitments towards patient safety, the participants portrayed a contrasting picture to the one they conveyed to the Trust, and have almost unanimous views that the patient safety is number one priority for them, and they are striving to keep in that remit:

> I think the patient safety has always been in the first instance for us [critical care nurses] … I mean I was taught this in day one in the ITU.
>
> [Nadia, senior staff nurse, level 3 critical care, the Oak Hospital].

Participants also gave evidence from their daily practices which, according to them, demonstrate their commitment to ensuring patient and medication safety:

> We've always been taught from the start that if the alarm goes, check that, and you always check the patient first, don't worry about the machinery, check the patient, because you always look for the breathing, signs you as a nurse can tell that there is something wrong. Therefore, I think patient safety has always been an issue for us … I think it [patient safety] is very important for us and has been stressed for, and I think it has always been ....
>
> [Nadia, senior staff nurse, level 3 critical care, the Oak Hospital].

The participants were keen to emphasize their high regard for patient safety and welfare. Moreover, they expressed positive emotions around the safety successes they attributed to their personal abilities and talents, which were perceived to lessen errors and patient harm. This is consistent with the findings of Elder at al. (2008), who conducted focus groups to assess nurses' perceptions of patient safety in Intensive Care Unit. They noted that the patients' well-being was the nurses' highest priority in their job. Similar findings were also reported by Mohr et al. (2004), who found that an essential component of the healthcare micro-systems, such as nurses, clinicians,

and support staff, is that they recognize their efforts as part of providing effective care for the patient, while also maintaining safe operations within the larger macro-system.

Although a number of participants in this study maintained that patient safety remains the top priority for the Trust, others appeared doubtful about this notion, not only because their perceived lack of support from the Trust's management was seen as an obstacle for them to function successfully, but also because of the perceived contradiction between the Trust's perceived stance of making patient safety a top priority, and the lack of support from the Trust to materialize this notion on the ground. In the context of evidence, the support of the healthcare organization for its micro-system components, such as nurses, doctors, and pharmacists, was cited to be essential for delivering safe and high quality healthcare. For example, Nelson et al. (2002) studied the characteristics of the safe and resilient performance of a healthcare organization. They found that among nine factors, leadership and macro-organizational support for its micro-system components were precursors for sustaining the safety and performance of the organization. Furthermore, the conflicting priorities between the micro-system components (i.e. The need those exhibited by the needs of the front line staff) and their larger macro-system (i.e. The need for those on the top management echelon) contribute to the micro-system's inability to provide superior, cost-effective care, and at the same time to create a negative, less attractive working environment.

The participants' views suggest that both the participants and the Trust's management appear to have differing drivers to the patient safety according to the Trust management. Their views suggest that their perceived commitment and ability to

improve and sustain the safety of their patients was clashing with those of the Trust, which was perceived to be more interested in other priorities, although such clashes were, according to some participants, inevitable. There are many aspects in the NHS that are competing for the attention of the managers, and trade-offs may be an inevitable outcome (Paul 2001). However, such perceived clashes would not be helpful in terms of establishing a safety culture in healthcare organizations, according to Kirk et al. (2006), who suggested that one of the principles of positive safety culture is the existence of shared perceptions of the importance of safety, and while most of the participants appeared to suggest that the Trust is on the opposite side of the safety drive, this may create a fertile culture for resentment and devaluing of their personal integrity.

In summary, the participants' views have, on many occasions, suggested a discrepancy between their drive to safeguard the patient safety, and the one adopted by the Trust management on the macro-level. While some participants considered this reality to be an outcome of the competing priorities that the Trust managers face, other participants used it to justify their sense of scepticism about the Trust's true commitment to drive patient safety forward.

7.5 Concluding summary

This chapter gives an insight into the participants' views on the dynamics and interaction between many factors that influence the safety of medication administration, and how these dynamics impact on the overall safety. The analysis of the participants' views on the context of the working environment suggests that the communication style between nurses and other healthcare professionals remains an

influential determinant for the safety of medication administration. Its influence depends crucially on the interactions between many organizational tools, such as the organizational culture and management, which often impact on the overall patient safety in a contradicting manner. Some aspects of the working environment are perceived by the participants to be essential for the safety of medication administration, but were not equally considered as problem-free, and they exist with their own inherited problems. Incident reporting is said to be one of the navigational aids for the organization. To be effective, the participants have to use it effectively and learn to report incidents of unsafe medication administration practice. In this context, the reporting behaviour appears to be subject to the sum influence of the incentive and disincentive factors embedded within the organization.

In general, there were expectations from the participants that medication administration policies and protocols provide important and standardized guidance on how to administer most of the medications, particularly the IV ones, and the need to adhere to it. Simultaneously, however, views from many participants suggest that the organizational structures were not adequately developed to ensure that those policies and guidelines are incorporated in every day practice. In turn, this has led to the creation of a pattern where procedural violations, risk-taking behaviour, and non-compliance with the policies and protocols of medication administration became often acceptable norms.

A fundamental issue that emerged from the participants' views was a variation in how they perceived, or perhaps were conditioned to perceive, their liability to unsafe medication administration. The participants appeared to have different perceptions of

the doctors' and pharmacists' liability to prescribing and dispensing errors. This may highlight how the questioning culture has been integrated in the participants' working environment, but also give impetus for future research to explore the underlying causes for such behaviour.

It is useful to point out that the paradoxes in the way many system factors appear to influence the participants' behaviour in the organization remain a relative issue. The complexity of the hospital environment, particularly the critical care settings, means that it becomes very difficult to quantify the influence of each factor on the ultimate medication safety. Moreover, the influence of one single factor cannot always be defined as mutually exclusive in relation to medication safety. For example, one can argue that the double-checking of medication prior to administration can reduce MAE's, because there will be another "pair of eyes" to ascertain that medication is prepared and administered correctly. On the other hand, the physical presence of checkers during the process of double-checking can lead to diffusing responsibility for both checkers, leading to potentially inadequate checking, hence, the safety of medication administration becomes the victim of its own guardian. Another reason for not assuming an absolute influence of those system factors is related to methodological issues. The complexity of the medical domain means that there could be an endless list of system factors that, in many ways, could interact and influence the safety of medication administration, sometimes in contradicting ways. This present a critical challenge for the OSSM, as it is difficult to classify those factors according to the model components. For example, what could be latent factors in one context, but could also be a system intrinsic one in different context. Only those factors which dominate the participants' views in this study have been discussed in

this context. The impacts of many other system factors which were not mentioned by the participants are likely to be overlooked. Therefore, For this reason, the data analysis suggest that the influence of one factor on the safety of medication administration may not absolute, but it is relative to the context in which it can be looked at. The next chapter will look at the critique of the OSSM model in the context of the data analyzed from this thesis.

Chapter Eight

Pulling the Threads Together:

Towards Organizational Perspectives on

Medication Administration

8.1 Introduction

Previous chapters in this thesis have sought to provide the theoretical and methodological foundations for investigating the organizational factors which influence the safety of medication administration in adult critical care settings. To recap, the literature review has indicated that adult critical care settings sustain higher rates of Medication Administration Errors (MAE's) and near misses than other general hospital settings (Cullen et al. 1997; Van den Bemt et al. 2002), and are often associated with more severe consequences (Calabrese et al. 2001). In line with the majority of health safety research, research into the safety of medication administration has focused narrowly on the factors which can potentiate unsafe medication administration practice, with less focus on those which can enhance safety and resilience. The Organizational Safety Space Mode (OSSM) was identified as a potential tool to address the balance between the negative face of the safety, such as accidents, and the positive face, such as resilience against accidents (Reason 1997; Carthey et al. 2001). This thesis utilized the OSSM as a tool to investigate the nurses' views on the organizational factors which jeopardize the safety of medication administration, as represented by the latent factors and the local contributing factors, as well as those factors which enhance the resilience of medication administration, as represented by the system intrinsic factors and navigational aids.

The three main themes presented in previous three chapters: *Building System Resilience*, *System Threats* and *Context of Safe Medication Administration*, showed how the participants' perspectives provided a useful starting point for understanding the contextual influences of the organizational aspects on the safety of medication administration. In order to meet the stated aims and objectives for this research, this concluding chapter seeks to address three main points. Firstly, to revisit the findings presented in this thesis in the context of wider literature on the organizational contributions toward the safety of medication administration in adult critical care settings. Secondly, to assess the adequacy of the Organizational Safety Space Model (OSSM) as a framework to investigate the safety of medication administration in adult critical care settings based on the findings presented in the past three chapters, taking into consideration the contemporary developments in the field of investigating the organizational safety. Finally, to suggest areas where further research is needed.

8.2 Socio-cultural dimension of critical care settings

The analysis of the participants' views has revealed three socio-cultural aspects which appeared to be influential to the safety of medication administration. These are: a questioning culture, the hierarchy between professions and the content of nursing education. The analysis of the participants' views suggests that being able to question any aspect of medication safety is a fundamental pre-requisite for a resilient medication administration practice. This is reflected in the ability of some participants', especially the senior ones, and their confidence in questioning a doctors' prescribing decision if they are uncomfortable with it. In contrast, a study in the US indicated that nurses in the ICU are less likely to speak up about problems related to patient care compared with doctors (Miller 2001; Thomas et al. 2003). Similarly, in

the UK, Reader et al. (2007) found that ICU nurses were less likely to challenge the senior or junior doctors regarding any aspects of patient care. They found that hierarchy, gender, and different patient care responsibilities and leadership are determining factors for open communication among various members of the critical care team. Moreover, Manias and Street (2001) reported that critical care nurses in Australia were reluctant to disagree with the doctors in discussing decisions related to patient care, and they also faced enormous difficulties in raising their concerns related to patient issues during the ward round.

The finding of the current study, where some nurses may challenge the doctors, appear to reflect changes in the traditional nurse-doctor relationships, which Stein argued is governed by the doctor-nurse game (Stein 1967), where the doctor's authority dictates the taken-for granted attitude of nurses. The participants' views in this study support previous evidence, which suggested that the perceived special expertise of critical care nurses can assist them in gaining the momentum in confront their doctor counterparts when they wish to challenge a medical decision (Chaboyer and Patterson 2001). Being preoccupied with the failure and anticipating an error before it happens is said to be a fundamental principle of engineering resilient organization (Reason 1990; 1995). Anticipating the doctor's propensity for error, and perhaps the desire to avoid being associated with the unsafe medication administration as a consequence of the doctors' unsafe prescribing, appears to empower some participants to stand up and challenge the doctors prescribing. What the findings from the current study add is the role of effective leadership in empowering the critical care nurses to challenge the doctors' decisions when it comes to patient safety. As evident in section 5.4.1, some participants in this study felt

supported by their senior nursing managers and colleagues when it comes to questioning the doctors for the sake of medication safety. However, the participant's views on their ability in challenging the doctor decision are not always reflected in the literature, and there seems to be still strong evidence from the literature about the very nature of nurse-doctor division of labour. In particular, its intricate intersection of structural power relations between doctor and nurses, means that it is almost inevitably a site for contest and negotiation (Rafferty, Ball et al. 2001), and while nurses in general, and critical care nurses in particular, have gone some way into increasingly their participation in decision-making process with doctors, it is clear that nurses were perceived, and did not perceive themselves to have a substantial power base within the decision making process. This left nurses feeling that there was little opportunity for them to input into decisions in formal ward rounds. One study in the interplay of knowledge and decision making between nurses and doctors in critical care ward round found that adult critical care nurses 'voice during the ward round was not visible. In fact, when nurses were able to speak during the ward round, they provided patient assessment information and asked questions on the patient's or family's behalf. Essentially, the nurses' contribution and communication during the ward round was reactive, which contrasted with the proactive stance of doctors, particularly the senior doctors (Manias. and. Street 2001). In ward settings other than critical care ones, there is evidence which suggest that nurse, particularly the senior nurses, may still able to question their doctor counterparts regarding aspects of patient care, and that the professional identity is related to demonstration of professional competence, particularly from those who are able to demonstrate their competency to medical doctors (often more senior nurses) (Pullon 2008) This in turn related to developments of mutual interprofessional respect and enduring interprofessional trust.

