UNIVERSITY OF SOUTHERN QUEENSLAND

PSYCHOLOGICAL FACTORS INFLUENCING UNSAFE BEHAVIOUR DURING MEDICATION ADMINISTRATION

A Dissertation submitted by

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For the award of

Doctor of Philosophy

2004

Abstract

The health system in Australia delivers safe and effective health care to millions of patients each year. However, health care is not as safe as it could be with research indicating that errors involving medications are a leading cause of unintended harm to patients both in Australia and internationally. Historically, hospital authorities have attempted to reduce incidents by focusing on the actions of individuals. However, the health system is now taking advantage of research carried out in other complex industries which indicates that error is inevitable and that identifying individuals as the ultimate cause of adverse incidents is of limited value unless the context in which the incident occurred is well understood.

This series of studies used Reason's (1990) model of accident causation as the basis for the search into possible contributing factors to unsafe behaviour by nurses during medication administration. Structural equation modelling was used to operationalise Reason's theory by developing a model linking organisational and individual factors to unsafe behaviour in the hospital system. Study 1 in this series was a preliminary investigation of the role of organisational factors in contributing to violations by nurses in rural and remote areas in Queensland, Australia. Data were collected using a self-report questionnaire with this instrument being used to develop a structural model wherein organisational variables predicted 23% of the variance in self-reported violations. Study 2 extended the number of organisational factors measured by using a validated instrument that is widely used in public sector hospitals in Queensland. This instrument measures organisational climate and also a number of individual factors. In addition to the outcome variable, violation behaviour, a measure of errors was included. Data were collected from nurses working in two rural health service districts. A structural model was developed from

this instrument wherein organisational variables predicted 7% of the variance in self-reported violations and 24% of the variance in errors. The hypothesised relationships between the individual factors and errors were not supported in this study. Study 3 investigated the impact of individual factors and a specific type of organisational climate, that is, safety climate on unsafe behaviour. The violation behaviour and error scales were extended and improved in this study, for example, the error scale was expanded to include near misses. In addition, a new scale measuring reporting behaviour was developed and included. Data were collected from nurses working in a large rural centre. The structural model developed from the instrument indicated that safety climate predicted 27% of the variance in violation behaviour, 61% of the variance in errors and near misses, and 20% of the variance in willingness to report.

This series of studies identified underlying contributing factors to unsafe behaviour during medication administration, indicated the strength of the relationships among the various elements, and illustrated how the various parts of the system link together to influence safety outcomes. By identifying which elements are important by the use of structural equation modelling, this research provides the basis for predicting unsafe organisational conditions and leads to suggestions for suitably targeted interventions to reduce unsafe behaviour and adverse incidents.

Certification of Thesis

I certify that the ideas, experimental work, results, analyses, software, and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

_____ _____

Christine M. McKeon Date

_____ _____

Prof. Gerard J. Fogarty (Supervisor) Date

Acknowledgements

This has been such an interesting journey. I really do appreciate the enormous privilege it has been to take it and all the people who have helped me along the way.

My sincere thanks to my supervisor, Professor Gerard Fogarty, for being my guide on this journey and for bringing me from "looking blank and feeling lost" to a much better place! You were right, Gerry, about all the skills we learn along the way. Thanks for challenging me and for your expertise and encouragement.

Thanks to all the nurses who gave guidance and expert advice, and for teaching me the language of nursing. Particular thanks to Lorna, Sharron, and Desley and the nurses at the Centre. Thanks to Sue Goddard, Alan Dixon, Mark Davey, Bronwyn Hartwig, Judy March, and Clint Moloney for your generous assistance in data collection. And many thanks to all the wonderful nurses who completed questionnaires. I know you are "over-surveyed" but you still generously gave your time. I hope that, together, we will contribute to a safer health care system.

Thanks to all the friendly folk at Psychology Technical Services, particularly Susie and Kym, for your wonderful skills, helpful assistance, and friendship. Thanks also to all those at Research and Higher Degrees for your helpful support.

To my travelling companions, Sandra and Nancey … Thanks, roomies, for creating such a great atmosphere to work in. And many thanks to my friends, Dr Liz and Dr Maj, the intrepid scouts who went out before us to smooth the way.

And to my darling boys and their darling girls, Andrew, Shell, and Dylan, Matt and Suz, Ceej and Jami, and to Mum and Dad and the McKeon clan. Thank you all for your love and support.

And Andy … Thanks Darl for all the laughter and for being so proud of me!

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Chapter 1 – Introduction

1.1 Statement of the Problem

The health system in Australia delivers safe and effective health care to millions of patients each year (Australian Council for Safety and Quality in Health Care [ACSQHC], 2001c). However, health care delivery involves complex and dynamic processes and systems, and health care is not as safe as it could be. Research indicates that adverse events involving medical error are a leading cause of death and injury both in Australia and internationally (Brennan et al., 1991; Kohn, Corrigan, & Donaldson, 1999; Thomas et al., 2000; Vincent, Neale, & Woloshynowych, 2001; Wilson et al., 1995). An adverse event is defined as an unintended injury or complication that results in disability, death, or prolongation of hospital stay and is caused by health care management rather than the patient's disease (ACSQHC, 2001a).

The extent of the problem of hospital-based errors was highlighted in the United States of America (US) when the Institute of Medicine (IOM) released a report on patient safety in November, 1999 (Kohn et al., 1999). The IOM report cited two studies of large samples of hospital admissions, one in New York using 1984 data (Brennan et al., 1991) and another in Colorado and Utah using 1992 data (Thomas et al., 2000). These studies found that the proportion of hospital admissions experiencing an adverse event was 3.7% and 2.9%, respectively. The results of these two studies imply that the number of deaths resulting from medical error in US hospitals is at least 44,000 and perhaps as many as 98,000 each year (Kohn et al.). The annual toll exceeds the combined number of deaths and injuries from motor and air crashes, suicides, falls, poisonings, and drownings (Barach & Small, 2000).

The most comprehensive study of this type in Australia was the Quality in Australian Health Care Study, which involved the retrospective review of over 14,000 medical records from 28 hospitals in 1992 (Wilson, Harrison, Gibberd, & Hamilton, 1999; Wilson et al., 1995). This study suggested that Australia had a relatively high rate of adverse events (16.6% of hospital admissions) when compared to the US research. However, reanalysis of the Australian data found that this percentage would drop to 10.6% of hospital admissions being associated with an adverse event if the US methodology had been applied in Australia (ACSQHC, 2001c). Further review of the adverse events recorded and of the methods used suggested that most of these events were minor in nature, and that both the Australian and US studies had a virtually identical rate of serious adverse events comprising about 2% of cases, with 1.7% of admissions being associated with serious disability and 0.3% with death (ACSQHC, 2001c). Apart from the heavy toll in human costs, it has been estimated that the direct medical costs of these events in Australia exceed $2 billion per year and that the total life-time cost of such preventable injury may be twice that amount (Runciman & Moller, 2001).

Although there has been some debate over the reliability of the figures quoted in the above studies (Adams, 2001; Leape, 2000; McDonald, Weiner, & Hui, 2000; McNeil & Leeder, 1995), it is well accepted that modern health care is increasingly complex with inevitable risks for patients as a result of this complexity (ACSQHC, 2001b). Available international data suggest that probably about 10% of admissions to hospitals are associated with some form of adverse event and that this is likely to be similar in health systems in most developed countries (ACSQHC, 2001c; Neale, Woloshynowych, & Vincent, 2001; Vincent et al., 2001).

1.2 Objectives of the Current Research Project

Health-care delivery involves complex and dynamic processes and systems, and therefore, it is unrealistic to expect perfect performance in all situations. However, every patient hurt by the system matters and, as the research discussed in the previous section indicates, safety concerns are real (ACSQHC, 2001a). Historically, hospital authorities have attempted to reduce adverse events by focusing on the actions of individuals (Leape, 1994). However, the health care system is now taking advantage of the research carried out in other complex industries which indicates that error is inevitable and that identifying individuals as the ultimate cause of adverse incidents is of limited value unless the context in which the incident occurred is well understood (McCarthy, Healey, Wright, & Harrison, 1997; Reason, 1997). Unfortunately, most studies in this area report only the extent and cost of the problem rather than identifying why errors are happening (Roughead, 1999; Vincent, Taylor-Adams, & Stanhope, 1998). Research is required to investigate and identify the underlying contributing factors as this lack of knowledge limits efforts to improve the current situation (ACSQHC, 2001c).

The aim of the current project was to examine organisational and individual factors considered likely to impact on medication administration performance in the hospital system; explore the relations among these variables; and develop a model for predicting unsafe behaviour, a major precursor to adverse events (Reason, 1997). This model was developed using the technique called structural equation modelling. This technique facilitates understanding of the interactions among variables and illustrates how the various parts of the system link together to influence outcomes. Models such as these enable the prediction of unsafe organisational conditions, which in turn assists in the design of suitably targeted intervention programs to

reduce unsafe behaviour and adverse incidents (Fogarty, 2004). The specific area examined in this project was medication administration by nurses. The following section will outline the rationale for this focus.

1.3 Medication Error

Within the medical environment, adverse events resulting from medication errors are recognised as a leading cause of unintended harm to patients (Kohn et al., 1999; Wilson et al., 1995), with between 10% and 20% of all adverse events being drug related (Bates, 1999). In Australia it has been estimated that adverse drug events result in at least 80,000 hospital admissions each year at a cost of around $350 million. Between 32% and 69% of these hospitalisations are considered preventable, that is, due to error rather than the disease process (Roughead, 1999; Roughead, Gilbert, Primrose, & Sansom, 1998). An adverse drug event that is not preventable is known as an adverse drug reaction, that is, when the right drug is used for the correct indication in the right dose given by the right route, but the patient suffers unexpected and unpreventable harm as a result (ACSQHC, 2002a). If, however, the patient had a previous reaction that was recorded in the medical records, and this was overlooked by the doctor, pharmacist, and/or nurse, then this would be considered preventable. Only preventable adverse drug events will be considered in the present research.

Medication error has been defined as a failure in the drug treatment process resulting in inappropriate medication use (ACSQHC, 2001b). This can occur at any time along the continuum of the medication system, from prescription by the doctor to administration by the nurse. Leape et al. (1995) found that most errors occur in the prescription (39%) and administration (38%) stages, with the remainder nearly equally divided between transcription and pharmacy dispensing. The current research

focused on the medication administration stage of the process and this is discussed in the next section.

1.3.1 Medication Administration Errors by Nurses

Medication administration is a complex and time-consuming task that forms a major part of the nurse's role (O'Shea, 1999). Medicines are normally prescribed by a doctor and dispensed by a pharmacist or nurse, but responsibility for the safe administration of the medication rests with the nurse (Gibson, 2001; Wakefield, Wakefield, Uden-Holman, & Blegen, 1998). The nurse must ensure that correct procedures are followed so that the right dose of the right drug is administered to the right patient at the right time by the right route (Delaune & Ladner, 1998). Nurses are not only responsible for the administration of medications, but also for preparing and checking medications, updating their own knowledge of medications, monitoring the effectiveness of treatment, reporting adverse reactions, and teaching patients about their drugs (Australian Nursing Council, 2000; Delaune & Ladner). The complexity of the medication process increases the potential for error. If an error occurs, the nurse often assumes or is assigned responsibility for the error even though the actions of others involved in the system and the system design itself may have contributed to the situation (Wakefield et al.). Contributing factors for medication administration errors may include nurse error, system design (medication administration system, drug company practices), and the actions of doctors, pharmacists, and other nurses.

Although some studies are beginning to look at contributing factors to errors by nurses (e.g., Edmondson, 1996; Meurier, 2000; Meurier, Vincent, & Parmar, 1997; Meurier, Vincent, & Parmar, 1998; Wakefield et al., 1998), research in this area has paid relatively little attention to the interactions among individual and organisational factors, and local circumstances in producing adverse events (Leape et

al., 1995; Roughead, 1999). Leape (1994) argued that more attention needs to be given to psychological and human factors that contribute to unsafe behaviour, particularly the fact that susceptibility to this behaviour is strongly affected by the context and conditions of work.

Our understanding of human functioning and errors has been enhanced by theory development and research activities in the areas of cognitive psychology and human factors (Helmreich, 2000; Helmreich, Merritt, & Wilhelm, 1999; Reason, 1990, 1997; Sexton, Thomas, & Helmreich, 2000). Much has been learned about mental functioning from psychologists who investigate possible causes of error at an individual/cognitive level. In contrast, human factors experts look at the issue of error more from a social/organisational perspective, that is, they study the interrelationships between humans, the tools they use, and the environment in which they live and work (Weinger, Pantiskas, Wiklund, & Carstensen, 1998). According to the human factors approach, managing risk and reducing unsafe behaviour and errors requires attention to the design of tasks and processes, and to the conditions under which people work (e.g., hours, schedules and workloads), how people interact with one another, and how people are trained (Leape & Berwick, 2000). The following section will discuss the contributions made by cognitive psychologists and human factors experts to explain why humans err and why they sometimes choose to act unsafely.

1.4 The Individual/Cognitive Approach to Human Error

Psychologists such as Hollnagel (1993) and Reason (1990) have studied the cognitive possesses involved in human error. Although the management of error in complex systems such as aviation and medicine is an organisational task that cannot be managed by dealing with psychological issues alone (Helmreich & Merritt, 1998;

Reason, 1997), errors by individuals and teams have their roots in human cognitive limitations, restricted memory, and information processing capacity (Reason, 1997).

Several human error taxonomies have been published, with the most prominent being the category of cognitive errors proposed by Reason (1990), Norman (1988), and Rasmussen (1982). Although these psychologically oriented taxonomies do not provide a diagnosis of error causality, they do help our understanding of the underlying cognitive mechanisms that result in human failure (Sutcliffe & Rugg, 1998).

1.4.1 Levels of Human Performance

An understanding of the different levels of performance involved in normal cognitive functioning can help to explain why errors occur. People pass through three stages of learning in their journey from novice to expert, that is, the cognitive, the associative, and the autonomous stages (Lourens, 1990; Rasmussen, 1982). The first stage is the knowledge-based level where reasoning, or thinking things through is required. As the person becomes more proficient, this declarative knowledge is replaced by procedural knowledge consisting of a list of rules (rule-based level) and, finally, of a set of automatic productions (skill-based level). The three levels of performance correspond to increasing levels of familiarity with the environment or task (Reason, 1990).

The knowledge-based level of performance is required in unfamiliar situations and in tasks for which no training was given or no procedures exist (Reason, 1990). Actions must be thought out using conscious analytical processes and stored knowledge. This conscious mode requires effort and is slow, sequential, restricted in capacity, and error-prone (Reason, 1997). It requires “paying attention” which is a limited resource that necessitates withdrawal of focus from other areas.

The rule-based level of performance is used when stored rules are used to solve known but not routine problems; for example, *if* this situation happens, *then* do these actions (Leape, 1994; Reason, 1997). This situation will likely be one that has been encountered before, or has been trained for, or is covered by procedures.

The skill-based level of performance is applied to well-known and routine activities and is governed by stored patterns of pre-programmed instructions (Reason, 1990). Routine, highly-practiced tasks are carried out unconsciously with occasional conscious checks on progress (Reason, 1997). This functioning is automatic, fast, and requires little conscious effort and is the way people operate most of the time.

If a person is trained in normal operating and error-recovery procedures, most cognitive processing will be at the skilled level. Diagnostic training usually indicates rule-based processing; and lack of training usually results in knowledge-based reasoning (Sutcliffe & Rugg, 1998). An understanding of these performance levels helps to classify the variety of ways people err (Reason, 1997), as discussed in the following section.

1.4.2 Errors

Errors are defined as the failure of planned actions to achieve their intended consequences (Reason, 1990, 1997). Errors can involve the involuntary deviation of action from intention (slips and lapses); or the departure of planned actions from some satisfactory path towards a desired goal (mistake). Slips occur when an intention is executed in an inappropriate manner, and lapses are the failure to perform some required action (Norman, 1988; Reason, 1990). Slips are potentially observable as they are external actions and are often caused by factors such as haste and divided attention (Hudson, 2000). Lapses, on the other hand, refer to more covert

memory failures and are often apparent only to the person. Slips and lapses occur at the skill-based level of performance (Rasmussen, 1982). Skill-level errors include failures from lack of attention and misallocation of attention. External causes are interruptions, distractions, and unpredictable events. Many events happening simultaneously can cause information overload and task failure (Sutcliffe & Rugg, 1998). Most slips do not cause harm because they are often quickly detected by the individual. Lapses on the other hand can be missed as it is harder to detect an omitted behaviour (Hudson). For this reason, they are considered more dangerous than slips.