What is interesting is that they appear less likely to question the pharmacists about any aspect of medication administration, although there was no evidence to suggest that the participants were discouraged by their senior managers to follow suit with the pharmacist. One can suggest that the questioning culture is an important part of broader socio-cultural debate for the safety in any organization, and particularly in the context of critical care settings, where nurses are able to point out to the safe and unsafe aspects of clinical practice, with the benefits of patient safety.

It is noteworthy that some participants' views suggest that they feel able to question the doctors, particularly the junior ones, but in contrast, they exhibit different attitudes toward questioning other member of health care professionals, such as the pharmacists, but also among themselves, particularly the senior nurses. Such a situation may reflect the hierarchical culture perceived by the participants for the health care professions. The working culture in critical care settings appears to dictate that participants observe a particular hierarchy of professions when it comes to questioning aspects of medication management. In particular, the participants appeared empowered to question the doctor, but at the same time being less challenging both to the pharmacist and among themselves. The establishment of such unique hierarchy of professions among the participants in this study seems to be enhanced by the mutual adjustment from three professionals toward this hierarchy, according to the participants' views. For example, many participants suggested that the critical care doctors in this study appear to adjust themselves to the new culture of critical care settings, and feel positive toward the fact that nurses may challenge their prescribing decisions, or indeed any medical decisions related to patient care. The pharmacist and other nurses, particularly the senior nurses, appear to exercise their

role as "advice giver". It appears that the working culture, as well as the nature of nursing education, whether it is pre or post-registration education, can be influential in shaping such a hierarchy of professions among the participants. Some of the participants' criticism was directed towards the design and content of pre-registration nursing education. What appears to be lacking from their views is the presence of any formal in-hospital training. In particular, on issues surrounding establishing of questioning culture, and the lack of skills and understanding related to the human factors and the possibility of error which underpins the issue of technical competency in medication administration, often called the "non-technical skills" of medication administration (Glavin and Maran 2003). A study in the operating theatre found that non-technical skills for healthcare professionals such as team work, assertive communication (where anyone can question any aspect of unsafe practice), interpersonal skills, and situation awareness can significantly contribute to increasing patient safety awareness and reducing unsafe practice (Bleakley et al. 2004). In the context of the current study, such non-technical skills can be as important as those related to the technical issues of medication administration (i.e. policies and protocols, and training on the use of infusion pump). MAE's and near misses are well-documented reality in the context of critical care settings (Cullen et al. 1997; Van den Bemt et al. 2002). There is increasingly growing evidence in the literature which calls for shifting the focus from the individual to the system, using the human factor approach, when tackling the problem of unsafe medication administration (Department of Health 2004). However, the data analysis showed that this issue does not seem to be adequately addressed at the hospital level, for example, during the hospital induction programme when the participants first joined the critical care settings. Some participants' views suggest that the working culture in some critical

care settings appears to reflect a better understanding for the need to shift the focus from the individual to the system when it comes to investigating unsafe medication administration. However, it fell short of achieving a formal recognition of such matters via soliciting formal in-hospital training. One participant reflects the need to change the peoples' attitude towards the issue of medication error and safety, but fell short of advocating formal education in the hospital to challenge the quality and nature of practice experience and education received during the pre-registration training (see the views of Jenny, a ward manager, in section 7.4.1).

One issue which appears to have been discussed by some participants is the content of nursing education, which was perceived by a number of participants to emphasize the need for "perfection" in medication administration practice, when combined with the contributing factors, such as an unrewarding working culture for reporting unsafe medication administration practice. This situation was seen as a an important factor to covering up errors, rather than exposing them to constructive learning opportunities, and because nursing education is considered as essential for sustaining long-term practice (Blegen et al. 2001), any learning picked up during pre-registration training, whether in practice or in university, is likely to dominate nursing practice unless seriously challenged. The findings from this thesis suggest that way of teaching nurses may need some fundamental revision. Effective nursing education is likely to enhance patient safety when nurses are taught to question and challenge what they perceive as contradictory with principles of ensuring the safety of medication administration. It is imperative that any educational plan should encourage nurses, as well as other healthcare professionals, to speak up about their concerns in any aspects of medication safety, and where anyone involved not only in medication

administration, but also in patient care, is expected to be challenged and is receptive to being questioned, as long as the aim is to safeguard the patient.

8.3 Competing priorities for critical care settings

A wide range of latent conditions and local contributing factors were elicited from the participants' views leading to unsafe medication administration practice. In section 6.2.2, the participants' views on unsatisfactory communication channels between the top management staff in the Trust and the frontline nurses was found to be a fundamental latent condition, which appears to affect the nurses' performance and opens up opportunities for unsafe medication administration practice. This was particularly felt in the way decisions were imposed on front line nurses- such as coping with understaffing - rather than trying to engage them in the decision-making processes. The participant's views in this study also suggest that the nursing voice has been largely marginalized when it comes to supplying medicines to the ward, as their views were not considered when buying the medications that are felt safer to administer. However, this should be viewed in the context of other hospital work dynamics. Trust's managers are required to respond to external pressure to achieve targets which are essential to the Trust's performance. The financial constraints against organizational priorities are well-documented challenges in any healthcare organization (Travis et al. 2004). This may sometimes render the organization limited in the decisions and choices they can pursue. Moreover, it may not always be feasible to incorporate the opinions of those at the "sharp end" of the healthcare system, compared with the more senior managers, who oversee the wider picture, and are perhaps in a better position to balance the risks and benefits of involving many professionals in the strategic decision-making processes. Therefore, involving other

healthcare professionals in strategic decision-making processes should be based on realistic expectations from each party. Nevertheless, the analysis of the data suggests that the safety of medication administration can be best achieved by active co-operation between all parties involved in the manufacturing, purchasing, prescribing, dispensing and administration of medication, where each party can listen to one another's views on how to develop and evaluate a range of measures to improve the safety of medication administration at the sharp end of the system.

The analysis of the data suggests that imposing these decisions appears to reflect an external pressure on the Trust, where the study took place, to meet certain performance targets. This context may arguably provide internal representation of externally encountered pressure, and is said to be one way in which the organization manages uncertainties in their environment, specifically those created by legislative, regulatory, or market pressure (Power 2005). The participants perceived the Trust's need to respond to such external pressure as a precursor for such unilateral communication, which was felt to dominate the communication climate between the Trust management at the top of the hierarchy, versus those at the sharp end of the system (including nurses). One way of resolving such pressure is, probably, by having a consensus among all key healthcare professionals to diffuse the pressure, rather than passing it to the frontline nurses, and probably other healthcare professionals. But even reaching such a consensus with the frontline nurses, and other healthcare professionals, may compete with other organizational priorities, and may not be achievable. Managers in any healthcare organization are said to be under pressure to improve the performance of their organization, and any decisions they make are likely to be a compromise in respect of other issues (Reason 1997).

Some participants expressed concerns about the poor nurse-patient visibility as a result of ward layout, and the inability to double-check other medications because of the existence of partitions between the patients (section 6.4.2). Some of these concerns can be described as legitimate. Given the participant views on the complex interplay between many aspects that influence the overall safety of medication administration, the safety of medication administration in the adult critical care settings investigated can be subject to a constantly renegotiated set of inevitable tradeoffs. In this study, some participants argued that maintaining patient privacy and the desire to minimize the risk of cross-infection using ward partitions may have been traded-off with the risk of medication safety needs, which represents a tension between the ethical system components. These findings have been demonstrated in a previous study conducted in the Operating Room, where Espin et al. (2006) reported that the application of certain standards in a system often conflict with other processes and values. For example, the pressure to maintain Operating Room schedules or complete other tasks may conflict with the desire of nurses and surgeons to ensure accurate sponge counts. In the context of this study, it could be said that the participants are always under conflicting pressure, whether consciously or subconsciously, to choose to follow standards of medication administration, comply with protocols, or to simply carry out medication safety procedures. The direction of the pressure hosted by the organization appears to be decisive in defining what is given priority. Prior evidence in the literature supports similar claims. Carayon et al. (2005) found that a high nursing workload is often associated with negative patient out-comes, including unsafe medication management in an ICU. Such a high nursing workload was imposed by managers on the macro-level of the organization to meet "market pressure", which was manifested by increasing bed occupancy and financial

constraints. However, it does not consider the contextual organizational characteristics of a particular ICU, such as the unit layout, skill mix, patient dependency, and whether these factors are adequately addressed to meet the high work load. In another study, critical care nurses felt that strategic decisions made at the organizational level were made beyond their control, and were driven by incentives to meet government demands which are unlikely to be sensitive to their safe performance, including their medication administration practice (Wynne 2004). Given the competing priorities between safety, performance level, and resources constraints, a lesson that can be drawn from this literature, as well as evidence drawn up from the participant's views in this thesis, is that getting the balance right between the production demand and safety principles is a key to ensuring and maintaining the medication safety in the critical care settings investigated. It was suggested that organizational safety must not be relegated with respect to other priorities, nor be traded off at the margins for competing organizational values such as greater efficiency or production output (Schulman 2004). While acknowledging the inevitable, and perhaps the legitimate, tension between various organizational priorities, healthcare organizations must strive to explore strategies where such tensions can be best managed, and where organizational priorities must be balanced between safeguarding the safety of medication administration in critical care settings, while acknowledging the legitimate tension between various patient dignity, ethical, or moral organizational priorities and the strive for safety and performance, ensuring that the strategic goals of the Trust are met without compromising the safety of other operations.

The previous example provides evidence of the legitimate competition between various organizational objectives. So even if the principles of human factors are integrated into the organizational design, they can be constrained by the moral and ethical issues, but also by the departmental budget and the available resources to implement such changes. This is not to undermine the importance of integrating the human factors principle in any hospital design, but to recognize the contextual picture and the available resources which can, perhaps inevitably and understandably, hinder the implementation of such principles in practice. That leads to one of the arguments for this thesis that while important policies are established non-hierarchically in the organization, such as critical care settings, without explicitly favouring one aspect on another, the health care professionals (including nurses) appear to re-arrange these policies in a hierarchically manner according to their perceived needs in their specialities. Providing patient dignity and privacy by being nursed in an area physically separated from other patients seems to be on the Trust agenda when building the critical care settings, in addition to other agenda such as infection control agenda. However, the participants in this study appear to redefine this hierarchy of agenda by valuing the medication safety one, which is demonstrated in the patient being visible all the time. Their redefinition of such agenda was translated into the disregard of the partitions between patient beds.

The argument of redefining the priorities on the profession level for the staff and organization has been echoed in the literature, for example regarding the role of the medication labelling and packaging in precipitating unsafe medication administration practice (Kenagy and Stein 2001; Tuohy and Paparella 2005). Gosbee (2002) has suggested applying human factor engineering in the hospital to a wide range of areas,

including procurement, design, and awareness-raising activities. However, Singh (2004) suggested that patients admitted to skilled nursing facilities should receive such therapeutic interventions within a human context that emphasizes dignity, self-esteem, and personal choice as overarching factors that govern the clinical and socio-residential elements of service delivery. He also suggested that achieving the appropriate blend of clinical and socio-moral services is the goal which guides the way in which the facility's structures are developed and processes are implemented. Therefore, the ethical and moral issues are often contestable when evaluating the patient's needs in comparison with other benefits such as patient safety, and the debate is likely to continue on this issue. It is imperative that the environment design attracts less criticism if it is able to accommodate the ethical, moral, and financial concerns, as well as paying adequate attention to the concerns of patient safety.

Based on this argument, two findings from this research can be pulled together. Firstly, the questioning culture appears to be an influential strategy for safe medication administration. Secondly, the content of nursing education (whether it is in pre-registration stage or post registration education) can play a significant role in instigating and enforcing such a culture. The suggested lack of formal training of some participants on the non-technical skills can present little challenge to the "myth of perfection" that many participants appear to acquire during their pre or post registration training, which may lead to mistakes being hidden as a consequence of this. Moreover, the lack of such formal training may precipitate situations where participants are less likely to challenge the pharmacist, or indeed to challenge and question one another, for example when they handover patients between shifts. In the context of this study, such a questioning culture may not be fully utilized; particularly

where nurses felt unable to question, on occasion, the pharmacist's dispensing decision, or indeed their colleagues generally.

The participants' views suggest that there is a need for a considerable rethink of how to prepare nurses to work in critical care settings, and how to learn to administer complex medications to patients with rapidly changing conditions, including the incorporation of the "non-technical skills" in pre- and post-registration nursing training. Furthermore, effective partnerships between all healthcare professionals is maximized when everyone involved in medication administration is able to discuss, question, and if necessary, challenge one another, regarding any aspect which is relevant to the medication administration practice. The absence of a culture which endorses such attitude is likely to result in many, and perhaps serious, MAE's and near misses being invisible, rather than being brought into the open, addressed, and prevented from re-occurring. The focus on the possibilities of failure appeared to be often reinforced by the culture of critical care settings, where the psychological orientation, attitudes, and values are distributed among its members. This is illustrated in what is called "getting smarter in predicting the next accident" (Dekker 2006.p 79), where attention is directed ahead to possible failures against which the organization may yet be unprotected. The participants' views suggest that their critical care setting appears to employ a variety of checks and counter checks among the nurses, including multiple sign off, as a precaution against potential mistakes. These properties are observed in high reliability organizations, and are embedded in both their structure and culture (Schulman 2004). Further research will be useful to investigative such discrepancies in the nurses' attitudes towards questioning the doctors, pharmacists, and nurses in adult critical care settings.

Another argument that can be pulled from the thesis findings is that the competing drivers of organizational priorities, such as the need to maintain safe medication administration, reducing the associated costs, and improving the Trust's performance, appear to be inevitable competing out-comes in any organization, and the debate perhaps needs to focus on how to best manage such tension to produce the best possible realistic outcomes for the safety of medication administration, while taking into account other organizational priorities. It was suggested that organizational safety must not be relegated with respect to other priorities, nor be traded off at the margins for competing organizational values such as greater efficiency or production output (Schulman 2004). While acknowledging the inevitable, and perhaps the legitimate, tension between various organizational priorities, healthcare organizations must strive to explore strategies where such tensions can be managed effectively, where organizational priorities must be balanced between safeguarding the safety of medication administration in critical care settings, while acknowledging the legitimate tension between various patient dignity, ethical, or moral organizational priorities and the strive for safety and performance, ensuring that the strategic goals of the Trust are met without compromising the safety of other operations.

One implication that can be drawn from the aforementioned finding is that broadening the focus to incorporating the views of nurses, pharmacists, doctors, and patients in shaping key decisions and strategies related to medication safety is likely to yield a safer approach. However, this should be taken in the context of realistic expectations, and to acknowledge the feasibility of such actions may mean that the ultimate decision is likely to be a compromise between the views of those professionals, and the pressure exerted by other factors, such as the financial constraints.

8.4 The Safety of Medication Administration: The Contextual Influence of Organizational Safety

The analysis of the participants' views has revealed that some aspects of the critical care settings appeared to have contradictory influences on the safety of medication administration, depending on the context in which they are evaluated. The literature review highlighted the influence of such safety paradoxes. For example, Reason (2000) suggested that measures designed to enhance system safety can also bring its own destruction. In the context of the current study, the pharmacist role was perceived by many participants as a defence against unsafe medication administration practice. This is in line with the initial expectations from the literature, which suggest that pharmacists can have a central role in improving the safety of medication administration in critical care settings (Leape et al. 1999; Department of Health 2004). At the same time, many participants expressed their full faith in the pharmacist's dispensing decision and practice, although medication dispensing errors are well-documented (Beso et al. 2005). The later attitude appears to overlook the fact that the pharmacist is vulnerable to error, and this contrasts with the questioning approach that dominates many of the participants' attitudes toward the doctors. Many participants expressed their lack of knowledge of medication pharmacology, which seems to hinder their ability to question the pharmacist. In addition, the dynamic of the relationships between the nurses and the pharmacist, where the nurses appear to be completely dependent on the knowledge, expertise, and advice of the pharmacist, seems to engender the participants less empowered to challenge them. Pepper (1995) found that adequate knowledge of pharmacological features of medications significantly enhances nurses' ability to detect unsafe medication management. Other

evidence from the literature endorses this assumption (Manias and Bullock 2002; Morrison-Griffiths et al. 2002). This brings the argument back to the quality and nature of participants' pre and post registration nursing education. The pharmacology education received by the participants during their pre-registration training was criticized by many participants, particularly for being inadequate in terms of the depth of information provided (section 7.2.1). Improved pharmacological teaching in the pre-registration nursing curriculum and during the induction program is likely to increase nurses' confidence in performing safe medication administration and decrease the anxiety associated with it (King 2004). In this context, a revisit to pharmacology education for the pre-registration nursing training may be necessary to ensure that future nurses have adequate knowledge both in medication pharmacology, and the dispensing role of the pharmacists. This is likely to improve their confidence and ability to assert the safety of the medication they are administering.

Another contextual influence on the safety of medication administration perceived by participants can be elicited from their attitudes towards the double-checking of medication prior to administration. While many participants have acknowledged that checking the medication by another member of staff is essential to minimize the opportunity of any unsafe medication administration, they recognize that genuine double-checking does not often take place for variety of reasons. Dilution of responsibility was suggested as one reason (Armitage 2007a), whereby each checker assumes that the other one has checked the medication, and therefore, the medication ends up being improperly checked. Improper double-checking can also be ascribed to "confirmation bias" (Cohen 2000), where a second checker tends to overlook the evidence of contrary. Thus, depending on the context in which it is practised, double-

checking of medication can be a safe or unsafe practice in terms of its impact on the safety of medication administration. This finding reflects in many ways the controversy in the literature surrounding the claimed benefits and risks associated with the practice of double-checking of medication. For example, some studies argued that double-checking of medication reduces opportunities for unsafe medication administration on the grounds that if one person misses an error the other will detect it (Kruse et al. 1992 ; Hodgkinson et al. 2006). Others warned against the negative impact of double-checking as it provides a sense of false security due to diffusion of responsibility among checkers (Catlin 2004; Armitage 2007a) or the ambiguity of the role of second checker (Sanghera et al. 2007). What the findings from this thesis suggest is that the contexts in which the double-checking of medication are conducted is likely to have a significant role in determining the risks and benefits associated with the double-checking of medication prior to administration, and unless the context is looked at adequately when evaluating the impact of medication double-checking in medication administration practice, the controversy surrounding the adequacy of medication administration is likely to continue.

Many strategies have been suggested to counter the risk associated with double-checking of medication prior to administration, particularly the risk of diffusion of responsibility. For example, Armitage (2007) suggested encouraging critical thinking while checking by enforcing a time difference and distance between the checkers (independent checking). Others urged the establishment of a clearer definition of the role of both of the checkers, therefore addressing some of the inherent social hierarchies that contaminate the process within and across the professions (Sanghera et al. 2007). The "Challenge response" method was also said to reduce the risk

associated with double-checking, whereby the second checker checks to refute, rather than to confirm, the information being asked to be double-checked (Stokowski 2007). Moreover, it was proposed that the introduction of bar-coding technology for the medication administration can reduce the MAE's by replacing the whole process of the double-checking of medication with a computerized bar-coding technique (Pedersen et al. 2003; Round Discussion 2003; Department of Health 2004). However, experience in several domains has shown that automation can create confusion and decision errors that can be made more dangerous than the slips and lapses it was intended to avoid (Sarter and Woods 1992; Hughes 1995a). An ethnographic study to explore the nurses, doctors, and pharmacists' interaction with a newly-instigated computerized system for bar-code medication administration (BCMA) found that nurses were confused over the automated removal of medication by the BCMA (Patterson et al. 2002), where the observed side-effect might create a new path for adverse drug events. Therefore, more research is needed to assess the feasibility, applicability and the cost of introducing such new technology.

8.5 Organizational Contributions towards the Safety of Medication Administration: A Model Evaluation

This research sought to provide a better understanding of the organizational contributions towards the safety of medication administration in adult critical care settings as perceived by a sample of the nurses who participated in this study. Many of these factors have been identified and analyzed using the OSSM. The literature has highlighted some useful developments towards the organizational contributions toward accidents and resilience within the organization, and it was felt useful to discuss and reflect on these developments in the context of the findings that emerged

from this study. The following discussion will also illustrate how the findings from this study can illuminate on issues within the theoretical framework which underpins this study.

One of the critiques that became apparent from analyzing the participants' views according to the OSSM is that the model does not seem to provide a clear and concise relational interpretation of what counts as latent facts, contributing factors, system intrinsic and navigational aide. This thesis has identified a range of latent factors and contributing factors and navigation aids, and although the literature review highlighted a definition for each one, the interpretation of what counts as the specific components of the OSSM may be open for wide interpretations. For example, poor communication, environmental issues and design failure have all been identified as latent conditions toward unsafe medication administration. However, a different interpretation of the same participant's views may come up with different latent conditions. Being reflexive in the analysis of the participants' views dictates stepping back and acknowledging that the model does not seem to provide a consistent way for interpreting its element such as what counts as latent conditions. Evidence from the literature review suggested that in investigating organizational accidents, identifying the latent failures remains more difficult to expose, and to that end, the lack of explicit organizational classifications may leave the reader with little objective guidance regarding how to describe and identify such latent conditions, and that identifying such organizational factors remains a subjective issue, which is open for debate (McLean 1993; Thomadsen 2007). The model may not be fully operational in pinpointing the latent, contributing factors, system intrinsic factors and navigational aids. The participants' views on the safety of medication administration in this thesis

confirm this suggestion, and add that the model faces some difficulty in making a distinction between the socio-cultural issues and organizational factors which contribute to the safety of medication administration in adult critical care settings. The analysis of the participants' views suggests that the questioning culture and hierarchy of profession can be considered strong socio-cultural factors that appear to play a significant role in the translation of safety of medication administration into practice. In this regards, it is difficult to classify these factors according to the OSSM. The model does not seem to have adequately addressed the power of those issues. Indeed, Waring (2007) criticized Reason (1997)' classification of latent factors and contributing factors as they do not "dig deep" in the root of the risk and, does not address adequately the fundamental, distinct, interconnected factors, such as the cultural and institution context.

The participants' views on the contextual influence of organizational factors on the safety of medication administration present some challenges for role of the latent conditions and other local contributing factors as suggested by Reason (1990, 1997). Specifically, when it comes to assessing the influence of the role of the pharmacist and double-checking on the safety of medication administration, the participants' views suggest that they do not seem to exert their influence in a linear, sequential manner, because they can be part of the problem, but can also be part of the solution in a different context. But also, these findings suggest that some of the participants suggested aspects of medication safety do not seem to fit into either latent factors or contributing factors, or indeed into the system resilience factors. This represents a substantial critique for the model. Previous criticism of the Reason's (1990, 1997) explanation for the influence of latent conditions on the chain of events leading to an

accident, particularly that the model cannot account for the indirect, non-linear, and feedback relationships characteristic of accidents in complex systems (Marais et al. 2004; Qureshi et al. 2007). In these aspects, therefore, the OSSM appears to be insufficiently specific in explaining the inter-relationships between the organizational aspects which may have contradictory influences on the organization's safety, thus making it difficult to utilize as an investigative tool. The perceived influences of the perfect pharmacist, improper double-checking and poor medication design and labelling may all combine together, in complex ways, and are only few of perhaps innumerable causes of unsafe medication administration. The model does not provide a comprehensive picture where multiple factors combine in a complex, non-linear way leading to accidents, and it seems to have difficulty in allowing more complex interrelationships between the organizational aspects to be considered.