Mistakes are errors in the formation of an intention or in the choice of a strategy for achieving a goal (Reason, 1990). They involve deficiencies in the judgmental and/or inferential processes involved in the selection of an objective, or of the means to achieve it, or both. Mistakes can occur at the rule-based or knowledge-based level (Rasmussen, 1982). At the rule-based level, mistakes involve misapplication of normally good rules, applying an inappropriate rule, or the failure to apply a good rule. Good rules may be misapplied because of recognition problems, for example, when information overloading prevents normal recognition. Rule-based mistakes may be triggered by new variations to known problems and/or poor training (Sutcliffe & Rugg, 1998).

At the knowledge-based level, no problem-solving rules are available and the individual has to resort to resource-limited reasoning as a result of a novel situation. This can be a highly error-prone situation (Reason, 1997). Knowledge-based mistakes occur because people are faced with a novel, possibly emergency situation which requires conscious analytic processing and stored knowledge (Leape, 1994).

Slips and mistakes are errors of commission, whereas lapses are errors of omission (Sarter & Alexander, 2000). The majority of errors occur at the skill-based

level of performance followed by the rule-based level, and then the knowledge-based level (Lawton & Parker, 1998; Sarter & Alexander). This can be explained because nearly all adult actions have a skill-based component, that is, most things we do are at the automatic level. Skill-based errors are often detected by the individual, whereas rule-and knowledge-based mistakes can be more difficult to detect (Reason, 1990). Mistakes are considered more dangerous than slips or lapses because the person making the mistake thinks they are doing the right thing. Evidence to the contrary may be ignored because the person is so sure (Hudson, 2000).

1.5 A Change of Focus

Historically, the focus of safety research has been the individual. As noted earlier, errors by individuals and teams have their roots in human cognitive limitations, restricted memory, and information processing capacity (Reason, 1997). However, the management of error in complex systems cannot be achieved by dealing with psychological issues alone (Helmreich & Merritt, 1998; Reason, 1997). Lawton and Parker (1998) suggested that investigators may need to consider a range of possible contributing factors rather than focusing solely on the individual in isolation. They argued that individual, cognitive, social, and organisational factors all interact to generate the unsafe behaviours implicated in accidents.

The cognitive path to accident causation involves failures in information processing or skills, resulting in errors. However, the social-psychological path which involves attitudinal and behavioural factors, may lead to the deliberate deviation from safe working practices, that is, violation behaviour (Lawton & Parker, 1998). In addition, accidents can often involve both errors and violations in combination (Lawton & Parker). Although an error may appear to be the immediate cause of an incident, the necessary condition in the accident sequence may have been

a violation of a safety rule. Violations tend to take people into an area of greater risk, thereby making the situation less forgiving of subsequent errors (Lawton & Parker). In addition, organisational precursors such as inadequate training, incorrect procedures, and/or poor task allocation may contribute to accidents by creating the kind of workplace that invites unsafe behaviour, both errors and violations, by individuals or teams (Reason, 1997). To reduce violations and errors, a range of organisational interventions may be required. For example, compliance with procedures will be unlikely if they result in inefficient work practices. Reducing unrealistic work demands may be a way the organisation can encourage compliance with procedures in this case.

In summary, there is now a growing emphasis within safety research to look beyond the individual contributors to human error to the social and organisational factors that influence unsafe behaviour (Lawton & Parker, 1998). These include attitudinal and behavioural factors which can lead to the deliberate deviation from safe working practices, that is, violation behaviour. This behaviour will be defined and discussed in the next section followed by a discussion of the social and organisational contributors to human error.

1.5.1 Violation Behaviour – The Social/Psychological Contributors to Human Error

Violations are defined as behaviours that involve the deliberate deviation from rules that describe the safe or approved method of performing a particular task or job (Lawton, 1998; Reason, 1990). Violation behaviour is directly related to how people adapt to the situations they find themselves in and belongs to the social context in which behaviour is regulated by procedures, codes of practice, and rules (Hudson, 2000).

The conceptual boundaries between errors and violations are not always clear as both involve a deviation of action from some intended or required standard of performance (Reason, 1997). Reason has identified violations as a kind of rule-based mistake involving the failure to apply a good rule. He argued that rules can be broken for a variety of reasons and intentionality can serve to classify and distinguish among different types of behaviour (Reason, Manstead, Stradling, Baxter, & Campbell, 1990). For example, if there was no prior intention to commit a particular violation, then this can be classed as an *error*. However, if the violation was deliberate, and the intention was to cause harm to the system, this would be classified as *sabotage*. However, if no harm was intended, a *violation* has occurred (Reason, 1990).

Hudson (2000) also sees violations as a kind of mistake. However, he suggested that this involves a mistaken belief in one's own invulnerability, that is, the mistaken belief that one is in control of the situation and that nothing will go wrong. Hudson argued that violations are more dangerous than errors (slips, lapses, and mistakes) because they represent the deliberate intention not to follow safety or other procedures. Therefore, Hudson seems to be in agreement with Reason and others who believe that the question of intentionality can differentiate errors and violations (Reason et al., 1990).

In a review of research investigating the impact of personality factors, cognitive factors, and social factors on the likelihood of accident involvement, Lawton and Parker (1998) suggested that researchers in this area need to take into account the two possible routes to accident involvement via errors and/or violations. They proposed that, although errors are mainly associated with cognitive factors, violations originate in social/psychological factors. For example, Reason et al. (1990) found that a clear distinction could be made between errors and violations in a study

investigating self-reported driver behaviour. They argued that violations can be explained by social and motivational factors, for example, a willingness to bend rules to get the job done more efficiently or because everyone else is doing so. In contrast, errors involve the information processing characteristics of the individual, that is, failures of cognitive competence, for example, the failure to effectively direct attention as a result of inadequate training, bad habits, or distractions. They go on to explain that, with this difference in psychological origins, the remedial strategies required for each would benefit from taking these cognitive/motivational distinctions into account. They suggested that while skills training may be able to reduce errors, this will not significantly affect violation behaviour. Reducing violations may require an investigation of the motivational and attitudinal precursors to accidents.

Although violation behaviour is a deliberate deviation from rules, the adverse outcome is not intentional (Lawton, 1998). In general, people who violate work rules perceive this behaviour as necessary and the result of a well-intentioned desire to get the job done (Lawton; Lawton & Parker, 1998). For example, in a study of railway workers in the United Kingdom, Lawton found that time pressure, high workload, and a more efficient way of working were strongly endorsed reasons for not working to the procedures. She argued that the benefits to workers in terms of saved time, energy, and effort are common motivational reasons for violating procedures.

Simard and Marchand (1997) investigated organisational factors that may impact on compliance with safety rules in a number of manufacturing plants in Canada. The researchers found that social relationship variables at the shopfloor level were the best predictors of compliance behaviour. Van Vuuren (2000) examined the cultural influences on incident causation and risk management in the Dutch steel industry and medical environment. This research showed that there was a

poor attitude towards following safety procedures in both domains. For example, risks were taken in the steel industry in order to save time, and the use of personal protective equipment was considered inconvenient especially when working conditions were hot. These violations of safety procedures were accepted by both employees and many team leaders and had become the norm in this group. In a study conducted in 13 industrial plants located throughout Europe, the USA, and Canada, Rundmo (2000) found that acceptance of rule violations as the norm was the strongest predictor of unsafe behaviour. As the above research suggests, social and organisational factors can have an impact on violation behaviour and these will be discussed in the following section.

1.5.2 The Social/Organisational Contributors to Human Error

Human decisions and actions play a leading role in nearly all accidents (Reason, 1997; Shappell & Wiegmann, 2001). Reason noted that this was not surprising considering the major role that the human factor plays in complex industries, that is, people design, build, operate, maintain, manage, and defend these industries. However, failures in these industries need to be understood as a complex set of interrelated events with the role of cognitive, social, and organisational factors taken into account (Sutcliffe & Rugg, 1998). Individual factors such as stress, fatigue, and poor motivation often have their origins in the working environment. Contributing factors to failures can include attention being distracted, memory being overwhelmed by too many facts, or operator stress. Fatigue, stress, and interruptions are frequently vital contributing factors to cognitive failures. These can be induced by organisational factors such as poor workload planning, resulting in long working hours or in excessive workload in peak times, which demands too much concentration. Environmental factors such as unusual events, excessive workload,

and stressful situations put pressure on people and increase the probability of error. Time stress in particular is a powerful cause of mistakes at the rule-based level when people have a tendency to use recently memorised or frequently used rules even if they are wrong (Reason, 1990). In addition, social and organisational level failures can occur when management or the organisation have not created a safety-conscious culture (Reason, 1997). For example, normal operational procedures may be well designed and documented but never enforced due to cultural deficiencies. Group dynamics and the culture of the organisation play a role in determining how effectively safety is managed (Neal & Griffin, 2002; Sutcliffe & Rugg).

The Quality in Australian Health Care Study identified a number of system failures that contribute to adverse events in hospitals in Australia (Wilson et al., 1999; Wilson et al., 1995). These included weaknesses in the following areas: policies and procedures; education and training; access and transfer of information; organisational culture; organisational management; personnel, that is, number and quality; patients placed or managed in inappropriate facilities; and the availability and quality of equipment and other physical resources (ACSQHC, 2001a).

Each system possesses elaborate safety defences with accidents normally the product of a combination of a number of causal factors (Reason, 1997). Each factor is necessary to the adverse outcome, but not usually sufficient by itself to break through the safety defences. The people in the workforce are the final defensive filter and often inherit organisational defects, for example those created by inadequate design, conflicting goals, and poor management decisions (ACSQHC, 2001a).

In summary, human error has been implicated in a variety of occupational accidents (Shappell & Wiegmann, 2001). However, identifying human error as the ultimate cause of a system failure is of limited use unless the context in which the

error occurred is well understood (McCarthy et al., 1997). Error-resistant design has been influenced by cognitive models of human error such as Reason's (1990) and Norman's (1988). Rasmussen (1982) and Reason (1997) have now also included the organisational context of error by linking failure in organisational processes to individual actions and, ultimately, error. Reason argued that organisational failures such as lack of management commitment to safety, unclear safety responsibilities, and poor training contribute to accidents by creating the kind of workplace conditions (e.g., fatigue, time pressure, low morale) that provoke unsafe behaviour by the individual or team, or by creating deficiencies in system defences.

Reason's (1990) model of accident causation served as the basis for the search into possible organisational factors contributing to unsafe behaviour by nurses during medication administration in the current research. This model was not only chosen because of its widespread use in other complex industries but also because it has now been adopted by health care researchers interested in improving patient safety, including the [1]Australian Council for Safety and Quality in Health Care (ACSQHC, 2001a). Reason's model of accident causation will be described in the following section.

1.6 Reasons' Organisational Accident Model

Although many different accident causation theories exist, the accident causation system that has been used the most extensively is that of Reason (1990), based on theories by Rasmussen (1982) and Norman (1988). Reason's model has been widely adopted throughout complex industries such as aviation and nuclear power as the method of choice to investigate the way in which threats penetrate the

[1] The Australian Council for Safety and Quality in Health Care was established in January 2000 by Health Ministers to lead national efforts to improve the safety and quality of health care in Australia.

extensive defensive barriers protecting such industries and now Reason has applied his model to the field of medicine (Reason, 1994, 2000a). He argued that medical mishaps share many causal similarities with those experienced in other complex systems and, although these organisations seem far removed from the medical domain, Reason noted that they share important characteristics with healthcare institutions. That is, they are complex, internally dynamic, and interactive, and tasks are often performed under considerable time pressure (Reason, 2000a). For example, if comparing aviation and medicine, both domains are, for the most part, highly reliable. Considering the volume of air traffic and the number of people treated in hospitals every day, remarkably few incidents occur (ACSQHC, 2001a). Pilots, doctors, and nurses work in similar environments where small highly trained teams face dynamic changing demands and daily incongruities between production and safety goals. Human issues such as teamwork, communication, leadership, and decision making are common to both domains. The professional cultures in aviation and medicine share positives such as professionalism and ethics as well as other negative and unrealistic attitudes regarding individual performance in times of stress or fatigue (Helmreich & Merritt, 1998). Aviation and medicine are complex systems that require the coordination of a large number of human and technological elements (ACSQHC, 2001a).

Health care researchers are taking advantage of the experience and research carried out in the aviation industry (Leape, 1994). Historically, airlines and hospitals have attempted to reduce errors and adverse events by focusing on the actions of individuals. However, the aviation industry has discovered that system-wide strategies and education are required to maximise safety (Helmreich, 2000; Helmreich & Merritt, 1998; Helmreich et al., 1999). A description of these two

approaches, that is, the individual approach and the system approach, will be discussed in the following section.

1.6.1 The Individual Approach vs. the System Approach

Reason (2000a) suggested that the human error issue could be viewed in two ways: the individual or person approach and the system approach. The individual approach focuses on the unsafe behaviour, that is, the error or violation by the individual in the workplace. Using this approach there is a tendency to view most unsafe behaviour as attributable to forgetfulness, inattention, or incompetence on the part of those identified with this behaviour. This individual approach is the dominant tradition in medicine (Moray, 1994). The usual approach to reducing the frequency of error in medicine has been to find and punish the individual or individuals who carried out the unsafe act (Leape, 1994). This approach has proven ineffective since errors are inevitable and part of the human condition. Although it is true that some unsafe acts in any field are due to negligence, the vast majority are not. Most people who make even serious errors are conscientious and dedicated professionals who usually do their jobs well (Bates, 1999). The individual approach isolates the person and the unsafe behaviour from their system context (Reason, 1997).

The system approach looks at unsafe behaviour in a different way (Reason, 2000a). According to this approach, the most important cause of error within an organisation is faulty systems or design rather than the individual. Individuals are seen as fallible and errors as expected, even in the best organisations. This approach concentrates on the conditions under which individuals work and tries to build defences to prevent unsafe behaviour and errors or to diminish their effects. Errors are seen as consequences rather than causes, having their origins not so much in the fallibility of the individual as in contributing systemic factors. Countermeasures are

based on the assumption that though we cannot change the human condition, we can change the conditions under which humans work. From this perspective, an adverse event is seen to result from faults in system design that allow unsafe behaviour by the individual in the workplace that may result in an adverse outcome. The probability that unsafe acts will result in an adverse event can be minimised by changing the system (Reason, 1990, 1997). Examples of faulty system design in hospitals that relate to medication use include interruptions during drug administration, different drugs packaged in similar ways, and sound-alike drug names (Bates, 1999).

Defences, barriers, and safeguards occupy a key position in the system approach (Reason, 1997). High technology systems have many defensive layers: some are engineered, for example, alarms, physical barriers, and automatic shutdowns, others rely on people, and yet others depend on procedures and administrative controls. Mostly these defences are effective but there are always weaknesses. These weaknesses may arise for two reasons: active failures and latent conditions. Active failures are unsafe behaviour by people who are in direct contact with the patient or system. They take a variety of forms: action slips or failures, such as picking up the wrong syringe; cognitive failures, such as memory lapses; mistakes through ignorance or misreading a situation; and violations, that is, deviations from safe operating practices, procedures, or standards (Vincent et al., 2000; Vincent et al., 1998). Active failures have a direct and usually short-lived impact on the integrity of the defences. The individual approach looks no further for the causes of an adverse event once the proximal unsafe behaviour has been identified. However, virtually all such behaviour has a causal history that extends back in time and up through the levels of the system (Reason, 2000a). Blaming the individual for adverse events that are not due to negligence or lack of care does not help to improve the

health system or ensure that lessons will be learned when things do go wrong (Leape, 1994). To move beyond blame requires that the underlying contributing factors, that is, the latent conditions that provoke unsafe behaviour be identified (ACSQHC, 2001c).