In many instances, the analysis of the participants' views of the latent conditions and other operational hazards may create a tendency to shift the blame from the individuals at the sharp end of the system (i.e. nurses and other healthcare professionals) back to the Trust's senior management. Indeed, there is evidence through the data chapters, where the participants appear to blame the macro-management of the Trust for many aspects which they believe lead to unsafe medication administration, for example a lack of communication, section 6.2.2, poor staffing, section 6.4.3, and financial constraints, section 6.3.2. This tendency for blame is not helpful for the holistic approach of investigating safety research, rather than tackling the multi-faceted and complex interplay among many organizational aspects leading to unsafe medication administration. This assumption supports earlier evidence from the literature, which criticizes the concept of latent condition that can

shift the blame backwards, from a 'blame the pilot' to 'blame the management' culture (Shorrock et al. 2003). However, the key point from the safety management perspective is to try to address, with as much detailed as possible, the potential contributors to a multi-factorial process, rather than blaming one side for the whole failure, which can send a damaging message of assigning the blame as the prevailing purpose of any investigation, rather than the need to address the fundamental root of causes of the problem (Reason et al. 2006).

Another finding from this research which presents a challenge to the adequacy of the proposed OSSM is the ability of the latent conditions to address the root cause of the problems leading to unsafe medication administration. This can be exemplified from the participants' perspectives on the nature of pre-registration nursing education they received. This issue was found to have a significant impact on the way the participants perceived the origin of unsafe practice, and how they cope with it in the future. The attempt to apply OSSM in analyzing the participants' views does not seem to devote adequate attention to the role of pre-registration nursing education in shaping the future behaviour of nurses with regard to the unsafe medication administration practice and other safety issues. Particularly, the lack of "itemizations" of the specifics of latent conditions, and inadequate specification of the type, quality, nature, and detailed features of the education and the related contextual issues which influence the quality of education provided leading to unsafe medication administration. Evidence expressed in the literature suggested that in investigating organizational safety, latent conditions do not dig deep inside the "roots of the safety", and do not engage fully with the underlying causes of risks in healthcare organizations, because the analysis tends to conflate the analysis of organizational and

socio-cultural factors into the analysis of individual performance with the frontline operator (Waring 2007). Based on these findings, this thesis argues that Reason's OSSM can be usefully applied in the context of healthcare, but it does not take adequate account of the breadth of latent conditions, such as the role of education and its nuances, and therefore fails to address adequately a fundamental system improvement related to the quality of pre-registration education. For this reason, in the organizational culture where nurses are taught to strive for perfection in their nursing practice, including the medication administration, reporting MAE's and near misses and learning from them is greatly reduced, and the risk of unsafe medication is likely to continue.

It became apparent from data analysis that the over-familiarity of some participants with the poor conditions created as a result of the perceived hierarchical pressure may have led to a diminished appreciation of the risks involved as a consequence of this situation, where warnings about forthcoming risks were misinterpreted or ignored. For example, the participants often indicated that they are used to being understaffed due to the financial constraints, creating the impression that it was viewed as an accepted part of then the difficult financial situation in the Trust. Their attitude towards tolerating being short staffed can be seen as an attempt to accommodate the risk of being short staffed in favour of "getting the job done". Such attitudes are likely to lead to less "sense–making" of the risk by normalizing it, where short staffing within critical care settings could lead, for example, to the possibility that some potential threats to the safety of medication administration escaping appropriate attention, resulting in unsafe medication administration practice. Many participants suggested that understaffing was a leading factor for not carrying out appropriate checks of

medications, unsupervised practice by junior nurses, and the use of agency nurses. While this might be true for other hospital settings, the consequence of this reality could be more costly in critical care settings, which dictate a particular consideration due to their unique context (Cullen et al. 1997; Van den Bemt et al. 2002). In this study, the participants' reactions to trying to accommodate the consequences of problems, such as short-staffing and financial constraints, in the critical care settings is likely to encourage short-term reactive responses to risk, which emphasizes the importance of individual coping rather than the more systematic forms of learning associated with participating in incident reporting, where reporting incidents is often seen as unrewarding work by the participants. Therefore, risk-reporting among the participants can be subject to many constraining and contextual factors, one of these factors is how the risks are perceived and communicated in the first place.

8.6 Scope for Future Research

There are a number of areas identified in this thesis that can be targeted for future development and research, many of which arise from considering the limitations of this study. For example, the research presented in this thesis focuses only on the nurses' perspectives on the organizational factors which enhance or jeopardize the safety of medication administration. It has been previously suggested that because the system of medication management, and particularly the medication administration, involves complex interactions between nurses, doctors, pharmacists, and patients (Department of Health 2004), any attempts to explore the wider system aspects which influence the safety of medication administration may need to broaden the focus to involve those who are actively involved in the system of medication administration within the healthcare organization , such as doctors, pharmacists and patients (Cohen

and Smetzer 1999). In the current study, the views of those professionals might have added other perspectives on the organization of medication administration, and might have helped tackle the issue of safe medication administration from a distinctly different angle, therefore enriching the picture of the organizational contributions toward the safety of medication administration. However, despite this limitation, this research produced detailed information on a particular cohort of nurses, who are heavily involved in the practice of medication administration (Armitage and Knapman 2003). The views of such a group of nurses from diverse backgrounds have not been scrutinised with equal depth in previous research. Thus, this research sought to meet its aim of producing theoretical interpretations from the data to explain the organizational contributions towards the safety of medication administration in adult critical care settings. While this research has arguably provided an in-depth insight into the nurses' views on the issue of medication safety in adult critical cares settings, and given the number of nurses participants and their diverse experiences, ranking, and their clinical settings, it is hoped that future research can focus in-depth on the views of the pharmacists, doctors, and patients on this issue, thereby further contributing to the development of a wider understanding of the dynamics and organizational contributions towards the safety of medication administration in adult critical care settings.

This thesis has produced findings regarding the pre and post-registration nursing education, and its ability to integrate the principle of human factors in its agenda. Such findings can provide a foundation for future research to build on. It is not known at this stage how the human factor principles can be best integrated in the educational curriculum to achieve the desired outcomes, and how the human factor of education

can practically be enhanced. This raises two interesting areas for further research. Firstly, to assess the extent to which the human factor approach can be integrated in the pre-registration nursing education regarding the safety of medication safety, and what types of "non-technical skills" are needed by the students or qualified nurses, which are essential to enhance the safety of medication administration in adult critical care settings, particularly given that medication administration is likely to be a major role for the student nurses in the future. Future research in this area may assess the existing learning agenda of human fallibility, and the educational materials that aim to shift the focus of medication safety away from the individual to the system and organization. Secondly, establishing an educational plan for the pre-registration student, which addresses the main challenges of developing and incorporating elements of human factors education related to the safety of medication administration, integrating it into the curriculum, and reinforcing the concepts in the workplace through staff development, and also drawing the line for accountability boundaries, and also, how these plans could be integrated for an induction program for the post-registration nurses upon joining the critical care settings. Findings from such work may highlight the on-going needs of specific educational plans that may need to be incorporated on the medication safety for pre- and post-registration nursing education.

Using the OSSM, the analysis of the participants' views drew attention to various organizational factors which contribute to the safety of medication administration in adult critical care settings. However, it was difficult to evaluate the specific contextual influence of some issues on overall medication safety, particularly those factors which can have contradicting influence on the safety of medication administration in

different organizational contexts. Future research can direct more efforts to utilizing an alternative framework, which may give more adequate attention to the contextual influence of the organizational factors, therefore providing a more comprehensive account of the position of the organization on the OSSM.

8.7 Concluding Summary

One of the contributions of knowledge that this thesis offers is the evaluation of the OSSM model in eliciting the organizational contributions toward the safety of medication administration in adult critical care settings. A key contribution of the OSSM utilized in this study is to draw attention to the importance of latent conditions, contributing factors, system intrinsic factors and navigational aids toward the safety of the organization. The following table summarize some of the organizational factors elicited from the participants' during in this study.

System intrinsic factors	Navigational aids	Latent factors	Contributing factors
Role of the pharmacist Policies and protocols Double checking Standardization Questioning culture	Incident reporting	Poor communication Environmental issues Design failure.	Understaffing Interruption Lack of supervision,

Table 6 Summary of some of the organizational factors related to safety of medication administration identified from the participants views.

It is noteworthy, however, that the use of OSSM to analyse the participants' views on the safety of medication administration, the model does not appear to provide a clear and concise relational interpretations of what counts as latent factors, contributing factors, system intrinsic and navigational aide. This thesis has identified a range of latent factor and contributing factor and navigation aids, and although there is a

definition for each one, the interpretation of what count as the specific component of the OSSM may be open for wide interpretation. For example, poor communication, environmental issues and design failure have all identified as a latent condition toward unsafe medication administration. However, different interpretations of the same participant's views may come up with different latent factors, contributing factors, navigational aids or system intrinsic factors. Evidence from the literature review suggested that in investigating organizational accidents, identifying the latent failures remains more difficult to expose, therefore, identifying organizational factors related to the safety remains a subjective issue, which is open for debate, with diverse researchers focusing on different organizational issues claiming to be latent conditions contributing to unsafe practice (McLean 1993; Thomadsen 2007). The participants' views on the safety of medication administration in this thesis confirms this suggestion, and adds that the model faces some difficulty in making a distinction between the socio-cultural issues and organizational factors which contribute to the safety of medication administration in adult critical care settings. The analysis of the participants views suggest that the questioning culture, hierarchy of profession can be considered strong socio-cultural factors that appear to play a significant role in the translation of safety of medication administration in practice. In this regard, it is difficult to classify these factors according to the OSSM, and it does not seem to adequately address the power of those issues. Indeed, Waring (2007) suggested that the classification of latent and contributing factors as they do not "dig deep" in the root of the risk and, does not address adequately the fundamental, distinct, interconnected factors, such as the cultural and institution context. The ability to question doctors pharmacist and each other, and how such behaviours are instigated among different health care professions, may not be appropriate to classify them as

into purely organizational issues, as they are the properties of individuals, culture and social norms. Therefore, to address these issues are property of the organization may not convey the true dynamics of interplay among diverse issues which influence the safety of medication administration.

While this thesis adapts one framework to investigate the safety of medication administration in adult critical care settings, it also appreciates that other theories can provide useful explanations for the system and individual behaviours, which in many ways have a direct or an indirect impact on the safety of medication administration. This thesis is not meant to be a sole explanation of the organizational contributions toward the safety of the medication administration in adult critical care settings, rather it is an attempt to provide an understanding from the nurses' perspectives, perhaps among several other existing understandings, of how systems, rather than the individuals, can appeal to the safety of medication administration in a complex environment such as the adult critical care environment.

The views of the participants shed light on the wide range of socio-cultural aspects of nursing in critical care settings regarding the safety of medication administration. The questioning culture was shown to be a significant tool for intercepting and unsafe medication administration, although such culture does not seem to be instigated with the same magnitude across staff from different health care professions. This may provide an impetus for future research to address this interesting finding. The findings from this thesis also shed the light on the role of nursing leadership, culture expectation as well as nursing education in the critical care settings, and how participants perceived the influence of these factors on instigating a safety culture in

the organization, and they how they saw it as enforcing to the "myth of perfection".

One participant criticized the pre-registration nursing education for lacking an effective curriculum to dispel such "perfection myth", their views appear to lack any views on the post-registration education in challenging such reality, although they seem to point to the importance of technical skills (i.e. training for IV medication administration) during the induction program in enhancing the safety of medication administration. This raises the question of whether critical care settings should have a formal educational induction program about the safety of medication administration, the safety culture, and how to challenge unsafe aspects of medication administration in particular, and medication management in general, given the high rate of unsafe medication administration practice in adult critical care settings. Therefore, a formal induction program in the safety of medication administration which incorporates effective "non-technical skills", such as communication, situation awareness, decision making and teamwork, can be of significant importance to enhance staff awareness, and to increase their resilience to unsafe medication administration.

The competing priorities, combined with the limited available resources in a healthcare organization, make the tension among such priorities inevitable. Such priorities are often legitimate, and dictate careful considerations from the echelons of higher management. In order to accommodate and satisfy these priorities, the tradeoffs among many organizational requirements is likely to take place. In this context, the perceived needs for the safety of medication administration are sometimes traded-off with other aspects of healthcare management that are perceived to be more demanding. For example, data analysis demonstrates that the existence of partitions between patient beds may inhibit double-checking practice, but

simultaneously they protect patient privacy and prevent cross infection. Equally, some organizational aspects which were designed to enhance the safety of medication administration have their own inherent risks. For example, the double-checking of medication brings with it the delusion of diminished responsibility, which can render medication administration a more dangerous practice. What is important, however, is to manage such tensions effectively and to establish a balanced account for the resources available and the safety agenda, therefore accommodating to the best possible extent such inevitable trade-offs.

The analysis of the participant's views revealed that identifying the organizational attributes of the safety of medication administration, while essential, are not sufficient to have a full understanding of the ways that such organizational attributes can contribute to the safety of the administration of medication. The OSSM does not seem to capture adequately the breadth of some important organizational issues which can have a contradictory influence on the safety of medication administration. Nonetheless, the analysis of the participants' views provided an important insight into the nurses' perspectives on a range of organizational issues which contribute to the safety of medication administration. It is anticipated that the findings of this study will add to the current debate on the organizational contributions towards the safety of medication administration in complex settings such as adult critical care settings. Future research could perhaps explore other ways where the contextual influence of the wider organizational factors can be more accurately measured and quantified.

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Appendixes

Appendix A: Interview Guide

Critical care nurses views of medication administration: An organizational perspective.

Interview Guide

In this study, your views are important. Before we proceed, I would like to thank you for agreeing to participate and to remind you that your comments are confidential, and any response you make will be anonymized so that you cannot be identified.

The interview should take about 60 minutes. You can stop the interview or ask questions at any time.

Just to remind you the study is about *the organization of drug administration in critical care.*

The interview is in three parts:
> **a) background information**
> **b) factors which promote safe administration of drugs**
> **c) issues which may cause drug administration problems**

Do you have any questions before we start?

A. Background information:
1. How long have you been working in your current ward?

2. Have you worked in other critical care wards?
    > - If yes where, and for how long?

3. How many hours do you usually work per week?

4. Do you rotate in shifts in your work?
    > - If yes, do you have a shift you usually work?

B. Factors which promote safe drug administration:

In this second part of the interview, I am trying to learn more about the ways in which social, physical and organizational factors influence safe drug administration in critical care settings.

5. The evidence shows that the majority of medications are administered safely. Could you take me through an example, with which you are familiar, of safe drug administration?

6. Please would you explain in more detail about what you think makes drug administration safe in critical care? Examples will be useful, if they are relevant.

Prompts:
- ward organization
- level of teamwork (all professions/nurses/doctors/pharmacist)
- staffing levels
- workload
- training and experience
- drug ordering, storage and management
- calculations
- preparation
- policies and guidelines
- leadership on the unit/ward

7. Are there patients whose drugs are particularly difficult to manage safely?

8. How are patients with particularly complex conditions managed safely?

9. Are there any other key issues that you think contribute to safe drug administration?

C. Issues that may cause problems in drug administration

In this third part of the interview, I am trying to learn more about the ways in which organizational issues can cause problems in drug administration.

10. Do you think there are any issues which may cause problems in drug administration in critical care?

11. Are there any particular types of drugs or drug administration systems that you think are more problematic than others? Would you explain why?

12. Could you explain some of those in more detail? Could you give me any examples?
Prompts:

    checking system

    prescribing, drug charts

    patient throughput

    shift changeover

    numbers of staff (doctors, nurses, pharmacists, receptionists, porters)

    organization of staff/ organizational change

    shift/time of day

    quality of staff relations/teamwork

    medical devices

    name of and instructions on medication

13. Are there any patients, or patients with particular kinds of medical conditions that are more likely to give rise to problems with drug administration? Please would you give an example(s).

14. If you have worked in other critical care units, were there any differences in their ways of organising drug administration? Which did you consider best, and why? Can you give examples?

15. Are there any other key issues that you think may cause problems?

16. Do you think there are any changes that could be made that could help avoid drug administration problems?

17. Are there any other points you would like to make in this section?

Before we finish, from your experience, are there any other issues you think it would be helpful for me to know about?

Are there any questions you want to ask me?

Thank you.

To remind you I am using this information as part of a study of systems. Would you be willing for me to come back to you if there are any issues it would be helpful to pick up with you?

Thanks again.

Mansour Mansour
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Tel: +44 (0) 115 82 30994
Mobile: 07810652647

Appendix B: Demographical Questionnaire

Critical care nurses views of medication administration:
An organizational perspective

Demographic questionnaire ⬜⬜⬜

Dear (Nurse' name),
Thank you for your willingness to participate in this study. I would be grateful if
would complete the following short questionnaire and return it to me in the enclosed
stamped-addressed envelope. I will then contact you to arrange an interview at a time
and place of your convenience. This questionnaire will be used to select a sample of
nurses with the relevant background for the study.

**Let me remind you that this research aims to enhance our understanding of the
system impact on medication administration. It is entirely up to you to decide
whether or not to take part. You can withdraw at any stage of the study without
giving a reason. All the information you provide will be made anonymous and
your name will not be identified in the research report**.

- **Please circle categories relevant to you**:
    1. **Your Sex :**
        A. Male   B. Female

    2. **Your years of experience as qualified nurse:**
        A. Less than one year   B. 1 – 5 Years

        D. 6 – 10 years   C. More than 10 years

    3. **Your hospital campus**:
        A. The Oak Hospital   B. The Beech Hospital

    4. **Your band:**
        A. Band 5   B. Band 6   C. Band 7 or above

- **Please state the ward/unit that you work in** ……………………………
- **Please provide your contact details** :
     Name: …………………………
     Address:…………………………
            …………………………
     Tel: ………………………… E-mail …………………………….

**Thank you very much for agreeing to participate. If you have any queries, please
do not hesitate to contact me on the following contact details:**

Mansour Mansour
School of Nursing- University of Nottingham
Room F1188 – F Floor, Queen's Medical Centre, Nottingham NG7 2UH,
E-mail: ntxmm3@nottingham.ac.uk. Tel: +44 (0) 115 82 30994

Appendix C: Invitation Letter

Dear Nurse,

Re: <u>Critical care nurse views of medication administration:</u>
<u>An organizational perspective.</u>

My name is Mansour Mansour. I am a PhD student in the School of Nursing at the University of Nottingham. I am conducting a doctoral study, on nurses views of medication administration in adult critical care settings. You are being invited to participate in this study. I would like to interview a sample of adult critical care nurses in The Oak Hospital and The Beech Hospital. Please take your time to read the information enclosed. If you are happy to participate, please complete the enclosed questionnaire and post it to me using the stamped-addressed envelope enclosed. Your participation in this study is highly valued.

Kind regards

Mansour Mansour
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School of Nursing
Room F1188
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Queen's Medical Centre
Nottingham
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E-mail: ntxmm3@nottingham.ac.uk
Tel: +44 (0) 115 82 30994
Mobile: 07810652647

Enclosed:
Invitation letter
Participant information sheet
Demographic questionnaire
Stamped-addressed envelope

Appendix D: Participants Information Sheet

Project Title: **Critical care nurses views of medication administration:**
An organizational perspective

Name of Investigators*:*
Mansour Mansour. RN, MSc, MPhil/PhD student
School of Nursing

University of Nottingham

Supervisors:

Veronica James. PhD, MA - Sociology, RGN
Professor of Nursing Studies
School of Nursing
University of Nottingham

and

Alison Edgley. PhD, MSc, BSc
Lecturer in Social Sciences
School of Nursing
University of Nottingham

Information sheet for Interview Volunteers

Date:

Dear Nurse

Invitation

You are being invited to take part in a research study to understand the organizational factors which influence safe medication administration in adult critical care settings. Before you decide whether to take part or not, it is important for you to understand why the research is being done and what it will involve. Please take your time to read the following information carefully and discuss it with friends and colleagues if you wish to.

What is the purpose of the study?

This study is part of a PhD in Nursing Studies which I am undertaking at the School of Nursing, University of Nottingham. The aim of the study is to understand the impact of organizational factors on the safety of medication administration in adult critical care settings. Research shows that social, physical and organizational factors can have a significant impact on the safety of medication administration. Your views and experiences of this are of particular importance for understanding strengths and limitations of particular organizational systems which may influence the safety of medication administration in adult critical care settings. .

Why have I been chosen?

The fact that you are a registered nurse working in adult critical care setting means that you are involved in administering medication on a routine basis. Any registered nurse who is working in an adult critical care setting in The Beech Hospital or The Oak Hospital will be eligible to participate in this research. Your views and experiences about medication administration will be of a particular interest for the purpose of this research. The analysis of such experience aims to assist understanding of the organizational and system factors that pertain to safe medication administration in adult critical care settings.

Do I have to take part?

It is entirely up to you to decide whether to take part or not. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

What are the possible disadvantages and risks of taking part?

- There are no physical risks in participating in the interviews.
- Your identity will be protected and the information you supply will only be used in the data analysis and the findings of the research.
- The interview will include a general discussion of the organizational factors which may influence the safety of medication administration in adult critical care settings. Your personal account represents a very valuable asset in understanding the wider context which can influence the safety of medication administration.
- As in any study where the researcher is a registered nurse, the researcher adheres to the Nursing and Midwifery Council (NMC) code of conduct, and has a professional obligation to report any instances of professional misconduct.

Will my taking part in this study be kept confidential?

Your name will not be used at all in the study. When analysing the data, identities will always be anonymised by numbers and pseudonames. Data will be made anonymous so that you can not be identified. If the interview is audiotaped, I will keep the tapes in a secure place and I will not share them with anyone other than my doctoral supervisors, Professor Veronica James and Dr. Alison Edgley from the University of Nottingham, and if necessary, my PhD examiners.

What does the study involve?

- I intend to interview 32 nurses across a range of job role from level 2 and level 3 adult critical care in Woodland University Hospital Trust.
- I will be conducting face to face interviews with those who are willing to be interviewed.
- The interviewee will choose the interview date, time and venue.
- The interviews will last no more than 60 minutes and will be audiotaped (with permission of the interviewee).
- I will transcribe the tapes after the interview.
- The interviews would take place over a period of about 8 months from February 2007 to September 2007.

What will happen to the results of the study?

The material generated in the interviews will be analysed and become part of a written project to fulfil the requirement of PhD theses. I also anticipate publications from this research. The nature of these publications would most likely be, but may not be limited to, scholarly research destined for an academic audience. Publications will be available for you to look at upon request. Presentations will also be given at conferences.

Who is organizing and funding the research?

The research is part of a PhD study and has no specific funding, apart from that allocated by the School of Nursing. I do not expect to benefit financially from this research in any direct way.

Who has reviewed the study?