Latent conditions/failures stem from fallible decisions, often made by people not directly involved in the workplace, such as designers, writers of policies and procedures, and senior management (Reason, 1997). Latent failures provide the conditions under which unsafe behaviour occurs. Reason referred to these as errors "waiting to happen" arising from poorly designed processes and systems (Reason, 1990; Reinertsen, 2000). They can have two kinds of adverse effects: producing error-provoking conditions within the workplace (e.g., time pressure, understaffing, inadequate equipment, fatigue, and inexperience), and/or creating long-lasting holes or weaknesses in the defences (e.g., unworkable procedures and design deficiencies). Latent conditions may lie dormant within the system for many years before they combine with active failures and local triggers to create an accident opportunity. Unlike active failures, whose specific forms are often difficult to anticipate, latent conditions can be identified and remedied before an adverse event occurs (Reason, 2000a).

Whereas organisations that follow the individual approach direct most of their management resources at trying to make individuals less fallible, advocates of the system approach strive for a more holistic management program aimed at several different areas, that is, the individual, the team, the task, the workplace, and the institution as a whole (Reason, 2000a). Leape et al. (1995) argued that the concept of system failures as underlying causes of unsafe behaviour and errors has not been

widely accepted in medicine, although accident causation is more likely to be prevented by changing the system rather than the individual.

In summary, analyses of incidents in medicine and elsewhere have led to a much broader understanding of accident causation, and a greater appreciation of the complexity of the chain of events that may lead to an adverse event (R. I. Cook & Woods, 1994). Reason (1997) argued that many errors result from interacting causes involving physical, cognitive, social, and organisational factors. This system approach focuses on the human component within complex systems with less emphasis on the individual and more on pre-existing organisational factors that provide the conditions in which unsafe behaviour occurs (Reason, 1990). The contributing factors may lie in several interrelated factors, such as communication and supervision problems, excessive workload, and training deficiencies (Vincent, 1997).

1.7 Operationalising Reason's Model

There is now a substantial body of empirical support from the general safety and nursing literature demonstrating the impact of individual and organisational factors on safety outcomes as proposed by Reason. For example, associations have been found between accidents and organisational factors such as work pressure and communication problems (Hofmann & Stetzer, 1996), and individual factors such as motivation (Lawton & Parker, 1998) and unsafe behaviour (Lawton, 1998; Mearns, Flin, Gordon, & Fleming, 2001; Oliver, Cheyne, Tomas, & Cox, 2002). Mearns et al. (2003) found that less favourable scores on safety dimensions such as perceived management commitment to safety, willingness to report incidents, and work pressure were associated with higher self-reported accident involvement in the offshore oil industry.

Hemingway and Smith (1999) explored the relationships among organisational climate variables, occupational stress, and stress-related outcomes, including injuries, in a sample of nurses in four hospitals in Canada. Injuries in this study were injuries to nurses rather than patients. They included near misses and reported and unreported injuries which consisted of contusions, scratches, sprains/strains, and cuts/punctures. The results suggested that different injury categories were predicted by different occupational stressors. For example, increased stress owing to the death and dying of patients resulted in more near-miss and unreported injuries, while nurses experiencing role ambiguity were more likely to experience a reportable injury at work.

Oliver, Cheyne, Tomas, and Cox (2002) used a modelling technique to investigate the impact of work environment, social, organisational, and individual variables on occupational accidents in workers from the industrial sector in Spain. The results (see Figure 1.1) indicated that work environment variables impacted on occupational accidents, both directly and when mediated by individual factors. That is, workers perceived that occupational accidents were decreased when individuals demonstrated safe behaviours and were in good general health. In addition, accidents were lower when the organisation was more involved in safety management, and when the physical work environment was less hazardous.

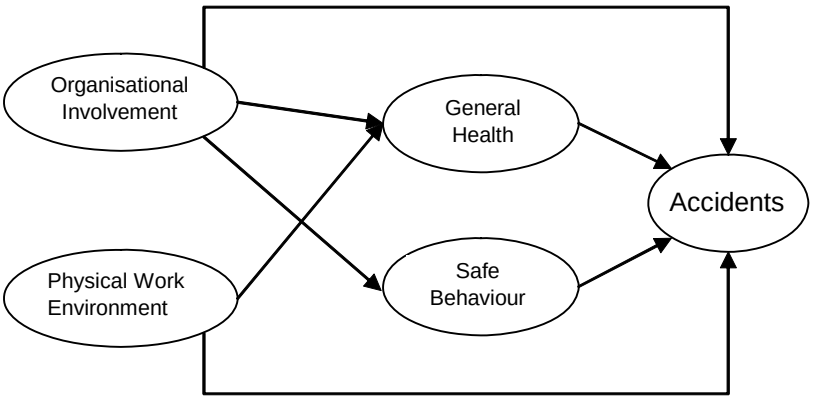

Figure 1.1 Oliver, Cheyne, Tomas, and Cox (2002) Model

In addition to investigating the associations between organisational and individual variables and accident liability, researchers are also looking at the precursors to accidents, for example, errors and violations and the safety climate of the organisation. Lawton and Parker (1998) and others (e.g., Shappell & Wiegmann, 2001) argued that it is more beneficial to focus on these precursors because of the low frequency of accidents and, therefore, the unreliability of accidents as an outcome measure. They suggested that these precursors are a more sensitive and less ambiguous measure of safety performance and can be investigated using self-report measures. Coyle, Sleeman, and Adams (1995) believe that measuring the precursors of accidents, as identified in an analysis of the safety climate of an organisation, provides a powerful proactive management tool.

Fogarty and colleagues (Fogarty, 2004; Fogarty, Saunders, & Collyer, 1999, 2001) developed a conceptual model to predict aircraft maintenance performance and to investigate the role of individual and organisational factors in aviation maintenance (see Figure 1.2). Their model was based on Reason's theory in that it highlighted background variables that induce unsafe behaviour. To provide an empirical test of Reason's theory, they developed a model linking organisational and

individual variables to outcomes including job satisfaction, turnover intentions, and tendency to make errors in aircraft maintenance. They found support for a structural model that showed organisational variables predicting personal health variables, which in turn predicted self-reported maintenance errors.

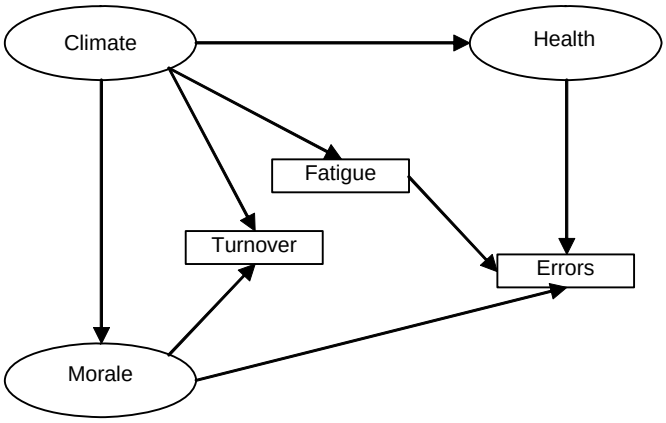

Figure 1.2 Fogarty (2004) Model

Prussia, Brown, and Willis (2003) also used modelling to predict safe work behaviours in a steel plant in the US to determine the extent to which managers and employees agreed on safety issues (see Figure 1.3). Their model included the organisational variables: safety hazards, management's influence on workplace safety, and pressure for expediency over safety. Results suggested that managers and employees agreed that these system-level factors influenced individual-level factors (cavalier attitude towards safety behaviour and safety efficacy, that is, belief in one's ability to work safely), which in turn impacted on safe workplace behaviour.

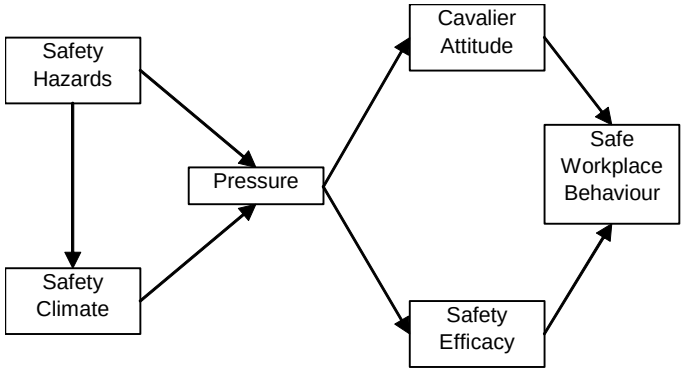

Figure 1.3 Prussia, Brown, and Willis (2003) Model

In a study of employees from a number of different work groups in the hospital system in Australia, Neal et al. (2000) tested a model examining the effects of general organisational climate on safety climate and safety performance (see Figure 1.4). Organisational climate measured aspects of the work environment such as leadership, professional interaction, decision making processes, and role clarity. These factors were found to have a significant impact on safety climate, that is, perceptions of safety within the hospital environment such as management values, communication, training, and safety systems. Safety climate, in turn, was related to self-reports of compliance with safety regulations and procedures as well as participation in safety-related activities.

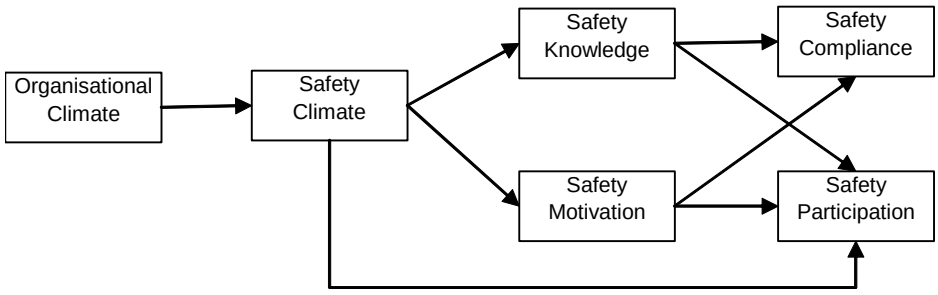

Figure 1.4 Neal et al. (2000) Model

The above research provides support for the influence of individual and organisational factors on safety outcomes as proposed by Reason. These studies were conducted in a variety of countries (i.e., Canada, Spain, Australia, and the US) and industries (e.g., health, chemical, steel, and aviation) and included outcome variables such as injuries, accidents, errors, and safety compliance.

Health care researchers are now taking advantage of the experience and research conducted in other complex industries (ACSQHC, 2001a). Despite some cultural and contextual differences, the medical domain and these other industries have economic efficiency and safety as common goals. However, as Leape (2001) explained, while many of these industries are associated with substantial hazards, the health care setting is the only one in which adverse events result from the actions of individuals whose sole aim is to relieve the pain and suffering of the victim and, in particular, to "do no harm". The following section will detail research investigating the impact of individual and organisational factors on unsafe behaviour and adverse events in the hospital system.

1.7.1 Investigating Errors and Adverse Events in the Hospital System

A study into the factors underlying the occurrence and reporting of medication errors by nurses was conducted by Gladstone (1995) in a district general hospital in the United Kingdom (UK). Data were collected from a variety of sources, that is, medication error reports, questionnaires, and interviews with nurses who had been involved in medication errors. The questionnaire results indicated that nurses and nurse managers both considered distractions, doctors' writing, and failure to follow procedures, that is, checking patient's name band, as reasons why medication errors occur. Additional information obtained from interviews with nurses who had made medication errors suggested that these nurses perceived that factors such as

workload, poor skill mix, interruptions, and loss of concentration had contributed to their error.

Edmondson (1996) explored the impact of group and organisational factors on preventable drug administration errors in eight units in two urban hospitals in the US. Surveys were distributed to nurses, physicians, and pharmacists with potentially harmful drug-related errors being identified by a combination of patient chart reviews and voluntary reporting. The analyses of the relationships between unit characteristics and error rates yielded unexpected results. That is, higher error rates were strongly associated with higher scores on perceived unit performance, quality of unit relationships, and nurse manager leadership behaviours. Edmondson suggested that this result may have been due in part to respondents' perceptions of how safe it was to discuss errors in their unit and this interpretation was supported by additional quantitative and qualitative results. For example, the qualitative data analysis identified several variables that distinguished among units, such as unit climate (blame oriented vs. learning oriented), openness, nurses' trust in nurse manager, and perceived supportiveness. It was discovered that shared perceptions about the consequences of making errors influenced the climate and reporting behaviours within each team. For example, authoritarian leadership within a unit generated a climate of fear which tended to suppress reporting or discussion of errors.

In order to examine the causes and consequences of errors as well as the potential for errors to initiate changes in practice, Meurier et al. (1997) surveyed nurses in a district general hospital in the UK. A nursing error was defined in this study as any wrongful decision, omission, or action that had adverse or potentially adverse consequences for the patient, and that would have been judged as wrong by

knowledgeable peers. Medication errors were not included in this study. Nurses reported that the most common contributing factors were lack of knowledge or information, work overload, stressful atmosphere, and lack of support from senior staff. Accepting responsibility for an error tended to lead to positive changes in practice, while negative coping strategies such as distancing were associated with defensive changes, in particular the tendency not to report errors.

Wakefield et al. (1998) surveyed nurses in 24 acute care hospitals in the US to ascertain their perceptions of why medication administration errors occur. Five categories of reasons were identified. These were, in order of frequency of response, physician, systems, pharmacy, individual, and knowledge reasons. Descriptive statistics revealed that the contributing factors most endorsed on the questionnaire were to do with interruptions during administration and illegibility of doctors' orders. Further analysis suggested that nurse managers were more likely to perceive individual factors as reasons for adverse events, while staff nurses were more likely to view physicians, pharmacists, and system issues as contributing factors.

Meurier (2000) used Reason's Organisational Accident Model to analyse critical incident reports of errors by nurses which had resulted in an adverse or potentially adverse event in the UK. Respondents were invited to produce a critical incident report of an error they had made in their professional practice and this was followed by an in-depth interview to explore further issues relating to the incidents. A detailed analysis of one of the incidents was reported in the article with results suggesting that a number of pre-existing organisational conditions may have contributed to the adverse event. These included staffing levels on the ward, lack of management support, inadequacy of protocol/policies, inadequacy of communication, and insufficient experience and training.

Headford, McGowan, and Clifford (2001) described a project by nursing staff and pharmacists in a hospital in Australia who reviewed medication incident data, and revised and established a new system of reporting. The researchers found that the most common type of incident in this study was the omission of a dose of a medication. This incident accounted for half of the 475 medication incidents reported in the year of the study. To establish factors that contributed to each incident, a pharmacist and nurse manager reviewed and discussed medication incident forms, medication charts, and other relevant documentation. Misreading the medication chart was considered to be a contributing factor for 25% of all reported incidents, with the next most commonly cited factor being a deviation from nursing policy. Other factors cited were medical orders that were unclear or written incorrectly, pharmacy dispensing error, and lack of staff education.

A recent study in the US examined the link between the nurse-to-patient ratio and patient mortality among surgical patients, and factors related to nurse retention including the relationship between staffing levels and job dissatisfaction and burnout (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). The study used cross-sectional analyses of linked data from 10,184 nurses, over 200,000 surgery patients, and administrative data from 168 hospitals. The results indicated that nurse staffing levels had a significant effect on patient well-being, for example, for each additional patient over four in a nurse's workload, the risk of death increased by 7%. In this study, patients in hospitals with the highest patient-to-nurse ratio, that is, eight patients per nurse, had a 31% greater risk of dying than those in hospitals with four patients per nurse. In addition to the above, it was found that patient load had a direct impact on nurse retention rates. That is, higher patient-to-nurse ratios were strongly associated with increased job-related burnout and greater job dissatisfaction.

A descriptive correlational design was used by McGillis Hall, Doran, and Pink (2004) to determine the association between nursing staff skill mix, costs, and patient safety outcomes in urban teaching hospitals in Canada. Nurse staffing variables were measured by questionnaires to unit managers, and outcome data, that is, costs and patient safety outcomes, were obtained through administrative records. Data collected on patient safety outcomes included patient falls, medication errors, wound infections, and urinary tract infections. The results suggested that nurse staffing was related to patient safety outcomes, that is, units that employed a lower proportion of professional nursing staff had a higher number of medication errors and wound infections. In addition, the less experienced the nurse, the higher the number of wound infections.

Recent research in rural hospitals in the US used a multimethod approach, that is, questionnaires, interviews, and textual analysis of responses to case studies to examine the different processes and systems within the hospitals that impacted on patient safety (A. F. Cook, Hoas, Guttmannova, & Joyner, 2004). Participants included nurses, doctors, pharmacists, and administrators from 29 rural hospitals in nine US states. The results suggested that there was a lack of agreement among professions as to what constitutes health care error, with this being viewed as more often involving nursing practice than medical practice. For example, both doctors and nurses were hesitant to categorise treatment and diagnostic problems as errors but rather doctors referred to them as “practice variances”, “suboptimal outcomes”, or examples of “differences in clinical judgment”. It was suggested by some respondents that this lack of agreement influenced health care workers’ willingness to report and chart errors and develop strategies that might mitigate risk. In addition, many nurse participants reported that they were reluctant to challenge doctors’

clinical decisions and definitions of error, noting that this was considered detrimental to collegiality and beyond their authority. Those nurses who had questioned orders or clinical decisions reported that they had often been reprimanded by doctors for doing so. As a result of the perception that most errors fall within the realms of nursing practice, doctors and administrators, as well as nurses tended to believe that patient safety was predominantly a nursing responsibility. In addition, only 22% of respondents believed that doctors, nurses, pharmacists, and administrators should share responsibility for patient safety equally. Notwithstanding this allocation of responsibility, the participation of nurses in various patient-safety and error-reporting processes was limited among respondents. The researchers argued that a systems approach to patient safety was required in which responsibility for safety was shared by all members of the team rather than being assigned to the nursing profession. This is a sentiment echoed by Ballard (2003) who suggested that a variety of stakeholders (i.e., patients, nurses, nursing educators, administrators, and researchers, doctors, governments and legislative bodies, professional associations, and accrediting agencies) are all responsible for ensuring that patient care is safely delivered.

1.8 The Current Research Project

The above research provides support, in the hospital system, for the influence of individual and organisational factors on safety outcomes as proposed by Reason's Organisational Accident Model. This research suggests that, although human decisions and actions play a leading role in nearly all accidents, identifying human error as the ultimate cause of a system failure is of limited use unless the context in which the unsafe behaviour occurred is well understood (McCarthy et al., 1997). Reason's model includes the organisational context by linking failure in organisational processes to individual actions and, ultimately, accidents. Although

errors are failures in cognitive competence and violations involve motivational factors, Reason (1997) argued that organisational failures contribute to accidents by creating the kind of workplace conditions that provoke unsafe behaviour by the individual or team, or by creating deficiencies in system defences.

Historically, hospitals have attempted to reduce errors and adverse events by focusing on the actions of individuals (Leape, 1994). However, the health care industry is now taking advantage of research carried out in other complex industries which indicates that system-wide strategies and education are required to maximise safety. The ACSQHC (2001a) suggested that health care will show evidence of a culture of safety when it accepts the inevitability of error and system failures and actively works to minimise the impact and prevention of error by understanding the causes of adverse events.

Reason's model of accident causation has been widely adopted throughout complex industries and has revolutionised modern understanding of accident causation (Shappell & Wiegmann, 2001). However, this model is mainly descriptive and linear, appropriate for accident investigation but not well-suited to predicting accidents. To understand the various interactions requires a relational modelling technique that is able to illustrate how the various parts of the system link together to influence outcomes. Such a model is able to indicate the strength of the relationships among the various elements whilst taking into account the influence of all other variables. Examples of how researchers in the safety field are using this technique were demonstrated in the previous section (i.e., Fogarty, 2004; Fogarty et al., 1999, 2001; Neal et al., 2000; Oliver et al., 2002; Prussia et al., 2003). Fogarty suggested that models such as these provide the basis for predicting unsafe organisational

conditions, which in turn will lead to the design of suitable intervention programs to reduce unsafe behaviour and adverse incidents.

The current research used the technique, structural equation modelling, to operationalise Reason's theory by developing a model linking organisational factors to unsafe behaviour in the hospital system. Specifically, the first study investigated the impact of organisational issues on procedural violations by nurses during medication administration. Violations are defined as behaviours that involve the deliberate deviation from rules that describe the safe or approved method of performing a particular task or job (Lawton, 1998; Reason, 1990). Strong claims have been made in the safety literature about the connection between violations and errors (Reason, 1990) and violations and adverse occurrences (e.g., Lawton, Parker, Stradling, & Manstead, 1997; Mearns, Flin et al., 2001). However, in the medical field in particular, there is limited empirical evidence that can serve as a basis for understanding why workers deviate from established procedures. The aim of Study 1 was to identify organisational factors that create conditions wherein violation behaviour is more likely to occur.

Study 1 explored the role of organisational factors in medication administration by nurses in rural and remote areas in Queensland, Australia. The above issues are particularly relevant to rural and remote area nurses. The facilities where these nurses work range in size from base or provincial hospitals where medical and allied health professionals are on site, to health facilities staffed by one nurse who relies on communication with the Royal Flying Doctor Service or other off-site medical support. The literature suggests that the nature of the rural and remote environment determines the scope of nursing practice in these areas (Hegney, 1996). The professional isolation, which most of the remote area nurses experience,

can result in them taking on an expanded or advanced practice role in order to fill the gaps caused by the lack of medical and allied health professionals (Hegney, Pearson, & McCarthy, 1997).

The second study expanded on this research by including individual factors and more organisational factors, that is, a measure of organisational climate. In addition to the outcome variable, violation behaviour, a measurement of error was included in this study. The third study in the series again investigated the impact of organisational and individual factors on unsafe behaviour. However, in this study, a specific type of organisational climate was examined, that is, safety climate. In addition, the violation behaviour and error instruments were expanded and improved. Details of Study 1 are reported in the following chapter.

Chapter 2 – Study 1

The Influence of Organisational Factors on Violations during Medication Administration

2.1 Introduction

This section introduces Study 1. This study investigated the impact of organisational issues in the rural and remote environment on nurses' ability to follow procedures that describe the safe or approved method of performing medication administration. The objectives of the study were to examine organisational factors considered likely to impact on medication administration performance; explore the relations among these variables; and develop a model for predicting the work outcome variable, self-reported violation behaviour. The following section will introduce the variables used in this study.

2.2 Developing a model to explain violations by nurses

The variables measured in the current study were Level of Knowledge, Reference Material, Workload, Expectation by Doctor, and Violation Behaviour. These variables were chosen with reference to nursing and safety literature, as discussed in the previous chapter, and from the expertise of the members of a team of subject matter experts who have years of experience in rural and remote area nursing. The rationale for the inclusion of each variable follows.

2.2.1 Level of Knowledge

Nurses are expected to have up-to-date knowledge of the actions, side-effects, and dosage of any medication they administer (Delaune & Ladner, 1998). The

responsibility to update this knowledge intensifies as increasing numbers of new medications become available (Lilley & Guanci, 1995; Westien, 1994).

In the aviation industry, low level of knowledge due to inadequate training was found to be a contributing factor to safety incidents (Hobbs & Williamson, 2002). In another study in the same industry, training was found to impact on errors through the mediating effects of individual health (Fogarty, 2004). In the medical environment, lack of knowledge or education is a commonly cited contributor to unsafe behaviour in nursing practice (e.g., Headford et al., 2001; Meurier, 2000; Meurier et al., 1997; Wakefield et al., 1998). In particular, a lack of medication knowledge has been identified as one of the most common system failures contributing to medication errors (Leape et al., 1995; O'Shea, 1999).

In this study, the scale used to measure this variable referred to nurses' perceptions of the adequacy of their level of knowledge of medications and how these medications work. Nurses were also asked to rate their ability to explain this information to patients.

2.2.2 Reference Material

Although nurses are required to have up-to-date knowledge of medications, it is unrealistic to expect them to remember all information about all medications at all times. Therefore, nurses who are unsure about the actions, dosage, or side effects of any medications they administer are required to have reasonable access to and familiarity with relevant and appropriate reference materials (Australian Nursing Council [ANC], 2000; Delaune & Ladner, 1998; The Joanna Briggs Institute for Evidence Based Nursing and Midwifery, 2000). Reference materials accessed by nurses in Queensland include the MIMS Manual and recently published pharmacology textbooks. The MIMS Manual contains comprehensive product

information on medications and is available in print, online, via CD ROM, and, in some hospitals, on palm pilot.

Nurses are also required to know the rules and regulations governing their practice (ANC, 2000; Delaune & Ladner, 1998; The Joanna Briggs Institute for Evidence Based Nursing and Midwifery, 2000). The *Health (Drugs and Poisons) Regulation 1996 (Qld)* (Queensland Government, 2003), hereinafter called the *Regulation*, outlines the legal responsibilities and practice requirements of registered and enrolled nurses in Queensland with regard to medication practice. That is, it sets out the requirements for the administration, management, and supply of controlled and restricted drugs and poisons[2] in the practice of nursing. Nurses are expected to have a good working knowledge of this legislation and work within its guidelines.

Difficulties arise, however, when reference materials or the *Regulation* are not readily accessible, up-to-date, and adequate, as this may impact on the nurse's ability to follow the rules and guidelines for safe practice (Reason, 1997). In this study, the scale used to measure this variable covered the ease of access of up-to-date reference materials such as MIMS and the adequacy of these materials. In addition, respondents were asked if they had easy access to the *Regulation*.

2.2.3 Workload

Susceptibility to unsafe acts is strongly affected by adverse conditions of work such as excessive workload (Leape, 1994; Vincent et al., 1998). Flin et al. (2000) argued that work pressure influences safety and performance in the workplace because of such issues as inadequate resources and time restrictions. In the offshore

[2] Schedule 2 and Schedule 3 medications (referred to as poisons in the *Regulation*) (e.g., paracetamol) are used for minor ailments and are substantially safe substances for therapeutic use. Schedule 4 or restricted drugs (e.g., amoxicillin) are only available on prescription and require professional management and monitoring. Schedule 8 or controlled drugs (e.g., morphine) are prescription only medications which are mainly used for strong pain relief. Their supply and use is controlled because of their dependence-forming nature and potential for abuse.

oil industry, work pressure was found to influence safety behaviour, with these workers attributing their unsafe behaviour to pressure from management to put production before safety (Mearns, Flin et al., 2001). Oliver, Cheyne, Tomas, and Cox (2002) found workload to be one of the aspects of the work environment that affected the individual health of Spanish production workers, which in turn led to accidents among these workers.

In the medical environment, researchers have found that workload factors impact on the rate of unsafe acts by nurses during medication administration (Leape et al., 1995; O'Shea, 1999). Under heavy workloads workers tend to ignore safety rules and procedures in order to complete tasks on time (Zeitlin, 1994). With nurses under increasing time pressure (Hegney, Plank, & Parker, 2003; McVicar, 2003), this may lead to a greater likelihood that safety will be compromised through shortcuts and errors. In support of this, research analysing incident reports submitted to the Australian Incident Monitoring Study indicated that incidents due to nursing staff shortages were associated with negative patient outcomes such as major physiological change, patient/relative dissatisfaction, and physical injury (Beckmann, Baldwin, Durie, Morrison, & Shaw, 1998). Issues such as work overload, poor skill mix, and inadequate staffing levels have been found to impact on both nurse and patient well-being (Aiken et al., 2002; McGillis Hall et al., 2004; Meurier, 2000; Meurier et al., 1997).

This scale measured respondents' perceptions about the impact of workload issues on their ability to comply with the *Regulation*. Issues covered included workload factors, and the adequacy of staffing levels and skill mix.

2.2.4 Expectation by Doctor

The *Regulation* states that medication practice is a multidisciplinary responsibility. Therefore, the behaviour of other health professionals, particularly doctors, has a direct impact on a nurse's ability to work within the rules (Queensland Government, 2003). In the safety literature, the attitude of significant others (i.e., management and supervisors) is considered one of the most common factors influencing workers' attitudes to following procedures for safe practice (Flin, Mearns, O'Connor, & Bryden, 2000; Reason, 1997).

In the current study, this variable was adapted to the medical domain by measuring nurses' perceptions of the extent to which doctors expected them to work outside the *Regulation*. In rural and remote areas, nurses are often expected to work outside their scope of practice (Hegney, 1996; Hegney et al., 1997). In a study investigating professional relationships between nurses and doctors in rural Australia, Blue and Fitzgerald (2002) found that nurses in rural areas accept more responsibility and risk for a variety of reasons. For example, protective practices by nurses towards doctors were common, that is, initiating actions that minimised the attendance of a doctor when he/she was busy or after hours. Because of the shortage of doctors in these areas, this practice was not only to protect the overworked doctor but also to decrease the risk of losing the doctor from the district. Doctors reported in this study that they knew and trusted the nurses' capabilities and what they could or could not do in the way of managing patients. They also noted, however, that they resented being contacted repeatedly for minor issues and expected nurses to deal with these. Role blurring was also seen as an issue in a study in Wales (Snelgrove & Hughes, 2000). Nurses working on night shift in this study often reported moving

across usual boundaries to ease pressure on over-burdened doctors or to compensate for the unavailability of day-time services.

2.2.5 Violation Behaviour

Violations are defined as behaviours that involve the deliberate deviation from rules that describe the safe or approved method of performing a particular task or job (Lawton, 1998; Reason, 1990). As noted earlier, strong claims have been made in the literature about the connection between violations and errors (Reason) and violations and adverse occurrences (e.g., Lawton et al., 1997; Mearns, Flin et al., 2001). For example, in a study examining the occurrence and reporting of medication errors by nurses in the UK, Gladstone (1995) reported that both nurses and nurse managers considered failure to follow procedures as a reason why medication errors occurred. See Section 1.5.1 for a detailed discussion of violation behaviour.

The scale used to measure this variable included a number of statements covering legal and best practice issues with regard to medication administration. Strengths and weaknesses in current practice in rural and remote areas were identified during a chart audit, in a sample of facilities, conducted by a team from the Centre for Rural and Remote Area Health (CRRAH) prior to this study (Hegney, McKeon, Plank, Raith, & Watson, 2003). Current practice was compared with the *Regulation* (Queensland Government, 2003) and best practice in medication administration as identified by the Joanna Briggs Institute for Evidence Based Nursing and Midwifery (2000).

2.3 The Conceptual Model

Figure 2.1 presents a conceptual model illustrating graphically the relationships to be evaluated in Study 1 using the statistical technique, structural equation modelling. The relationships in this model are based on research and consultations with a team of subject matter experts. The proposed model presents the direct and indirect effects of level of workload, availability and accessibility of reference material, level of knowledge of medications, and expectation by doctor on violation behaviour.

This conceptual model is proposed and tested based on the following hypotheses:

1. Level of workload will have a positive impact on violation behaviour, that is, higher workload will produce more violation behaviour (Leape et al., 1995; O'Shea, 1999; Snelgrove & Hughes, 2000).
2. Availability and accessibility of reference materials will have a negative impact on violation behaviour, that is, higher availability and accessibility will produce less violation behaviour (Reason, 1997).
3. Level of knowledge will have a negative impact on violation behaviour, that is, higher levels of knowledge will produce less violation behaviour (Headford et al., 2001; Meurier, 2000; Meurier et al., 1997).
4. Expectation by doctor will have a positive impact on violation behaviour, that is, higher perceived expectation by doctor will produce higher levels of violation behaviour (Blue & Fitzgerald, 2002; Hegney et al., 1997).
5. Expectation by doctor will mediate the relationship between workload and violation behaviour (Flin et al., 2000; Hegney et al., 1997; Reason, 1997). In a study of interprofessional relationships between doctors and

nurses in Wales, Snelgrove and Hughes (2000) found that work pressures often led to informal crossing of boundaries, that is, nurses making decisions about treatment without consulting a doctor.

6. Expectation by doctor will mediate the relationship between reference material and violation behaviour. Although this indirect link is not specifically covered in the literature, it was included after consultation with a team of subject matter experts. These experts were registered nurses with extensive experience in rural and remote nursing.