This study is reviewed and approved by the NHS Local Research Ethics Committee, and the Research & Development Department at the Woodland University Hospitals Trust.

What I have to do if I want to take part

Please, complete the enclosed demographic questionnaire and return it to the researcher in the enclosed stamp-addressed envelop. The researcher will contact you thereafter to arrange a convenient date, time and venue for the interview.

Contact for further information

I would like to thank you for your consideration of my request. For further information feel free to contact me on the following address:

Mansour Mansour
Faculty of Medicine and Health Sciences
School of Nursing
Room F1188
The Medical School
Queen's Medical Centre
Nottingham
NG7 2UH
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Tel: +44 (0) 115 82 30994
Mobile: 07810652647

Appendix E: Interview Response Letter (1)

Dear [Nurse' name]

<div align="center">

Re**: Critical care nurses views of medication administration:**
An organizational perspective

</div>

Thank you very much for agreeing to participate in this study. I appreciate the effort and time you are willing to contribute.

I have had a high number of responses from nurses across a range of backgrounds. For this reason, I would like to hold your name in reserve, so that, should I need to come back to you at later stage of the study, I can contact you again. Of course, if at this stage this is not convenient for, you can withdraw your offer of participation.

I will be in touch with you again to let you know either way. In the meantime, many thanks for your willingness to participate in this study. Your offer of time and expertise is greatly appreciated.

Kind Regards

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Appendix F: Interview Response Letter (2)

Dear [Nurse' name]

<u>**Re:** **Critical care nurses views of medication administration:**</u>
<u>**An organizational perspective**</u>

Thank you very much for your initial offer to participate in this research study. I'm writing to you to ask if you are still willing to participate. If you are still willing to do so, please tick the appropriate box below, and return this letter in the enclosed stamped-addressed envelope.

I would like to thank you for the time you have taken to read this letter and for your consideration of participation.

☐   Yes, I'm still willing to participate in the study.

☐   No, I'm not willing to participate in the study.

Kind regards

Mansour Mansour
Faculty of Medicine and Health Sciences
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Appendix G: Interview Response Letter (3)

Dear [Nurse' name]

Re: Critical care nurses views of medication administration:
An organizational perspective

Thank you very much for indicating your willingness to participate in this study. I am extremely grateful to you for offering your time and expertise for the purpose of this study.

I have found that I have a sufficient number of respondents and that I do not need to ask you for interview. I would like to take this opportunity of thanking you for your interest in the study and for offering your time.

Kind regards

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Appendix H: Participants Consent Form

Title of Project: **<u>Critical care nurses views of medication administration:</u>**
<u>An organizational perspective</u>

Participant's Consent Form

Name of Researcher: Mansour Mansour
Supervisors: Professor Veronica James and Dr Alison Edgley.

Before the interview commences I would like you to sign this sheet to indicate that you have read and understand the terms of the interview, and that you do consent to being interviewed. If you are happy, Please initial the box for each sentence

1. I confirm that I have read and understand the information sheet dated
   <u>5</u> /2/2007 (version.2) for the above study. I have had the opportunity
   to consider the information, ask questions and have had these answered
   satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw
   at any time without giving a reason.

3. I understand that information about me recorded during the study will be
   kept in a secure database. Data will be kept for 7 years after the results of
   this study have been published. My contribution will be made anonymous.

4. I voluntarily agree to take part in this study.

_____   _____   _____
Name of Participant   Date   Signature

_____   _____   _____
Name of the Researcher   Date   Signature

Investigator Name & Contact address:

Mansour Mansour
Faculty of Medicine and Health Sciences
School of Nursing, Room F1188 - F Floor
Queen's Medical Centre
Nottingham NG7 2UH
E-mail: ntxmm3@nottingham.ac.uk
Tel: +44 (0) 115 82 30994
Mobile: 0781065264

Appendix I: Ethics Committee Approval Letter

<div align="right">

Woodland Research Ethics Committee 2
1 Address
Address
Woodland
Post code

Telephone: 0000000000
Facsimile: 00000000000

</div>

07 February 2007

Professor Veronica James
Professor of Nursing Studies
School of Nursing, University of Nottingham
A Floor, Queen's Medical Centre
Nottingham, NG7 2UH

Dear Professor James,

Full title of study:	**Critical care nurses views of medication administration: an organizational perspective**
REC reference number:	**06/Q2404/180**

Thank you for your letter of 05 February 2007, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA). There is no requirement for [other] Local Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents
The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date	
Application	1	30 November 2006	
Investigator CV - Student			
Investigator CV - Supervisor		01 November 2006	
Protocol	1	30 November 2006	
Peer Review	1	07 April 2006	
Interview Schedules/Topic Guides	1	30 November 2006	
Questionnaire: Demographic	1	30 November 2006	
Letter of invitation to participant	1	30 November 2006	
Participant Information Sheet: Volunteers	2	06 February 2007	
Participant Consent Form: Volunteers	2	05 February 2007	
Response to Request for Further Information		05 February 2007	
Letter from Occupational Health		05 February 2007	
Guidance for School of Nursing Staff			
Appendix D	1	30 November 2006	
Appendix C	1	30 November 2006	
Appendix B	1	30 November 2006	

Research governance approval

You should arrange for the R&D department at all relevant NHS care organisations to be notified that the research will be taking place, and provide a copy of the REC application, the protocol and this letter.

All researchers and research collaborators who will be participating in the research must obtain final research governance approval before commencing any research procedures. Where a substantive contract is not held with the care organisation, it may be necessary for an honorary contract to be issued before approval for the research can be given.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

| 06/Q2404/180 | Please quote this number on all correspondence |

With the Committee's best wishes for the success of this project
Yours sincerely

Dr M H/Ms L E
Chair/Co-ordinator
Email:

Enclosures: *Standard approval conditions*
Copy to: P. C
       University of Nottingham

       R&D Department for NHS care organisation at lead site:
       The Woodland Hospital NHS Trust – The Beech Campus
       The Woodland Hospital NHS Trust – The Oak Campus

Appendix J: Research and Development Approval Letter

The Woodland Hospital NHS Trust   **NHS**

Research and Development Department

Address One

Post Code

Direct Dial: 0115 970 9049
Tel: 0115 9249924 ext 41049

Ref: 06IT002

Date: 8 February 2007

Professor V James
School of Nursing
University of Nottingham
Queens Medical Centre

Dear Professor James

Re: Critical care nurse views of medication administration: an organisational perspective

R&D Reference: 06IT002

Ethics Reference: 06/Q2404/180

The R&D Department have considered the following documents:

- NHS REC application form
- R&D Application form
- Protocol; version 1, dated 30/11/06
- Participant Information sheet; version 2, dated 05/02/07
- Participant consent form; version 2, dated 05/02/07
- Invitation letter to participants B; version 1, dated 30/11/06
- Invitation letter to participants C; version 1, dated 30/11/06
- Invitation letter to participants D; version 1, dated 30/11/06
- Questionnaire; version 1, dated 30/11/06

The study now has R&D approval subject to the conditions set out below:

That you:

- Abide by the Clinical Trial/Research agreement (as applicable)

- Abide by the terms of your substantive employment/honorary contract with the Trust (where applicable)

- Ensure that all study personnel, not employed by The Woodland Hospital NHS Trust, hold Honorary contracts with this Trust, before they have access to any facilities, patients, staff, their identifiable data, tissues or organs.

- Conduct all Clinical Trials under the jurisdiction of the EU Directive 2001/20/EC in accordance with The Medicines for Human Use (Clinical Trials) Regulations 2004

- Comply with the current Research Governance Framework for Health and Social Care. (Copies of the Research Governance Framework for Health and Social Care can be found at www.doh.gov.uk or via the R&D office)

- Report all research, which is discontinued temporarily or permanently, to the R&D Department in a timely manner

- Provide information for R&D reporting purposes including publications, Serious Adverse Events and progress reports as requested/required

- Request written approval from the R&D Department for any changes to the project protocol including amendments, study personnel and study documentation you propose to implement

- Notify the R&D Department as soon as you are made aware of any study inspection/audit by an external organisation

- Must not start your project until you have received all relevant written regulatory approvals/authorisations

In addition:

- All projects are liable to be monitored by the Trust

- Unless you have indicated otherwise on the R&D application form the project details will be uploaded to the National Research Register (NRR) database (The NRR can be accessed on www.nrr.nhs.uk)

Yours sincerely

Dr B   T
Director of Research and Development

Appendix K: Example of Pre-printed Medication Charts used at the Adult Critical Care Settings Investigated

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy
	Morphine	60mg/120mg	Nacl 0.9%	50ml	IV	0-10ml/hr		

Date									
Additive added by									
Checked by									
Time Infusion started/stopped									
Started/ stopped by									

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy
	Alfentanil	25mg	Nacl 0.9%	50ml	IV	0-10ml/hr		

Date									
Additive added by									
Checked by									
Time Infusion started/stopped									
Started/ stopped by									

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy
	Midazolam	50mg/100mg	Nacl 0.9%	50ml	IV	0-10ml/hr		

Date									
Additive added by									
Checked by									
Time Infusion started/stopped									
Started/ stopped by									

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy
	Propofol 1%	1000mg	–	100ml	IV	0-20ml/hr		

Date									
1st Check									
2nd Check									
Time Infusion started/stopped									
Started/ stopped by									

SEDATION / STAT DOSES

Additional IV bolus sedation	Dose up to mg.	Frequency (max. doses/hr.)	Dr Sig	If max. number of bolus doses given and at maximum infusion rate, then inform medical staff						
Morphine	1 - 5mg	Four		Date Dose Time Sig						
Morphine	1 - 5mg	Four		Date Dose Time Sig						
Midazolam	2 - 5mg	Four		Date Dose Time Sig						
Midazolam	2 - 5mg	Four		Date Dose Time Sig						
Propofol	Up to 50mg	Four		Date Dose Time Sig						
Propofol	Up to 50mg	Four		Date Dose Time Sig						
Alfentanil	1 - 2mg	Four		Date Dose Time Sig						
Alfentanil	1 - 2mg	Four		Date Dose Time Sig						

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Remarks
Date								
Additive added by								
Checked by								
Time infusion started/stopped								
Started/ stopped by								

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Remarks
Date								
Additive added by								
Checked by								
Time infusion started/stopped								
Started/ stopped by								

Appendix K: Example of Pre-printed Medication Charts.