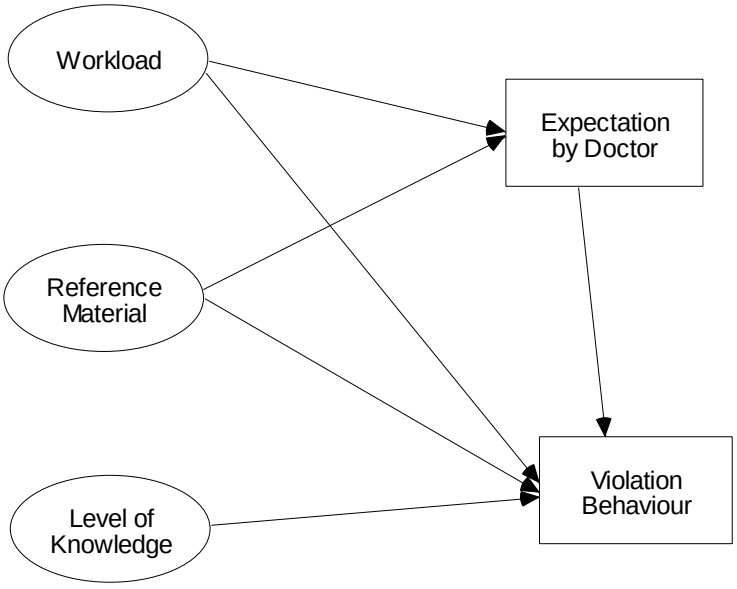

Figure 2.1 Conceptual Model of Relationships among Organisational Factors and Violation Behaviour

Although it is acknowledged that the sample data in this study are correlational, causality is postulated in the model and is represented by unidirectional arrows. Structural equation modelling is a popular statistical tool primarily because correlational data can be used to test causal relationships (MacCallum, Wegener, Uchino, & Fabrigar, 1993). However, this has initiated strong debate as to whether relationships in structural models can be interpreted as causal, with suggestions of alternative terms such as “influence” being substituted (Mueller, 1996).

Loehlin (1998) argued that a strict or narrow definition of cause is not necessary in path models. He believes the "essential feature for the use of a causal arrow in a path diagram is the assumption that a change in the variable at the tail of the arrow will result in a change in the variable at the head of the arrow, all else being equal, that is, with all other variables in the diagram held constant" (p. 4). The use of unidirectional arrows in the hypothesised model in the current study is supported by theoretical arguments suggesting temporal ordering of the variables.

2.4 Method

2.4.1 Participants

The target population for this study included all registered and enrolled nurses currently registered with the Queensland Nursing Council and working in rural and remote area facilities in Queensland. The inclusion criteria were nurses:

(a) working in government and non-government facilities with fewer than 50 acute beds, including community health facilities; and

(b) with an address in the postcode areas designated by the five Rural, Remote, and Metropolitan Areas (RRMA) classification. Categories used included small rural centres with population 10,000 – 24,999, other rural areas with population < 10,000, remote centres with population > 5,000, and other remote areas with population < 5,000.

Participants included 652 nurses working in either rural (n = 311, 47.7%) or remote areas (n = 340, 52.1%) (1 unidentified) in the state of Queensland, Australia. Most respondents were registered nurses (n = 497; 76.2%), with 148 (22.7%) being enrolled nurses, and 7 participants not indicating their registration category. The majority of the participants worked in acute hospitals (n = 396; 60.7%). Other health

services included Community Health (*n* = 46; 7.1%), multi-purpose health services (*n* = 71; 10.9%), and residential care facilities (*n* = 54; 8.3%). Nineteen (2.9%) participants did not indicate their location. Most were employed on a permanent full-time (*n* = 299, 45.9%) or permanent part-time basis (*n* = 248, 38.0%). The majority of participants were aged 40 years and over (*n* = 440; 67.5%) with the largest group being between 40 and 49 years (*n* = 235; 36.0%). Most participants had more than 10 years experience as a nurse (*n* = 548; 84.0%), with 365 (56.0%) having worked as a nurse for more than 20 years. There were 618 (94.8%) females and 27 (4.1%) males, with 7 not identifying their gender.

2.4.2 Materials

Scales needed to obtain measures on relevant variables were embedded within a larger instrument constructed by the author and a team from the Centre for Rural and Remote Area Health (CRRAH). The questionnaire measured a number of variables of specific interest to CRRAH and the Queensland Nursing Council that were not included in this study. This larger instrument was used to measure current practice regarding medication administration in rural and remote areas; to identify whether this practice complied with current legislation, patient management protocols, health policy, nursing standards, and best practice guidelines; and to identify if patient safety was being compromised.

A preliminary questionnaire was assembled and reviewed several times by the team at CRRAH. After the questionnaire was pilot tested on a random sample of rural and remote nurses (*n* = 44), it was modified and then peer reviewed by the Queensland Nursing Council and rural nurses in the Toowoomba Health Service District.

A description of each scale used in this study is listed below. Scales were formed on the basis of factor analysis. The mean response was used as the measure for each construct and was computed by dividing the total score for the scale by the number of items in the scale.

Level of Knowledge: This scale included three items asking respondents about the adequacy of their level of knowledge of medications and their ability to explain this information to patients. The items can be found in Section 2 (page 4) of the questionnaire in Appendix A, items 2.5(a), 2.5(b), and 2.5(c). The scale was rated on a 5-point Likert scale ranging from *strongly agree* to *strongly disagree*. The scale was reverse-scored so that higher scores indicated a higher level of knowledge. Example: *I am able to explain to my patients, in terms they can understand, how the medications they receive work.*

Reference Material: Three items were used to ascertain respondents' perceptions about the accessibility and adequacy of up-to-date reference material, and the accessibility of the *Regulation*. These items can be found in Section 2 (page 4) of the questionnaire in Appendix A, items 2.5(d), 2.5(e), and 2.5(f). A 5-point scale was used with ratings ranging from *strongly agree* to *strongly disagree*. The scale was reverse-scored so that higher scores represented a higher level of accessibility and adequacy. Example: *I have easy access to up-to-date reference material with regard to the administration and supply of medications.*

Workload: There were three questions in this scale asking respondents if their ability to comply with the *Regulation* was adversely affected by excessive workload, or inadequacy of staffing levels or skill mix. These items can be found in Section 3 (page 8) of the questionnaire in Appendix A, items 3.4(c), 3.4(d), and 3.4(g). The scale was rated using a 5-point scale ranging from *strongly agree* to

strongly disagree. Scores were reversed so that higher scores indicated higher workload, lower staffing levels, and lower skill mix. Example: *The workload in my facility is excessive*.

Expectation by Doctor: This single-item measure asked respondents if their ability to comply with the *Regulation* was adversely affected by the expectation of the medical practitioners in their facility/town. This item can be found in Section 3 (page 8) of the questionnaire in Appendix A, item 3.4(b). The item was rated using a 5-point scale from *strongly agree* to *strongly disagree*. Scores were reversed so that higher scores represented perceptions of higher expectation by the doctor. Item: *The medical practitioners in my health facility/town expect me to work outside the Regulation.*

Violation Behaviour: This scale covered legal and best practice issues with regard to medication administration. The scale originally included thirteen items and these items can be found in Section 3 (page 6) of the questionnaire in Appendix A, that is, all items in section 3.1 except 3.1(a). The scale was reduced to seven items after factor analysis was conducted (see Section 2.5.3 for the rationale for deletion of items). This scale was rated on a 4-point scale ranging from *always* to *never* with each statement indicating the legal or best practice requirement when administering medications, that is, safety behaviour. Therefore, higher scores represented higher numbers of violations in this scale. Example: *When available, I provide Consumer Product Information to patients regarding the medications I administer/supply to them*.

2.4.3 Procedure

The Queensland Nursing Council supplied the research team at the Centre for Rural and Remote Area Health (CRRAH) with a list of codes from its database

representing all registered and enrolled nurses working in eligible health facilities in rural and remote areas in Queensland. From these codes, a list of random numbers was computer-generated by the research team. Coded questionnaires were forwarded to the Queensland Nursing Council who then affixed an address label to correspond with the code number, and posted packages to respondents. The package included a reply-paid envelope so respondents were able to post completed questionnaires directly to the researchers at CRRAH. Reminder packages were posted to non-respondents three weeks after the initial mail-out. As with the initial mail-out, these packages were sent to the Queensland Nursing Council.

Of the 1999 questionnaires distributed, 756 were returned after reminder packages, representing a response rate of 38%. This number included questionnaires that were unusable due to incompleteness. The final number available for analyses was 652.

It is noted that 88 respondents returned blank questionnaires or declined to participate. Most of those who declined were still registered as nurses but were not in a clinical position, not working as a nurse, or not employed. Therefore, the above response rate may be deflated as it is unclear how many of the 1999 questionnaires were sent to nurses who were still on the register but not eligible to participate.

2.5 Results

2.5.1 Statistical Analyses

Data were screened using the complete sample ($N = 652$) prior to the main analyses to examine for accuracy of data entry, missing values, and fit between distributions and the assumptions of multivariate analysis. After deleting unusable cases, the data were then randomly split into two samples (each $N = 313$) using the

Select Cases command in SPSS 11.5 so that a cross-validation analysis could be conducted using the calibration sample (Sample 1) for model development and the validation sample (Sample 2) for model testing. With Sample 1 data only, exploratory factor analysis was used to examine the construct validity of the questionnaire. Reliability analyses (Cronbach's alpha) were conducted on the items remaining to test the internal consistency of the scales.

Structural equation modelling (AMOS 4) using Sample 1 data (N = 313) was then employed to test the fit of the a priori path model to the covariance matrix generated from the set of five variables in this sample. An exploratory approach to analysis was employed when testing the model, that is, a conceptual model was specified based on theory; the model was tested to examine its fit; the model was then respecified and re-estimated. To address the problems associated with post hoc model fitting, a cross-validation strategy was employed whereby the final model derived from Sample 1 data was tested on a second independent sample from the same population, that is, Sample 2 (J. C. Anderson & Gerbing, 1988; B. M. Byrne, 2001).

2.5.2 Data Screening

Prior to analyses and using the entire sample (N = 652), data were examined for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis (Tabachnick & Fidell, 1996). The accuracy of the data file was checked by proofreading a random sample of 100 of the original data against a computerized listing (SPSS printout). In addition, the Frequencies command in SPSS Version 11.5 was used to detect any out of range values. None were found.

The data were then checked for missing values. Four cases were deleted because all variables of interest were missing. A further 20 cases were deleted because all Violation Behaviour questions were either missing or answered with *Not Applicable*.

It is noted that missing values were not replaced for any items in the Violation section. Replacing missing values was considered inappropriate as some of these questions were not applicable to some participants. For example, one question asked whether Indigenous Health Workers or interpreters were accessed to provide patient education. This situation is more likely to apply to remote rather than rural areas. Instead, the Violation Behaviour scale was formed by averaging the available items for each individual (Schafer & Graham, 2002).

All other missing values on individual items were replaced using the Missing Value Analysis command (SPSS) prior to scale formation. The expectation maximization (EM) technique was used as this produces less biased estimates than other techniques, and is one of the techniques of choice when the amount of data missing is between 11 and 15% (Roth, 1994; Schafer & Graham, 2002). The range of missing data in this study was from 1.0% to 14.5%, with a mean of 5.4% (SD = 5.5%). The highest percentage of missing data was for the single-item variable, Expectation by Doctor. This is not surprising given the controversial nature of the question. An assumption when replacing missing data is that the data are "missing completely at random" (MCAR). The Little's MCAR test was conducted and resulted in a non-significant χ^2, suggesting that the data were missing at random (i.e., no identifiable pattern exists in the missing data) (Little, 1988).

Table 2.1 below presents the number and percentage of missing data for each item in the final sample of 626.

Table 2.1
Number and Percentage of Missing Values (N = 626)

Item number	*N*	Number missing	Percent missing
Item 2.5 (a)	619	7	1.1
Item 2.5 (b)	620	6	1.0
Item 2.5 (c)	617	9	1.4
Item 2.5 (d)	618	8	1.3
Item 2.5 (e)	617	9	1.4
Item 2.5 (f)	618	8	1.3
Item 3.4 (b)	535	91	14.5
Item 3.4 (c)	554	72	11.5
Item 3.4 (d)	560	66	10.5
Item 3.4 (g)	563	63	10.1

Scales were formed from the individual items and these were tested for outliers. Box plots indicated a number of univariate outliers in the Level of Knowledge and Reference Material scales. Transformations were carried out; however, untransformed data were used for analyses for the reasons outlined in the section dealing with normality below. Using Mahalanobis distance with $p < .001$, two cases were identified as multivariate outliers. Examination of these cases indicated they were not typical of the target population, that is, one respondent worked on a casual basis and the other worked temporary part-time. Therefore, these cases were deleted leaving 626 cases for analysis.

The Kolmogorov-Smirnov Statistic indicated that normality could not be assumed. Further investigation was conducted using box plots and histograms, and the skewness and kurtosis statistics in SPSS. These indicated that the Violation Behaviour and Workload variables were normally distributed; however, Expectation by Doctor was significantly positively skewed (8.02), and Level of Knowledge and Reference Material were significantly negatively skewed (-4.62 and -6.98

respectively). Level of Knowledge also displayed significant positive kurtosis (7.58). Skewness and kurtosis were improved by transforming these three scales. Because Expectation by Doctor was positively skewed, a log transformation was used for this scale. Level of Knowledge was reflected before being transformed using a square root transformation (the log transformation made skewness worse for this scale). Reference Material was reflected and transformed using a log transformation.

Although transformations were conducted and considered, they were not applied for the following reasons:

- In large sample sizes, the impact of skewness and kurtosis is diminished (Tabachnick & Fidell, 1996).
- Analysis (structural equation modelling using AMOS 4) was carried out using the transformed and untransformed data to establish if there was any difference. There was little difference between the parameters obtained using the two data sets and fit statistics were comparable.
- These variables would not be expected to be normally distributed in the population (Tabachnick & Fidell, 1996). For example, it would be expected that more nurses would agree than disagree that they have a high level of knowledge and that reference materials are accessible and adequate; and to disagree rather than agree that doctors expect them to violate procedures. Given the lack of difference between models derived from transformed and untransformed data, it was decided to proceed with the dataset that corresponded with the actual distribution of these variables in the population.
- See also Section 2.5.6.1 – The Bootstrap Procedure. This procedure was used in later analyses, that is, structural equation modelling, to correct for non-normality.

2.5.3 Factor Analysis

The construct validity of the scales in Sample 1 ($N = 313$) was investigated by factor analysing the items using the Maximum Likelihood (ML) technique with direct oblimin rotation in SPSS 11.5. Although structural equation modelling was later used to test the fit of the model, exploratory factor analysis was used to help refine the measurement model.

To determine the factorability of the items, Bartlett's test of sphericity was applied, and the Kaiser-Meyer-Olkin's MSA was calculated. On both counts, the matrix was deemed to be factorable.

Items were deleted from scales using the following criteria (Coakes & Steed, 2003; Tabachnick & Fidell, 1996):

1. Items with a measure less than 0.5 in the Measures of Sampling Adequacy in the Anti-image Correlation Matrix.

2. Items with a measure less than 0.2 in the estimates of Communality.

3. Items with a poor loading (less than 0.3) on factors.

All items were entered together into the factor analysis, that is, they were not separated into scales. Results indicated that a number of items from the Violation Behaviour scale should be deleted using the above criteria. These items were Item 3.1(g) (< 0.5 in anti-image correlation matrix), Items 3.1(d) and 3.1(i) (low communality estimates). In addition, Item 3.1(n) from the same scale was deleted as it was highly correlated with Item 3.1(m) ($r = .94$) and therefore considered redundant.

The factor analysis was rerun with these four items deleted. Results then suggested that Item 3.1(h) be deleted because of a low communality estimate. Factor analysis was run again with this item removed. Results then suggested that Item

3.1(j) be deleted as the factor loading was less than 0.3 in the Pattern Matrix. Therefore, the Violation Behaviour scale was reduced to seven items, that is, 3.1(b), (c), (e), (f), (k), (l), and (m).

When the analysis was rerun, all factors sat together well with Violation Behaviour breaking into two factors, that is, violations originating with doctors and violations originating with nurses. These two were combined into one variable because, although some of these violations originate with doctors, these issues become the nurse's responsibility to follow up rather than the doctor's. For example, if a doctor issues a prescription for a controlled drug over the telephone, the legislation requires that the order must be put in writing within 24 hours. If the doctor does not do so, it becomes the nurse's responsibility to follow this up with him/her and then with the Director of Nursing or Medical Superintendent (Queensland Government, 2003). That is, nurses are not only accountable for their own performance, but also for the performance of others (Gibson, 2001).

The rotated pattern matrix for the remaining 16 items is presented in Table 2.2. Five factors were extracted and accounted for 67.07% of the variance. The eigenvalues, percentage of variance explained, and the correlation matrix are also displayed in this table.