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharm. Sign/Date
	Noradrenaline (Norepinephrine)	20mg	Dextrose 5%	250ml	Central Line only	0 - 1.0 mcg/kg/min ___ to ___ ml/hr		
Date								
Additive added by								
Checked by								
Time Infusion started/stopped								
Started/ stopped by								

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharm. Sign/Date
	Adrenaline (Epinephrine)	20mg	Dextrose 5%	250ml	Central Line only	0 - 1.0 mcg/kg/min ___ to ___ ml/hr		
Date								
Additive added by								
Checked by								
Time Infusion started/stopped								
Started/ stopped by								

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharm. Sign/Date
	Dobutamine	500mg	Dextrose 5%	100ml	Central Line only	0 - 20 mcg/kg/min ___ to ___ ml/hr		
Date								
Additive added by								
Checked by								
Time Infusion started/stopped								
Started/ stopped by								

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharm. Sign/Date
Date								
Additive added by								
Checked by								
Time Infusion started/stopped								
Started/ stopped by								

INTRAVENOUS DRUG INFUSIONS

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy Sign & Date
	Amiodarone Loading Dose	300mg	Dextrose 5%	25ml	Central Line Only	50ml/hr Stat 30 min infusion		
Date	Time	Additive added by		Checked by		Time started	Started by	

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy Sign & Date
	Amiodarone Day 1	900mg	Dextrose 5%	48ml	Central Line Only	2ml/hr		
Date	Time	Additive added by		Checked by		Time started	Started by	

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy Sign & Date
	Amiodarone Day 2-7 infusion	600mg/900mg Delete as appropriate	Dextrose 5%	48ml	Central Line Only	2ml/hr		

Date				
Additive added by				
Checked by				
Time Infusion Started/Stopped				
Started/ Stopped by				

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy Sign & Date

Date				
Additive added by				
Checked by				
Time Infusion started/stopped				
Started/ stopped by				

Date	Drug	Total amount of drug	Diluent	Total volume	Route	Rate/Rate range in mls/hr	Dr Signature & Print name	Pharmacy Sign & Date

Date				
Additive added by				
Checked by				
Time Infusion started/stopped				
Started/ stopped by				

Local Agreement for Potassium Chloride Infusions (see Protocol)

Date	GMC USE ONLY Drug	Total amount of drug	Route	Total volume	Rate in mls/hr	To maintain Potassium level of	Dr Signature & Print name
	Potassium Chloride	60mmol	Central Line Only	30ml	7.5ml/hr	4.0 to 4.5 mmol/l	
Date							
Initial K⁺ level							
K⁺ level at 2 hrs							
1st Check							
2nd Check							
Time infusion started							
Started by							

Date	CITY USE ONLY Drug	Total amount of drug	Route	Total volume	Rate in mls/hr	To maintain Potassium level of	Dr Signature & Print name
	Potassium Chloride	40mmol	Central Line Only	100ml	25ml/hr	4.0 to 4.5 mmol/l	
Date							
Initial K⁺ level							
K⁺ level at 2 hrs							
1st Check							
2nd Check							
Time infusion started							
Started by							

ELECTROLYTE INFUSIONS

Drug	Total amount of drug		Total volume	Route	Rate in mls/hr	Pharmacy Sign & Date
Potassium Acid Phosphate	40mmol	Each ml contains 1mmol K+	40ml	Central Line Only	6.6ml/hr	
Date	Time	Dr's Signature	Print Name	1st Check	2nd Check	Time started	Started by

Drug	Total amount of drug	Diluent	Total volume	Route	Rate in mls/hr	Pharmacy Sign & Date
Magnesium Sulphate 50%	20mmol	Dextrose 5% OR NaCl 0.9%	100ml	IV	50ml/hr	
Date	Time	Dr's Signature	Print Name	Additive added by	Checked by	Time started	Started by

Drug	Total amount of drug	Diluent	Total volume	Route	Rate in mls/hr	Pharmacy Sign & Date
Date	Time	Dr's Signature	Print Name	Additive added by	Checked by	Time started	Started by

Appendix K: Example of Pre-printed Medication Charts. 364

CARDIAC INTENSIVE CARE/HIGH DEPENDENCY
Continuous Intravenous Infusion Chart

Date of Admission					

DRUG ALLERGY or ADVERSE EVENT
If none known tick box ☐

This section must be completed and signed by a prescriber or pharmacist before a drug is administered

Signature_____ Date_____

Stick Patient's Printed label here

If label not available:-

SURNAME

FIRST NAME

DATE OF BIRTH ___/___/___

HOSPITAL NUMBER

Weight   Kg   Height   m

Start date	**Propofol 2%**		Date										
Dose **1000mg**	Diluent **Neat**	Route **IV**	Time										
Total Vol. **50ml**	Rate/range (ml/hr) **0-20ml/hr**	Pharm. Sign & Date	Given										
Prescriber Sign			Check										

Start date	**Adrenaline**		Date										
Dose **2mg/50ml** or **4mg/100ml**	Diluent **Dextrose 5%**	Route **Central Venous**	Time										
	Rate/range (ml/hr)	Pharm. Sign & Date	Dose										
			Given										
Prescriber Sign			Check										

Start date	**Noradrenaline**		Date										
Dose **2mg/50ml** or **4mg/100ml**	Diluent **Dextrose 5%**	Route **Central Venous**	Time										
	Rate/range (ml/hr)	Pharm. Sign & Date	Dose										
			Given										
Prescriber Sign			Check										

Start date	**Dopamine**		Date										
Dose **200mg/50ml** or **400mg/100ml**	Diluent **Dextrose 5%**	Route **Central Venous**	Time										
	Rate/range (ml/hr)	Pharm. Sign & Date	Dose										
			Given										
Prescriber Sign			Check										

Alterations to pre-printed prescriptions are NOT permitted. If a prescription varies from the standard it must be prescribed in one of the blank prescription boxes.

Intravenous Insulin Sliding Scale Prescription

Prescribers: If the sliding scale needs to be altered, cross out the standard scale and write in the next column.

Standard Scale

	Test stick Glucose/Gas	Insulin Rate Units/hr	Insulin Rate Units/hr	Insulin Rate Units/hr	Insulin Rate Units/hr
	<3.9	0			
AIM TO MAINTAIN BLOOD GLUCOSE BETWEEN 4 - 6.9 mmol/L	4-6.9	1			
	7-9.9	2			
	10-14.9	3			
	15-19.9	4			
	>20	5 and Contact medical staff			
Date					
Prescriber's signature					

Start date	Drug **HUMAN ACTRAPID INSULIN**		Date										
Dose 50 units	Diluent Sodium Chloride 0.9%	Route IV	Time										
Total Vol. 50ml	Rate See sliding scale	Pharm Sign & Date	Given										
Prescriber Sign			Check										

Start date	Drug **HUMAN ACTRAPID INSULIN**		Date										
Dose	Diluent Sodium Chloride 0.9%	Route IV	Time										
Total Vol. 50ml	Rate See sliding scale	Pharm Sign & Date	Given										
Prescriber Sign			Check										

Transducer Fluid

Date	Fluid	Volume	Rate (ml/hr)	Start time	Batch Number	Prescriber signature	Pharm Sign & Date
	Sodium Chloride 0.9%	500ml	3ml/hr or 3ml flush				

Authors:	MMC Reference No & Date: DRAFT Review Date: January 2009

AS REQUIRED DRUGS   ADMINISTRATION RECORD

For Cardiac ITU and Cardiac HDU use only							
Potassium Chloride	Dose 10-20 mmol	Dilute with prescribed maintenance fluid to total volume of 40ml	Route Central line only	Rate Max 20mmol over 30mins	Special instructions To maintain potassium level 4.5 to 5.5 mmol		Prescriber's Signature
Date							
Time							
K+ level							
Amount of drug given							
Checked by							
Started by							

Appendix L: Example of Competency Package for Intravenous (IV) Medication Administration
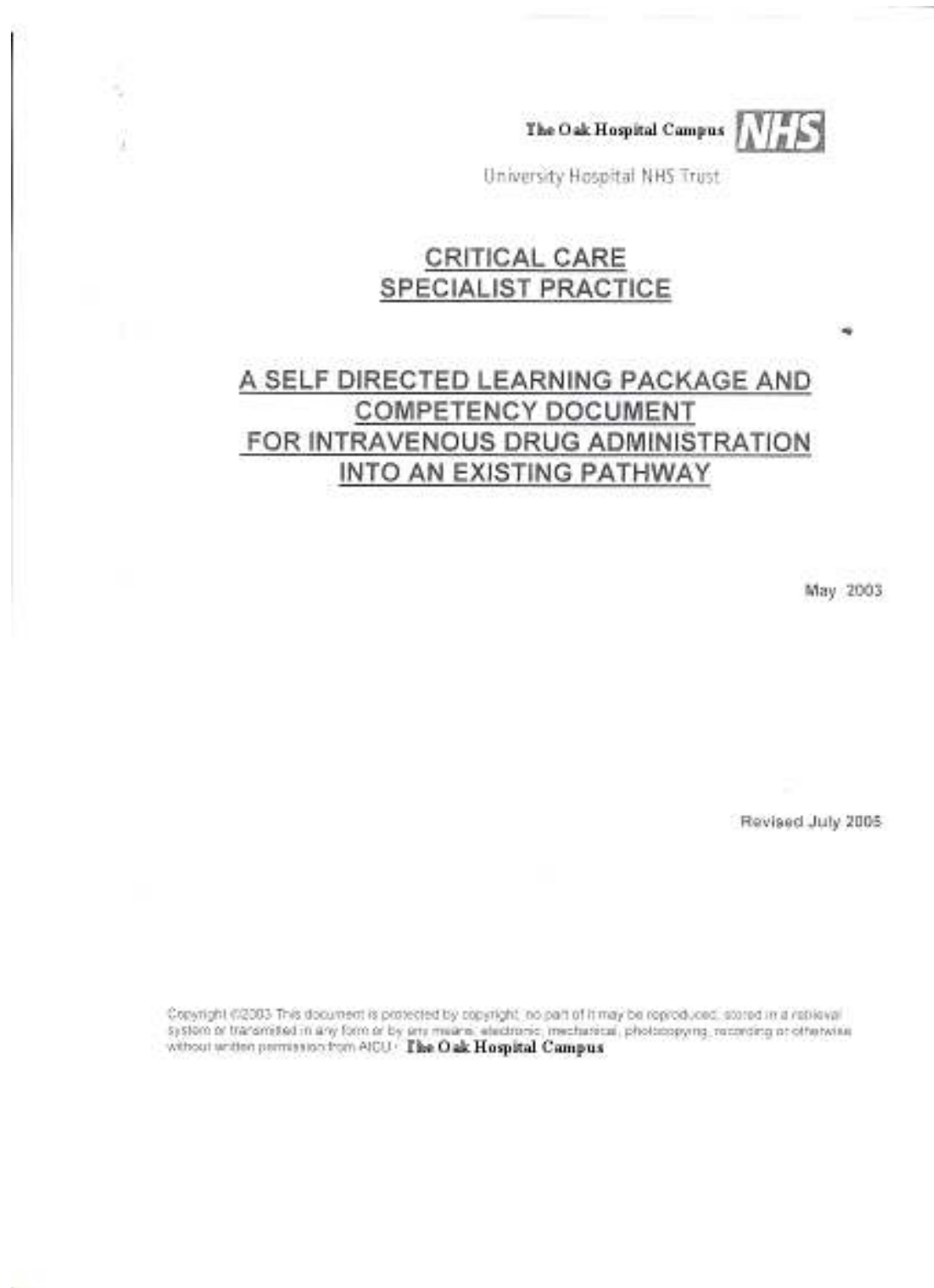
The Oak Hospital Campus **NHS**

University Hospital NHS Trust

CRITICAL CARE SPECIALIST PRACTICE

A SELF DIRECTED LEARNING PACKAGE AND COMPETENCY DOCUMENT FOR INTRAVENOUS DRUG ADMINISTRATION INTO AN EXISTING PATHWAY

May 2003

Revised July 2005

INTRODUCTION

This package is designed to help you gain the required knowledge and skills to safely administer intravenous drugs into an appropriate existing IV system. [...]

PRIOR TO ADMINISTRATION OF INTRAVENOUS MEDICINE

Prior to completing this package you should be aware of the procedures and policies included in the [...]

OBJECTIVES

The registered nurse/midwife is able to:

1.1 List the patient and prescribing information required on the patient's prescription chart before an intravenous drug is prescribed for administration

1.2 State what additional information is required to enable safe preparation of the drug

1.3 Discuss the policy regarding the use of single and multi-dose vials

1.4 Identify the information that is required about the patient having the drug administered

1.5 Identify the procedure that should be followed prior to administering the drug to the patient

1.6 Discuss the policy for checking IV drugs in the area of practice

1.7 Identify the safe procedure when storing up medicine drugs for one patient

1.8 Discuss reasons why an infusion device would be required to administer a drug

RECOMMENDED READING

RPS Compendium of Data sheets and summaries of product characteristics

British Medical Association and Royal Pharmaceutical Society of Great Britain

British National Formulary. Current Edition. London: BMA & RPSGB

Health & Safety at Work Act (1974) London: HMSO

NMC (1998) Medicines, records and report keeping. London: NMC

Queen's Medical Centre (1999) Guide to intravenous Therapy. Nottingham: QMC

NPSA (2000) Guidelines for the Administration of Medicines. London: NMC

Nursing and Midwifery Council (2002) The Code of Professional Conduct. London: NMC

Cole LH, Sewell Su (2001) Clinical Nursing Skills 5th Edition Philadelphia W B Saunders

Queen's Medical Centre (2000) Medicines Code of Practice. Nottingham: QMC

Downie's Medical Centre (2000) Sharps Handling. Infection Control Manual. Section 3.3 Nottingham: QMC

Rang H P, Dale M M, Ritter J M (1999) Pharmacology (4th Edition Edinburgh: Churchill Livingstone

Trouet L A (2001) Handbook of Injectable Drugs (11th edition) American Society of Health-Care Pharmacists (available as a reference source in designated information department)

Please note that a number of the above documents are currently being updated. Ensure that you review the up to date versions.

EXPANSION TO PRACTICE

Administration of intravenous medication

STANDARD STATEMENT

The practitioner will be able to administer intravenous therapy safely and competently.

WHAT YOU NEED TO KNOW

The content and implications of medicines codes of practice for the administration of medication in Nottingham Acute NHS Trust

WHAT YOU NEED TO DO

COMPETENCY STATEMENT

LEGAL & PROFESSIONAL ASPECTS OF INTRAVENOUS THERAPY

LEARNING OBJECTIVES

REVIEW OF THE CODE OF PROFESSIONAL CONDUCT

Vicarious Liability

TO CALCULATE MICROGRAMS

Concentration mg/ml
Total volume x 60 mins x weight kg   = mcg/kg/min

E.g. Dobutamine infusion of 500 mg in 250 mls running at 10 mls/hr
Patient weight is 70 kg

$$\frac{500 \times 10000 \times 10}{250 \times 60 \times 70} = 4.76 \text{ mcg/kg/min}$$

9. Noradrenaline is running at 5 ml/hr. The patient weighs 60 kgs and the solution is 20mg in 250mls. How many mcg/kg/min is the patient receiving?

10. Dobutamine is running at 21 ml/hr. The patient weighs 86 kgs and the solution is 500mg in 250mls. How many mcg/kg/min is the patient receiving?

HDU ONLY:

11. Fluids (epoprostenol) is running at 2.1mls /hour. Patient weight 70kgs and the solution is 500mcg in 50mls. How many nanograms/kg/min is the patient receiving?

Movement Self directed learning package checked out and fully completed. Action plan below.

1.

2.

1.

Date set for next review

Assessor   Print Name ....
             Signature ....

Nurse   Print Name ....
             Signature ....
             Date ....

Self directed learning package fully completed and all aspects verified for accuracy by a Sister/Charge Nurse.

Assessor   Print Name ....
             Signature ....

Nurse   Print Name ....
             Signature ....
             Date ....

Anaphylaxis

[faded text: an acute allergic reaction to certain drugs, an antibiotic, vaccines, bee stings and more. A reaction can occur within 1-20 minutes of administration. The reaction can vary from mild to fatal. (refer to the OMC policy on anaphylaxis.)]

Summarise the body's response to an antigen, ensuring you differentiate between the different degrees of reaction stages:

What is the:

- Immediate response?

- Resuscitation procedure

-

Air Embolism

List the signs and symptoms of an air embolism:

Explain why the risk of air embolism is greater if a central venous catheter is present.

What is the:

- Immediate treatment.

- Resuscitation procedure.

The nurse will be able to identify the following commonly used drugs. Fill in the boxes.

Drug	Indications within Critical Care	Normal dosage range Normal preparation	Route	Actions	Side effects
Adrenaline					
Noradrenaline					
Amiodarone					
Morphine					

Drug	Normal dosage range / Normal preparation		Route	Actions	Side effects
Clonidine	lidocaine within Critical Care				
Atracurium					
Morphine					
Midazolam					
Propofol					

POTASSIUM INFUSIONS

It is common practice when using concentrated potassium infusions in order to maintain the potassium levels within the therapeutic range. This group of patients may also be receiving drugs that either lower their potassium levels or have an increased risk of cardiac side effects in the presence of low serum potassium levels. For this reason the usual overall serum potassium level is between 4.0 – 4.5 mmol/L. Consideration as a result of a low whether a potassium infusion or an oral supplement is needed.

Critical Care has a local agreement for potassium administration, (revised 2006) which must be adhered to. Intravenous potassium must NOT be added to any intravenous infusion fluid, pre-prepared solutions are available from pharmacy. This local agreement has been written to concentrate care parameters of concentrated potassium infusions by nursing staff in our intensive care and the largest high dependency unit.

The local agreement recognises that:

i. The nurse is responsible for following the local agreement to ensure the safe administration of intravenous potassium chloride in accordance with the NMC guidelines for the Administration of Medicines 2002 and the NMC Medicines Code of Practice 2004.

ii. The prescriber is responsible for the potassium chloride prescription.

Under no circumstances should potassium or potassium and potassium ampoules be stored on other wards, staff from other wards should contact pharmacy directly.

Learning objectives

The nurse will familiarise themselves with

- Storage policy
- Preparations available
- Local policy regarding administration
- Potential complications

When should a potassium infusion be initiated?

Why is it essential to maintain potassium levels within the therapeutic range?

What is the concentration of potassium chloride per ml in
a) Potassium chloride 15% ampoules?
b) Potassium acid phosphate ampoules?

What is the maximum concentration of potassium that can be administered via the peripheral route?

What pre-made infusion bags are available at GWC with this concentration of potassium in?

What is the maximum infusion rate per hour?

Can an infusion of KCL 60mmols over 4 hours be delivered at the same time as an infusion of potassium acid phosphate 40mmols over 4 hours?

Following the local agreement, what is the maximum number of intravenous infusions that can be administered in a 24 hour period?

What documentation needs to be completed prior to administration of a neat potassium solution?

How is potassium chloride and potassium acid phosphate ordered?

DRUG CALCULATIONS

It is essential that you understand the measurement and the international system of units (SI Unit) changes and infusion rates correctly. It is your responsibility to ensure that you give the right dose at all times.

In 1975 the NHS adopted the international system of units (SI Unit).

The nurse will be able to convert the following you SI units.

Fill in the blanks:
- Volume 1 litre = _____ mls.

Weight
- 1 kilogram = _____ grams
- 1 gram = _____ milligrams (mg)
- 1 milligram = _____ micrograms (mcg)
- 1 microgram = _____ nanograms

Percentage
This is equivalent the weight of a drug in grams per 100ml of solution
e.g. 1% = 1gm in 100ml

- 1 litre of 0.9% sodium chloride contains _____ gms of sodium chloride
- 50 mls of 20% mannitol contains _____ gms of mannitol
- 20mls of 8.4% sodium bicarbonate _____ gms of sodium bicarbonate
- 50mls of 50% glucose contains _____ gms of glucose

Ratios
This refers to the weight of the drug in grams per 2ml of solution
e.g. 1 in 1000 = 1gm in 1000ms OR 1mg per ml

- 1:10,000 _____ gms in 10000ls OR _____ mg per ml
- Calculate 2.5mg adrenaline 1:1000 how many mls will are given _____ mls

TO CALCULATE MCG/KG/MIN

Concentration (mcg x 1000) = mcg/ml
Total volume x 60 mins x weight/kg

E.g. Dobutamine infusion of 500mgs in 250 mls is running at 10 mls/hr.
Patient weight is 70 kg.

$$\frac{500 \times 1000 \times 10}{250 \times 60 \times 70} = 4.76 \text{ mcg/kg/min}$$

9. Noradrenaline is running at 5 mls/hr. The patient weighs 55 kgs and the solution is 25mg in 250mls. How many mcg/kg/min is the patient receiving?

10. Dobutamine is running at 21 ml/hr. The patient weighs 85 kgs and the solution is 500mg in 250mls. How many mcg/kg/min is the patient receiving?

AICU ONLY

11. Phase (noradrenaline) is running at 2.1mls /hour. Patient weighs 78kgs and the solution is 600mcg in 50mls. How many nanograms/kg/min is the patient receiving?

Intravenous Self directed learning package checklist yet to be completed outline plan below

1. ....
2. ....
3. ....

Date set for next review ....

Assessor: Print Name ....
Signature ....

Nurse: Print Name ....
Signature ....
Date: ....

Self directed learning package fully completed and all aspects verified the nurse to be a Safe/Unsafe Nurse

Assessor: Print Name ....
Signature ....

Nurse: Print Name ....
Signature ....
Date: ....

Appendix M: Main Nursing Activities in the Adult Critical Care Setting Investigated

Time	Level 2 adult critical care	Level 3 adult critical care
07:00	The nurse arrives at the ward. Starts to receive handover from the in-charge nurse on the night shift. The nurse may or may not receive another bedside handover by the nurses who was looking after the assigned patients.	The nurse arrives to the shift. Received handover from the nurses in-charge on the night shift, then receives one-to-one hand over from the nurse who was looking after the assigned patient over night. .
07:30 08:00	Start morning medication round. Hourly observation (if needed)	Hourly observations Checking the medication that are being infused, patient medication lines, and doctor's orders. Start administering morning medication
08:00 09:00	Helping out in the washing the allocated patients (along with the auxiliary nurses). Check and prepare for any procedures that the patients are due to have today or soon The pharmacist arrives at the ward. Start with the doctor rounds , checking the drug chart and ordering the necessary drugs from the pharmacy Serving the patient breakfast (if patient is able to eat and drink) observation for those needing hourly observation	Hourly observation Prepare any medications which are due to run out soon, check for any procedures that the patients are due to have today or soon. The pharmacist arrives at the ward. Start with the doctor rounds and checking the drug chart and ordering the necessary drugs from the pharmacy Serving the patient breakfast (if patient is able to eat and drink)
09:00 10:00	Walking with doctor rounds, checks for any urgent doctor's order (usually band 6 nurse). Some doing mid morning observations. morning break (15 minutes)	Hourly observation. Standing with doctors rounds (usually band 6 nurse). Morning break (15 minutes)

10: 00 12: 00	Finishing off washing the patients, changing the patient's sheets. Any ongoing doctors or pharmacist' query (e.g. patient discharges). observation for those needing hourly observation	Hourly observation .Any ongoing doctors or pharmacist query.
12:00 13:00	Midday medication round. Helping in patient lunch (if patient is able to eat and drink) Hourly observation (if needed)	Hourly observation. Midday medication round. Helping patient lunch (if the patient able to eat and drink)
14:00 18:00	Afternoon observation Visiting time (talking to family if appropriate) Observation for those needing hourly observation	Hourly observation Visiting time (talking to family if appropriate).
18:00 19:00	Evening medication round nursing documentation Helping out with patient dinner	Hourly observation Evening medication round Nursing documentation Helping in patient dinner if patient can eat and drink
19 :00 20:00	Handing over to nurses in the next night shift	Handing over to nurses in the next night shift (the shift in charge nurse hand over to the nurse in charge of the nigh shift
20:00 22:00	checking the patient Hourly observation (if needed) Administering 22: medications	Hourly observation. Checking the patient medication, forthcoming patient procedures. Administering 22:00 medications
23: 00 03:00	Hourly observation (if needed) Administering the prescribed medications at 24:00	Hourly observation Administering any prescribed medication as 24:00
03:00 05:00	Hourly observation (if needed)	Hourly observation Starting the morning care

		(patient washing)
05:00 07:00	Hourly observation (if needed) Preparing and administering the morning IV medications Completing nursing documentation Preparing for handing over to the next shift.	Hourly observation Preparing and administering the morning IV medication Completing nursing documentation Preparing for handing over to the nurses in the next shift