Table 2.2
Pattern Matrix, Eigenvalues, Percentage of Variance Explained and Correlation Matrix for Sample 1 (N = 313)

Item	Factor 1 Violations by Doctor	Factor 2 Level of Knowledge	Factor 3 Workload	Factor 4 Violations by Nurse	Factor 5 Reference Material
*Q3.1(c) GP signs for telephone-ordered medications within 24 hrs	.926				
Q3.1(b) Medical super/registrar signs for telephone-ordered meds within 24 hrs	.891				
Q3.1(f) MO signs & dates cessation of medication orders	.441				
Q3.1(e) MOs' name & signature legible on medication orders	.345				
Q2.5(b) Able to explain to patients how medication they receive work		.851			
Q2.5(c) Able to explain to patients major side effects of medications		.704			
Q2.5(a) My knowledge of medication & how they work is adequate		.616			
Q3.4(d) The staffing levels in my facility are inadequate			.926		
Q3.4(c) The workload in my facility is excessive			.779		
Q3.4(g) The skill mix in my facility is inadequate			.476		
Q3.1(l) My name & signature are legible				.832	
3.1(k) Explain to patients relevant information about meds I administer/supply				.701	
Q3.1(m) Access Indigenous Health Workers/interpreters to provide patient education				.494	
Q2.5(e) Reference material in my facility adequate					-.779
Q2.5(d) Have easy access to up-to-date reference material					-.618
Q2.5(f) Have easy access to *Regulation* and its amendments					-.594
Eigenvalues	4.124	2.359	1.736	1.491	1.021
Percentage of Variance Explained	25.777	14.744	10.849	9.317	6.383
Correlation Matrix					
Factor 1 – Violation by Doctor	1.000				
Factor 2 – Level of Knowledge	-.162	1.000			
Factor 3 – Workload	.286	.003	1.000		
Factor 4 – Violation by Nurse	.273	-.403	.152	1.000	
Factor 5 – Reference Material	.244	-.420	.256	.214	1.000

* Questions paraphrased to save space.

2.5.4 Reliability Analysis

To ensure that the items comprising the factors produced reliable scales, Cronbach's alpha coefficient of internal consistency was calculated for each scale. The results are shown in Table 2.3 below.

Table 2.3
Cronbach's Alpha for each Scale – Sample 1 (N = 313)

Scale	Number of items	Cronbach's Alpha
Level of Knowledge	3	.80
Reference Material	3	.76
Workload	3	.78
Violation Behaviour	7	.73

2.5.5 Descriptive Statistics

The correlation matrix for Sample 1 showing relationships among the various scales, together with the means and standard deviations is presented in Table 2.4.

Table 2.4
Summary Statistics and Correlations for all Variables Sample 1 (N = 313)

	Mean	SD	Level of Knowledge	Reference Material	Workload	Expect by Doctor	Violations
Level of Knowledge	4.05	0.59	1.00				
Reference Material	4.06	0.73	.45**	1.00			
Workload	2.87	0.99	-.04	-.26**	1.00		
Expectation by Doctor	2.19	1.10	-.06	-.29**	.42**	1.00	
Violation Behaviour	2.27	0.55	-.30**	-.27**	.24**	.34**	1.00

Note. ** Correlation is significant at the 0.01 level (1-tailed).

Estimation of structural equation models are based on covariance, rather than correlation, matrices (Arbuckle & Wothke, 1999). However, Hoyle and Panter (1995) recommend presenting a correlation matrix as this is more informative than the covariance matrix for communicating the pattern of relations among variables. These descriptive statistics were calculated using SPSS Version 11.5. Level of Knowledge, Reference Material, Workload, and Expectation by Doctors were all measured using a 5-point scale. Mean responses to the Level of Knowledge and Reference Material scales were high, suggesting that most nurses perceived few problems in these areas. Workload was rated as average but the variance was larger for this variable. For example, approximately 33% of respondents either agreed or strongly agreed that their ability to comply with the *Regulation* was affected by excessive workload and staffing inadequacies; however, approximately the same proportion either disagreed or strongly disagreed that this was the case. The mean response for Expectation by Doctor was low which suggests that most nurses disagreed that their ability to comply with the *Regulation* was adversely affected by doctors' expectations. However, again, the variance was high for this item, with a number of respondents being unsure and 58 (approximately 19%) either agreeing or strongly agreeing that they felt pressured by doctors' expectations to work outside regulations. Violation Behaviour was measured using a 4-point scale with the mean response indicating that most nurses followed the procedures or best practice most of the time.

The correlation matrix indicated that all organisational factors were significantly related to each other with the exception of Level of Knowledge and Workload, and Level of Knowledge and Expectation by Doctor. Coefficients ranged from -.26 to .45. Violation Behaviour was significantly negatively correlated with

Level of Knowledge (-.30) and Reference Material (-.27), and significantly positively correlated with Workload (.24) and Expectation by Doctor (.34). All these coefficients were significant at the .01 level.

2.5.6 Structural Equation Modelling

AMOS 4 (Arbuckle & Wothke, 1999) was used to test the fit of the a priori path model to the covariance matrix generated from the set of five variables in Sample 1. The estimation method used was the maximum likelihood (ML) method. The full model to be tested was presented earlier in a simplified conceptual form (see Figure 2.1).

The principal objective of structural equation modelling is to fit the hypothetical model to a set of sample data and examine how well the model fits the data. If the fit is adequate, the model supports the hypothesised relations among variables (B. M. Byrne, 2001). Various measures of model fit are provided in AMOS and these will now be discussed.

2.5.6.1 Fit Criteria

This section will report the fit indices chosen for this study together with the justification for choosing those indices.

The χ^2 statistic. This statistic is an absolute fit index indicating how well an analysis succeeded in minimizing the discrepancy between the hypothesised covariance matrix and the sample covariance matrix (Hoyle & Panter, 1995). The smaller the value of χ^2 the better the fit, with zero indicating perfect fit and a value with an associated probability greater than .05 indicating acceptable fit (Hoyle, 1995; Tabachnick & Fidell, 1996). However, a number of writers have raised concern about the use of this statistic as a test of model fit (e.g., Bollen & Long, 1993; Hoyle,

1995; MacCallum, Browne, & Sugawara, 1996) because of its sensitivity to data that are not multivariate normally distributed and its tendency to indicate misfit as sample size increases (because of power). Despite these reservations, it has been used here as it allows for comparisons between models, with the χ^2 statistic for the hypothesised model providing a baseline value against which all subsequent tests of invariance can be compared (B. M. Byrne, 2001). Furthermore, in cross-validation analysis, the χ^2-difference test can be used whereby a non-significant difference between the χ^2 for the calibration sample and the χ^2 for the validation sample indicates no difference between the two models.

The Bootstrap Procedure (Diaconis & Efron, 1983). Maximum likelihood estimation of SEM parameters requires data with multivariate normal distribution. The violation of normality inflates the computed χ^2 value leading to possible model rejection or modification that may not be necessary. Violation of normality also tends to underestimate standard errors (B. M. Byrne, 2001). This technique uses a post hoc adjustment to account for non-normality in the underlying database and produces adjusted standard error estimates and the Bollen-Stine *p*-value, that is, a bootstrap modification of model χ^2. This *p*-value is used instead of the usual maximum likelihood *p*-value and should be greater than .05 to indicate overall model fit (B. M. Byrne, 2001).

The χ^2 /DF ratio. Researchers have addressed some of the limitations of the χ^2 statistic by developing a number of alternative goodness-of-fit indices (B. M. Byrne, 2001; Hoyle, 1995). One of these indices is the χ^2 /degrees of freedom ratio (reported as CMIN/DF), an index that is designed to compensate for the tendency of the χ^2 test to reject models when sample sizes are large. As with the χ^2 statistic, this ratio

provides an indication of the efficiency of the hypothetical model in reproducing the sample data. Values of 2 or less represent a good fit (B. M. Byrne, 2001).

The Root Mean-Square Error of Approximation Index (RMSEA). The RMSEA takes into account the error of approximation in the population and relaxes the stringent requirement on χ^2 that the model holds exactly in the population (Browne & Cudeck, 1993). Values of .05 or less indicate the hypothetical model is a close fit to the sample data, however, Browne and Cudeck suggest that models with RMSEA values of .08 or less can be accepted.

The Tucker-Lewis Index (TLI). This index is an incremental (or comparative) fit index which provides a measure of improvement in fit when the hypothesised model is compared with a more restricted baseline model. TLI is recommended when the maximum likelihood estimation method is used (Hoyle & Panter, 1995) as was the case in this study. TLI should be greater than 0.95 (Hu & Bentler, 1995) although values greater than 0.9 indicate reasonable fit (Hoyle & Panter, 1995). This index can exceed a value of 1 (i.e., it is a non-normed fit index), however, this indicates a lack of parsimony.

The Confirmatory Fit Index (CFI). The CFI is also an incremental fit index and is recommended when data are not multivariate normally distributed, as the CFI shows minimum estimation bias when this is the case (Hoyle, 1995). This index is normed with values constrained to fall between 0 and 1. CFI should be greater than 0.95 although values greater than 0.9 indicate reasonable fit (B. M. Byrne, 2001).

2.5.6.2 Model Fit – Sample 1

The fit indices for Sample 1 indicated that the hypothesised model was a good fit to the data, χ^2 (38, N = 313) = 74.48, [3]Bollen-Stine p = .05, CMIN/DF = 1.96, TLI = .95, CFI = .97, RMSEA = .06. However, the path from Reference Material to Violation Behaviour, with a standardised regression weight of .01, was not statistically significant and, for reasons of parsimony, this pathway was deleted and the model retested. The fit statistics for the revised model (see Figure 2.2) were good: χ^2 (39, N = 313) = 74.49, Bollen-Stine p = .07; CMIN/DF = 1.91; TLI = .96; CFI = .97; RMSEA = .05. This model accounted for 23% of the variance in Violation Behaviour, and 22% of the variance in the mediating variable, Expectation by Doctor.

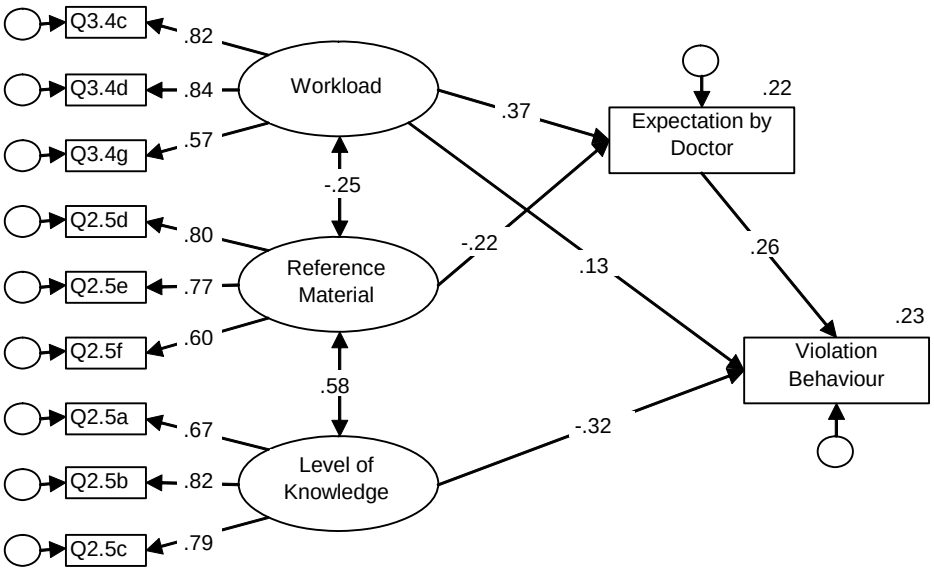

Figure 2.2 Structural Model of Relationships among Organisational Factors and Violation Behaviour – Sample 1

[3] The Bollen-Stine adjusted p has been used instead of the usual maximum likelihood p-value when data do not conform to the assumption of multivariate normality.

The numbers shown along the pathways in the model indicate the strength of the relationship between each variable. The higher the absolute value of the number, the stronger the relationship and the greater the benefit there is to be gained by manipulating the factor at the start of the chain. A negative value indicates an inverse influence on the outcome variable, that is, higher scores on one variable are associated with lower scores on the other.

2.5.6.3 Cross-Validation Analysis using Sample 2 (*N* = 313)

Models developed using an exploratory approach should be considered as a tentative solution because re-specifications of the model may be based on circumstances relating uniquely to that particular data set (Hoyle, 1995). Byrne (2001) has suggested an approach for addressing the problems associated with post hoc model fitting which involves an invariance-testing strategy to test for the replicability of structural paths across groups. This strategy involves cross-validating the findings by randomly splitting the dataset into two parts, with one sample becoming the calibration sample and the other the validation sample (Cudeck & Browne, 1983). The originally hypothesised model is tested using Sample 1, with post hoc analyses being conducted on this sample to obtain the best-fitting model. When the final model is determined using Sample 1 data, this then becomes the hypothesised model to be tested using Sample 2 data.

The first step in this process is to establish a multigroup baseline model against which to compare a subsequent model in which equality constraints are specified (B. M. Byrne, 2001). The final model for the calibration sample is the model used for the validation sample. The goodness of fit of the model for the two groups in combination with no equality constraints imposed was excellent: χ^2 (78) = 141.34, Bollen-Stine p = .09; CMIN/DF = 1.81; CFI = .97; TLI = .96; RMSEA = .04.

The χ^2 value, with its degrees of freedom, served as a comparison point to determine if the causal structure was the same across the calibration and validation groups. After equality constraints were applied, by labelling the five path coefficients to be constrained equal across groups, the analysis was rerun and the goodness-of-fit results investigated for the χ^2 value and its degrees of freedom. These were as follows: χ^2 (83) = 148.77. The difference in χ^2 values between this test and the previous test (with no constraints) is 7.43, with 5 degrees of freedom, which is not statistically significant. This suggests that the causal structure related to the model is equivalent across the calibration and validation samples, that is, the models are equivalent.

2.5.6.4 Comparing Rural and Remote Groups

The conditions under which nurses in this study worked varied considerably. Facilities ranged in size from base or provincial hospitals where medical and allied health professionals are on site, to those staffed by one nurse dependent on communication with the Royal Flying Doctor Service or other off-site medical support. Therefore, to investigate whether isolation acted as a moderating variable, a comparison was made between models for rural and remote communities using the multigroup procedure as explained in the previous section.

The rural dataset (N = 302) was used as the calibration sample and the remote dataset (N = 323) as the validation sample. The goodness of fit of the model for the two groups in combination with no equality constraints imposed was good: χ^2 (78) = 146.51, Bollen-Stine p = .03; CMIN/DF = 1.88; CFI = .97; TLI = .96; RMSEA = .04. The χ^2 difference when equality constraints were applied was 4.51, with 5 degrees of freedom. This is not statistically significant which suggests that the models and coefficients are equivalent across the rural and remote samples.

2.5.7 Qualitative Data Analysis

A number of open-ended questions were included in the questionnaire to help elicit further qualitative information. These were item numbers 2.6, 3.5, and 5.4 and can be found in the questionnaire in Appendix A. It is noted that these data were not analysed in depth and were merely used to support the quantitative data results. In general, this was found to be the case. This was considered particularly important, for example, with variables such as Expectation by Doctor, which was limited to one item. A summary of the results under each variable heading is listed below.

2.5.7.1 Level of Knowledge

The quantitative results indicated that most nurses perceived few problems in this area. This was supported by the qualitative data with 30 nurses focusing on how they kept their knowledge up to date. However, 13 respondents noted that there were limitations in their knowledge of medications and expressed a need for further education, for example:

> *Because the hospital I work in requires general knowledge of a number of different fields … my knowledge base in the specifics of those areas is not in-depth … there is definitely an indication for more education.*
>
> *… associating with different and unfamiliar drugs at times and ward being so busy, one administers without full knowledge of all [information] pertaining to drugs …*

Eleven respondents noted that issues such as time and distance all impacted on their ability to access education, for example:

> *Nowhere near enough time is available at work for self development in this area. All self development is attended in my own time.*
>
> *Difficult to access education and training programs due to the distance the town is from major centres …*

2.5.7.2 Reference Material

In the quantitative results, most nurses reported that they had easy access to adequate and up-to-date reference material. This outcome was supported here with 32 respondents noting that this was the case within their facility. Others noted that, if reference material was not available, they were able to access information and support either within their facility or nearby.

In contrast, 20 respondents noted that access to reference material was not available. In addition, 11 noted that they had access but that the material was out of date. Others indicated that, although reference materials were available, access was difficult due to lack of time or unavailability of computers for on-line information. For example:

> *Often there is no time to look up drugs while at work …*
>
> *I would like to have the time to use the online MIMS info, which is quite useful. But there are not enough computers and not enough time to access it.*

2.5.7.3 Workload

There was wide variability in the quantitative results for this factor with approximately the same number of respondents agreeing as disagreeing that workload was an issue impacting on their ability to comply with the *Regulation*. Qualitative comments were received from 71 nurses regarding workload, staffing levels, and skill mix. For example, 21 believed that the workload was high and 27 noted nursing staff levels were inadequate. Comments tended to suggest that workload issues were impacting on the nurses' ability to work safely, for example:

> *Mistakes happen because time frames to complete tasks safely become ridiculous and miscalculations may be done … disruptions happen trying to do too many things at once. Interruptions occur all the time.*

The current skill mix requires that staff often work above and beyond their expected roles.

Increased patient load [and] decreased nursing staff level push you to the limit of your ability to comply with regulations.

2.5.7.4 Expectation by Doctor

The variance for this variable was also high in the quantitative results with structural equation modelling indicating that doctors' expectations did have an impact on the number of violations. In answer to the qualitative items, 29 respondents commented on how issues relating to doctors' expectations impacted on their ability to work within the *Regulation*. These situations often involved emergency situations or were after-hours when doctors were less available. For example:

Several MOs … never provided documentation … expected you to make judgment calls re S4 meds at night …would get very short/hostile if woken for "trivial matters".

… doctors will not sign for medications within the legal time frame and regard you as a pain in the neck if you insist.

I am the only nurse … the doctors do expect me to work outside my scope of practice sometimes, usually during an emergency.

At night RNs are expected to do it – don't wake the doctors for anything that's not basically life threatening! Have been told by doctor to be more confident and to supply S4s for him to sign later. I don't feel I have any legal standing if something goes wrong.

Doctor on call often not happy if woken for phone orders – "can't you just give it". [They] need reminding that … legally I can't.

Comments such as the following tend to suggest that nurses perceive doctors in rural and remote areas to be overworked:

The main problem affecting staff and patients … is that the doctors are all overworked and stretched to their limits …

In our area we have approximately 4,000 people who are serviced by one GP/Medical Superintendent. He is on call 24 hours a day.

The number of doctors available in our district is totally inadequate – they have too many demands made on them …Nurse is obligated to fill the gap left by doctors.

2.5.7.5 Violation Behaviour

The quantitative data analysis revealed that most nurses in this study worked within the legal and best practice guidelines most of the time. This was supported by the qualitative data with the vast majority of nurses commenting that this was the case. However, comments such as the following also appeared:

There are some practices which all the ENs carry out which are outside regulations …

Small hospital … one doctor. Common practice to initiate, administer, and supply meds without MO order …

… I do this in the best interest of the patients. I do this only when it is within the scope of my knowledge and skills. It is done when a doctor is not readily available and it is unreasonable to expect patient to wait or suffer unnecessarily … this practice is done with the knowledge and concurrence of the medical superintendent. My concern is that it is not according to the letter of the law and I will be deregistered if caught.

Legally I'm not covered – my registration is in jeopardy. But if I know I am competent to give it and the patient will benefit, why shouldn't I?

Nursing staff are being used instead of pharmacist in some situations.

Nursing staff unsure of legal position; despite Act available some have difficulty understanding in real terms, i.e., what can I give? what's best for the patient? should I bother the doctor? – all influencing decision ultimately.

In conclusion, the following quote tends to sum up the general feeling and difficulties faced by nurses working in rural and remote areas:

> *It is very difficult for all staff to exactly follow the rules of the Health (Drugs & Poisons) Regulation 1996 at all times. Pressure of workload; small numbers of GPs; emergency situations lead to staff doing what is best for the patient at the time even if it is outside the guidelines. Nobody deliberately flouts the rules, but staff know that the GPs would "burn out" if they were called every time someone presents to the hospital after hours*.

2.6 Discussion

Human factors researchers know that organisational issues are a key determinant in the occurrence of adverse events, but the effect of these factors on violations is not as well understood. Reason (2000) argued that it is important to investigate the factors that contribute to these unsafe acts and this study has made a start in this direction in the rural and remote medical environment by demonstrating the link between organisational factors and violations. It was argued that, in order to understand this interaction, a model was required of how the components of the system work together to influence outcomes. This study has provided such a model for some parts of the system.

In addition to testing the conceptual model, a cross-validation analysis was carried out by randomly splitting the dataset into two parts. This analysis indicated that the causal structure was equivalent across the two samples. A comparison was also made between models for rural and remote communities to investigate the possible contributing factor of isolation as a moderating variable. The results of this analysis suggested that there was no difference between the rural and remote samples. As well as the quantitative data, a number of open-ended questions were included in the questionnaire. In general, these qualitative data supported the results of the quantitative analyses.

It was hypothesised that level of workload and expectation by doctor would have a positive impact on violation behaviour, and availability and accessibility of reference materials, and level of knowledge would have a negative impact on violation behaviour. Expectation by doctor was also expected to mediate the relationships between workload and violation behaviour and reference material and violation behaviour.

The strongest direct path to Violation Behaviour in the model was from Level of Knowledge. This indicates that the more nurses know about medications, the less likely they are to violate procedures and best practice. Nurses' perception of their level of Workload also had a direct influence on violation behaviour but this pathway was weaker. It appears that the number of violations was better explained in this case by the influence of the mediating variable Expectation by Doctor. This outcome suggests that when workloads are excessive, nurses succumb to perceived social pressure from doctors to work outside regulations, which, in turn, leads to more violation behaviour. This was also the case for Reference Material. That is, when reference materials are less accessible, nurses perceive that doctors expect them to work outside the guidelines more often, thus leading to more violations. The study was unable to support the hypothesised direct relationship between adequacy and accessibility of Reference Material and Violation Behaviour.

Historically, the focus of safety research in the hospital system has been the individual. However, as Reason (1997) and others (e.g., Dekker, 2001; Leape et al., 1998; Vincent et al., 1998) argued, this is the old view of human error. According to this approach, accidents are caused by people and management resources are directed at making these individuals less fallible by such activities as better training, automation, discipline, and proceduralisation. The new view of human error is much

more complicated and takes into account the human component within complex systems with less emphasis on the individual and more on pre-existing organisational factors that provide conditions in which unsafe behaviour occurs (Reason, 1990).

This old view of human error has been resistant to extinction (Dekker, 2002), especially in the health domain (Leape, 1994). Extensive investigations of incidents rarely occur in busy environments such as hospitals and too often the investigation stops at an arbitrary point where cause is identified. That stopping point usually involves someone else further removed from the actual incident site. For example, it is important to note that the mediating role played by doctors' expectations found in this study does not suggest a re-allocation of blame to doctors. Re-allocating blame in this manner is to perpetuate the old view of error, a view that Reason (1997) and others have shown to be counterproductive in terms of achieving institutional safety goals.

A better approach is to move away from a "blame culture" by using climate surveys to monitor organisational and individual variables that have an impact on safety outcomes (ACSQHC 2001), as in the current study. There is no single element in the model tested in this study that is the source of violation behaviour, but rather there is a network of interconnected variables, all of which act together to influence safety outcomes. Reason (1997) recommended such a strategy and it is now used in the offshore oil industry (Mearns, Whitaker, & Flin, 2001), aviation (Fogarty, 2004; Fogarty et al., 1999, 2001), and medicine (Neal et al., 2000). For this approach to work, however, the survey must capture the key variables that impact on safety behaviours. The present study has made a start in this direction but it is acknowledged that much has still to be learned about safety in health settings. Indeed, with only 23% of the variance in violation behaviour explained by the

variables in the current study, further investigation is warranted. Some of the limitations of the present study are dealt with in the next section.

2.6.1 Limitations

The current study was considered to be a preliminary exploration into this area and was necessarily limited in scope for a number of reasons. As noted earlier (Materials section), this study formed part of a larger study investigating a number of issues in rural and remote area nursing. Because of the length of the complete questionnaire (12 pages), the number of variables that could be investigated in the current study and the number of items used to measure each latent construct had to be restricted. The safety and nursing literature suggest a number of other factors that may contribute to unsafe behaviour and, in order to capture a larger percentage of the variance in safety outcomes, these were included in the next study in this series. A number of changes were made in Study 2 and these will be discussed in the following section.

2.6.2 Modifications for Study 2

The next study was conducted in rural health service districts only as no difference was found between rural and remote areas in Study 1. A validated instrument that is widely used in public sector hospitals in Queensland was employed to measure organisational and individual factors. Therefore, private hospitals were not included as this instrument has not been approved for use in that sector.

The instrument chosen for Study 2 included similar organisational issues measured in the previous study, that is, workload, professional growth, and professional interactions, as well as a number of other issues relevant to organisational climate. In addition, this instrument included individual factors such

as morale, distress, and quality of work life. Although availability and accessibility of reference materials was not measured, it was decided not to alter the organisational climate section of the questionnaire as this would impact on the validity and reliability of the instrument. This decision was not considered problematic as the hypothesis that this variable would directly impact on violation behaviour was not supported in the first study.

The Violation Behaviour scale in Study 1 included violations originating with doctors as well as nurses. In hindsight, it may have been more useful to include only those issues originating with nurses, that is, behaviours directly under their control. Therefore, this scale was modified in the next study to include more generic violation behaviour questions based on nursing competencies with regard to medication administration.

Also included in the next study was another measurement of unsafe behaviour, that is, medication errors. The items were developed in conjunction with subject matter experts and were based on the "five rights" of medication administration, that is, the right drug to the right patient at the right dose at the right time by the right route. It was expected that individual factors, that is, morale, distress, and quality of work life, would impact on errors as was suggested by research conducted by Fogarty and colleagues (Fogarty, 2004; Fogarty et al., 1999, 2001) in the aviation domain.

The next study included registered nurses and enrolled nurses (EN) with medication endorsement only, that is, enrolled nurses (without endorsement) were not invited to participate. The *Regulation* states that ENs are authorised to administer only Schedule 2 or Schedule 3 poisons under the supervision of a registered nurse or doctor. That is, ENs are not permitted to administer controlled or restricted drugs, or

intravenous drugs. Exclusion of ENs was considered appropriate as most adverse incidents with medications in the medical environment involve drugs in these categories (ACSQHC, 2002a; Headford et al., 2001). ENs with medication endorsement were included because they are authorised to administer restricted drugs (other than an anaesthetic) on a doctor's instruction and under the supervision of a registered nurse or doctor (Queensland Health, 2000). The following chapter will give a detailed description of Study 2.

Chapter 3 – Study 2

The Influence of Organisational Climate and Individual Factors on Violations and Errors during Medication Administration

3.1 Introduction

The first study investigated the impact of organisational issues on procedural violations by nurses in rural and remote areas during medication administration. The specific organisational variables measured were Level of Knowledge, availability and accessibility of Reference Material, level of Workload, and Expectation by Doctor. These variables accounted for 23% of the variance in Violation Behaviour and 22% of the variance in the mediating variable, Expectation by Doctor.

This chapter introduces Study 2. This study investigated the impact of organisational climate and individual factors on violations and errors during medication administration by nurses in rural areas. The following section will describe organisational climate, as well as the instrument used to measure this construct in the current study.

3.2 Organisational Climate

The concept of organisational climate was developed in the 1970s and originally referred to the global concept underlying the events and processes of an organisation. This concept is now known as organisational culture with organisational climate being seen as the manifestation of organisational culture (Guldenmund, 2000). Organisational culture refers to the norms, values, and basic assumptions of a given organisation, that is, the values, beliefs, and behaviours

shared by members of a group (Schein, 1990, 1992). Organisations with a strong culture display a degree of predictability of behaviour (Hudson, 2000). Culture binds people together as a group and provides cues and clues as to how to behave in a given situation. In particular, culture influences how subordinates relate to their seniors and how information is shared. Culture also impacts on how people relate to technology, such as computers, and adherence to rules. In aviation, investigations of accidents have suggested that poor organisational cultures were associated with accidents because of a lack of safety concerns, pressures to put production before safety, poor leadership, and an environment of conflict between pilots and management (Helmreich, 2000; Helmreich & Merritt, 1998).

Organisational climate reflect employees' perceptions of the organisation's culture, that is, the collective reflection of their experience of the culture (Schneider, 1987, 1990). A positive organisational climate is indicated by harmony between subcultures of the organisation, better teamwork, and greater safety awareness. Employees will tend to project pride and a sense of family in the organisation and will generally feel positive about their job (ACSQHC, 2001a).

Because of the interdisciplinary nature of this concept, definitions and methods for studying organisational culture vary according to the academic discipline from which they originated (Helmreich & Merritt, 1998). Traditionally, organisational culture has been studied by sociologists through qualitative methods such as interviews and observations, with organisational climate being studied by psychologists through quantitative methods such as self-administered questionnaires (Guldenmund, 2000). Organisational psychologists tend to focus on the practical significance of organisational climate and on the means by which to manipulate this climate to improve productivity, safety, and so on (Deal & Kennedy, 1988; Peters &

Waterman, 1984; Smircich, 1983). Schneider, Brief, and Guzzo (1996) argued that organisational culture can be changed through a focus on organisational climate. This is so because climate reflects the tangibles that produce the culture, that is, the events that happen to and around employees that they are able to describe. By changing the everyday policies, practices, procedures, and routines, this will impact on the beliefs and values that guide employee actions (Schneider et al.).

The measurement of organisational culture and climate has been complicated by the tendency for the two terms to be used interchangeably and the lack of agreement on the major dimensions that define them (Gershon, Stone, Bakken, & Larson, 2004; Schneider et al., 1996). However, Gershon et al. have identified the following common themes in a number of instruments used to measure organisational culture or climate in healthcare:

- **Leadership Characteristics** – For example, leadership styles, such as degree and type of supervision, degree of support and trust, degree of aloofness, and type of leadership hierarchy;
- **Group Behaviours and Relationships** – For example, characteristics of interpersonal interactions, group behaviours, perceptions of co-worker trust, degree of group supportiveness, group cohesion, and coordination of group effort;
- **Communication** – For example, formal and informal mechanisms for transfer of information and for conflict resolution;
- **Structural Attributes of Quality of Work Life** – For example, rewards, working conditions, hours of work, forced overtime, and job security.

The above common themes are included in the instrument chosen to measure organisational climate in this study. This instrument will be described in the next section.

3.2.1 Measuring Organisational Climate

Although a number of instruments are available to measure organisational culture/climate (cf., Gershon et al., 2004; Scott, Mannion, Davies, & Marshall, 2003), the one chosen for this study was the Queensland Public Agency Staff Survey (QPASS) (Hart, Griffin, Wearing, & Cooper, 1996). QPASS is a validated instrument and has been authorised by the Queensland Government to be used in public sector organisations in that state, and has been used extensively in a number of health service districts in Queensland. It has also been used widely with public sector groups such as the police (Hart & Cotton, 2002; Hart & Wearing, 1995a), teachers (Hart, 1994; Hart & Wearing, 1995b), and health professionals (Wilson-Evered & Griffin, 1998), as well as for comparative studies with local government workers and tertiary students (Hart & Wearing, 1995b).

3.3 Measuring Individual Variables

In addition to Organisational Climate, QPASS also measures a number of individual variables relating to occupational well-being, that is, Individual Distress, Individual Morale, and Quality of Work Life. According to the QPASS model (Hart et al., 1996; Hart & Wearing, 1995b), Organisational Climate directly affects Individual Distress, Individual Morale, and Quality of Work Life. Quality of Work Life is also indirectly affected by Organisational Climate through Distress and Morale. Quality of Work Life encompasses both negative (distress) and positive (morale) feelings that employees have about their work. According to this model, when evaluating the quality of their work life, people weigh up the good and bad aspects of their job and form an overall judgment.

It was considered appropriate to include these individual variables in the current study because stress is now recognised as one of the most significant and

fastest growing health hazards in the workplace (Chu & Dwyer, 2002; Spector, 2002). Constant exposure to stress can impact on psychological well-being, physical health, and social functioning (e.g., Folkman & Lazarus, 1991). Research suggests that people working under stress experience four to five times as many injuries as those not in stressful situations (Petersen, 1996). Work-related stress has been shown to impact on unsafe behaviour in high-risk industries such as offshore oil (Mearns, Flin et al., 2001), aviation (Fogarty, 2004; Fogarty & Worth, 2003), and the hospital system (Dugan et al., 1996). For example, in a study of nurses in the United States, stress levels of nurses were found to be associated with a number of patient incidents including falls and medication errors (Dugan et al.).

The QPASS model is based on the dynamic equilibrium theory of stress as proposed by Hart, Wearing, and Headey (e.g., Hart, 1994; Hart & Wearing, 1995a). According to this theory, stress is defined as a state of imbalance within the system of variables that relates people to their environment, which brings about a change in normal levels of psychological well-being. A variety of factors such as personality characteristics, coping strategies and processes, and organisational climate all contribute to this disequilibrium, however, the development of a supportive organisational climate has been identified as the most fruitful factor in terms of prevention of occupational stress.

Lawton and Parker (1998) suggested that people differ in the way they react to stress. Some respond by an increase in risk-taking or violation behaviour, while the effect on others is an increase in the likelihood of suboptimal cognitive processing, that is, susceptibility to errors. Reason (1990) believes that vulnerability to externally imposed stresses is associated with errors. He suggested that errors are not so much caused by stress but that the cognitive styles of some people result in

both higher rates of absentmindedness when stressed and in coping strategies that are inadequate for dealing with stressful situations. Although people are sensitive to the possible consequences of their fallible behaviour and attempt to protect themselves in risky conditions by being deliberately "present-minded", in certain stressful situations this is difficult because of limited cognitive resources (Reason & Mycielska, 1982). Human performance is affected by stress because it tends to induce "tunnel vision", that is, an inability to deal simultaneously with multiple stimuli, which is a characteristic of most tasks in complex systems (Petersen, 1996).

Research in the aviation industry investigating contributors to maintenance errors and violations suggests that errors are linked with individual variables, including stress, and violations with organisational factors (Fogarty & Worth, 2003). In addition, this research confirmed the claim in the literature that violations are often a predecessor to errors (Lawton, 1998; Reason, 1997). Therefore, in this study it is hypothesised that Organisational Climate will impact on Violation Behaviour, individual variables will impact on Errors, and Violation Behaviour will impact on Errors.

3.4 The Conceptual Model

Figure 3.1 below presents a conceptual model illustrating graphically the relationships to be evaluated in Study 2. The proposed model presents the direct and indirect effects of organisational climate and the individual variables, that is, individual distress, individual morale, and quality of work life on violation behaviour and errors.

This conceptual model is proposed and tested based on the following hypotheses:

1. Organisational climate will have a negative impact on violation behaviour, that is, a more positive organisational climate will produce fewer violations (Fogarty & Worth, 2003; Reason, 1990; Rundmo, 2000).
2. Violation behaviour will impact positively on errors in that higher numbers of violations will produce more errors (Lawton, 1998; Reason, 1997).
3. Organisational climate will have an indirect impact on errors through violations (Reason, 1997).
4. Organisational climate will impact directly on the individual variables. A more positive organisational climate will produce a higher quality of work life and individual morale, and lower individual distress (Hart & Cooper, 2001; Hart et al., 1996).
5. Organisational climate will have an indirect impact on errors through the individual variables (Fogarty & Worth, 2003).
6. Individual morale and individual distress will impact on quality of work life in that higher individual morale and lower distress will improve quality of work life (Hart & Cooper, 2001; Hart et al., 1996).
7. The individual variables will impact directly on error. That is, higher individual distress will produce more errors, higher quality of work life and higher individual morale will produce fewer errors (Fogarty, 2004; Fogarty & Worth, 2003).

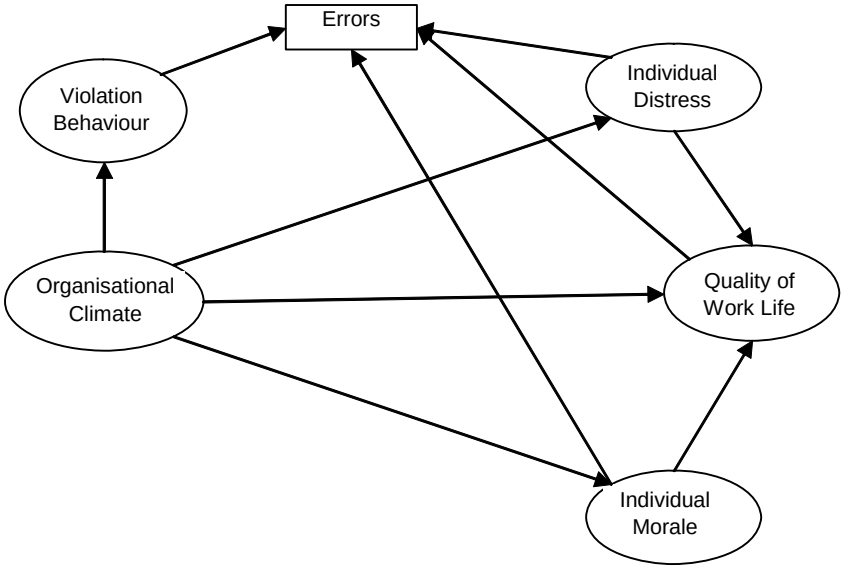

Figure 3.1 Conceptual Model of Relationships among Organisational Climate, Individual Factors, Violation Behaviour, and Errors

3.5 Method

3.5.1 Participants

Participants included 176 nurses working in 11 public sector hospitals in two rural health service districts in South-East Queensland, Australia. These hospitals ranged in size from 11 to 100 beds, with all hospitals providing acute inpatient care, long stay aged care, accident and emergency, and outpatients. Eight of the hospitals also provided facilities for obstetrics.

Most respondents were registered nurses (n = 136; 77.3%), with 37 (21.0%) being enrolled nurses with medication endorsement, and 3 participants not indicating their registration category. There were 162 (92.0%) females, 12 (6.8%) males, and 2 unidentified. Most were employed on a permanent full-time (n = 64; 36.4%) or permanent part-time basis (n = 85; 48.3%). The majority of participants were over the age of 40 years (n = 102; 58.0%) with the largest group being between 41 and 50 years (n = 59; 33.5%). Most participants had more than 10 years experience with

Queensland Health (*n* = 104; 59.1%), with a number (*n* = 38; 21.6%) having worked for the organisation for more than 20 years.

3.5.2 Materials

The variables used in the current study were Quality of Work Life, Individual Morale, Individual Distress, Organisational Climate, Violation Behaviour, and Errors. The first four scales were from the Queensland Public Agency Staff Survey and the Violation Behaviour and Error scales were developed for this study.

3.5.2.1 The Queensland Public Agency Staff Survey (QPASS)

Three scales measuring both the affective and cognitive components of occupational well-being were used in this study, that is, Quality of Work Life, Individual Morale, and Individual Distress (Hart & Cooper, 2001). The 6-item Quality of Work Life Scale (Hart et al., 1996), based on the Life Satisfaction Scale (Pavot & Diener, 1993), was used to measure nurses' level of satisfaction with conditions at work. Respondents were asked to indicate their level of agreement with a number of statements on a 7-point Likert scale ranging from *strongly disagree* to *strongly agree* with higher scores indicating a higher perceived quality of work life. These items can be found at the top of page 2 of the questionnaire in Appendix B. Example**:** *In most ways my work life is close to my ideal.*

The 14-item Occupational Positive and Negative Affect Scale was used to assess the positive (individual morale) and negative (individual distress) emotional responses that nurses have to their workplace. Respondents were asked to indicate how often over the past month they had experienced seven positive and seven negative emotions on a 7-point scale ranging from *not at all* to *all the time*. Higher scores indicated a higher level of emotion, either positive or negative. These items

can be found at the bottom of page 2 of the questionnaire in Appendix B. The individual morale items are the odd numbered statements and individual distress the even numbered statements. Example: *Over the past month I have been feeling enthusiastic at work.*

The Organisational Climate Scale covers a range of organisational behaviour and human resource management issues that are common to most organisations (Milton, Entrekin, & Stening, 1984; Schuler, Dowling, Smart, & Huber, 1992) and is based on the School Organisational Health Questionnaire (Hart, Wearing, Conn, Carter, & Dingle, 2000). The scale was used to assess perceptions about eight positive – workplace morale, supportive leadership, participative decision-making, role clarity, professional interaction, appraisal and recognition, professional growth, and goal congruence – and two negative aspects of the work environment – workplace distress and excessive work demands (Hart et al., 1996). This is a 50-item scale with respondents being asked to indicate their level of agreement on a 5-point scale ranging from *strongly disagree* to *strongly agree*. Higher scores indicate higher levels of each variable, either positive or negative. Confirmatory factor analysis indicated that the ten dimensions could be aggregated at a second-order level to provide an overall index of general organisational climate.

A definition of each subscale in the Organisational Climate scale is listed below. Also included are examples of items, the number of items in each scale, and the item numbers in the questionnaire. These items can be found on pages 3 and 4 of the questionnaire in Appendix B:

Workplace Morale: This 5-item scale measured perceptions of how other staff are coping in the workplace, that is, whether respondents perceive others in the workplace as showing enthusiasm, pride in their work, team spirit,

and energy. Example: *Staff go about their work with enthusiasm.* Item Nos. 7, 19, 29, 36, 45.

Supportive Leadership: This 5-item scale measured how respondents perceive their managers, that is, are managers approachable, dependable, and supportive; do they know the problems faced by staff; and do they communicate well with staff? Example: *I am able to approach the managers in this workplace to discuss concerns and grievances.* Item Nos. 2, 14, 24, 35, 40 (Item No. 14 is reverse-scored).

Participative Decision-Making: Four items were used to assess perceptions about the decision-making processes in the organisation, that is, whether staff are asked to participate in decisions and given opportunities to express their views. Example: *I am happy with the decision making processes used in this workplace.* Item Nos. 8, 20, 30, 46.

Role Clarity: This 4-item scale measured perceptions about whether expectations, work objectives, responsibilities, and lines of authority are clearly defined. Example: *My work objectives are always well defined.* Item Nos. 3, 15, 25, 41.

Professional Interaction: This scale replaced the Expectation by Doctor measure used in Study 1, as this new scale encompasses all staff and not specifically doctors. This 7-item scale assessed how workers interact in the workplace, that is, whether respondents perceive acceptance and support from others, with involvement, sharing, good communication, and help when needed. Example: *There is good communication among staff in this workplace.* Item Nos. 4, 11, 16, 26, 33, 42, 49.

Appraisal and Recognition: Six items were used to measure perceptions about the quality and quantity of feedback on work performance. Example: *I am happy with the quality of feedback I received on my work performance.* Item Nos. 6, 12, 18, 28, 44, 50.

Professional Growth: This scale replaced the Level of Knowledge scale used in Study 1. This 5-item scale measured perceptions about career development, that is, do respondents feel encouraged to attend further training and development and is there the opportunity to do so? Example: *I am encouraged to pursue further training and development.* Item Nos. 1, 13, 23, 34, 39.

Goal Congruence: Five items were used to measure whether respondents' personal goals are in agreement with workplace goals, and whether workplace goals are clearly stated and easily understood. Example: *This work place has a clearly stated set of objectives and goals.* Item Nos. 9, 21, 31, 37, 47 (Item No. 21 is reverse-scored).

Workplace Distress: This 5-item scale measured respondents' perceptions of how others in the workplace are coping, that is, whether they perceive others as frustrated, stressed, tense, anxious, and depressed about their work. Example: *Staff in this work place are frustrated with their job.* Item Nos. 10, 22, 32, 38, 48.

Excessive Work Demands: The scale replaced the Workload scale used in Study 1. This 4-item scale measured perceptions of the workload in the organisation, that is, whether staff are overloaded with work and under constant pressure to keep working. Example: *Staff in this work place are overloaded with work.* Item Nos. 5, 17, 27, 43.

3.5.2.2 Violation Behaviour Scale

This scale replaced the Violation Behaviour scale used in Study 1. It was modified to include more generic violation behaviours based on nursing competencies and to include only those behaviours directly under the control of the nurse administering the medication. That is, it excludes doctors' behaviours. This new scale was developed with the assistance of subject matter experts, that is, nurses with many years experience in medication administration, and with reference to the procedures required for safe medication administration, as outlined in Clinical Psychomotor Skills: Assessment Tools for Nursing Students (Tollefson, 2001) and other textbooks (e.g., Delaune & Ladner, 1998).

The scale included 13 items asking respondents to indicate how often in the past 12 months they had to bend the rules when administering a medication. The scale was measured on a 5-point scale ranging from *never* to *most of the time*, with higher scores representing higher numbers of violations. It is noted that the anchors on the Likert scale for these items were modified from Study 1, that is, changed from a 4-point (*never, sometimes, most of the time, always*) to a 5-point scale (*never, sometimes, often, frequently, most of the time*) in an attempt to capture more variability. The scale can be found on page 6 of the questionnaire in Appendix B. Example: *Did not check the patient's chart.*

3.5.2.3 Error Scale

This scale was also developed with the assistance of subject matter experts and was an additional measure not included in Study 1. The items were based on the 'five rights', that is, the guidelines traditionally taught to all nurses regarding medication administration: 'the right patient, the right drug, the right dose, the right route, and the right time' (Delaune & Ladner, 1998; Tollefson,

2001). In recent literature, these 'five rights' have been referred to as the ritual that nurses should use to prevent medication errors in nursing (Cheek & Gibson, 1996; J. Cox, 2000; Gibson, 2001). However, there is some debate as to whether rituals and procedures such as the five rights give nurses a sense of security, which in turn prevents errors (Keill & Johnson, 1993), or whether they can actually lead to errors as a result of ritualistic unthinking (Cheek & Gibson).

This scale included 5 items covering errors that can occur during medication administration. Respondents were asked on a 4-point scale (*never, once or twice, three or four times, more often*), how often in the past 12 months they had made an error when administering a medication. Higher scores represented higher numbers of errors. This scale can be found on page 5 of the questionnaire in Appendix B. Example: *Given the wrong DRUG.*

3.5.3 Procedure

Two health service districts in South-East Queensland were invited to take part in this study. In exchange for the participation of nurses, the researcher administered the Queensland Public Agency Staff Survey (QPASS) to all staff and provided a report on the survey results which was used by management and staff to assist with the implementation of strategies for workplace reform and ongoing development. The aim of the survey was to provide staff with an opportunity to comment on aspects of their work environment.

Questionnaires were either delivered or mailed to the various hospitals and data were collected over a one-week period. Staff were allocated work time to complete their questionnaires. Questionnaires were either picked up by the researcher, mailed individually by respondents to a reply-paid address, or collected at

a central point by the hospital and mailed altogether to the researcher. Of the 280 questionnaires distributed to nurses, 176 were completed and returned, representing a response rate of approximately 63%. It should be noted that the figure of 280 included enrolled nurses (without medication endorsement) who were not eligible to participate in this study. Therefore, the above response rate will be slightly deflated.

3.6 Results

3.6.1 Statistical Analyses

Data were screened prior to the main analyses to examine for accuracy of data entry, missing values, and fit between distributions and the assumptions of multivariate analysis. Confirmatory factor analysis (CFA) was conducted using structural equation modelling (AMOS 4) to verify the construct validity of the QPASS instrument. CFA was considered appropriate as QPASS is a well validated instrument with reliable scales. Exploratory factor analysis (EFA) was conducted on the violation behaviour scale and the error scale using structural equation modelling by testing the fit of the measurement model for each variable. Because these were new scales, the exploratory mode was chosen to identify the minimal number of variables underlying each factor (B. M. Byrne, 2001). Reliability analyses (Cronbach's alpha) were calculated on the items in each subscale to test the internal consistency of the scales. Structural equation modelling was then used to test the fit of the structural model including all variables.

3.6.2 Data Screening

The accuracy of the data file was verified by using the Frequencies command in SPSS Version 11.5 to detect any out of range values. None were found. This

verification was considered sufficient as the questionnaire was in a scannable format (Optical Mark Recognition) which increases the accuracy of data entry.

The data were then checked for missing values. All missing values on individual items were replaced using the Missing Value Analysis command (SPSS) prior to scale formation. The expectation maximization (EM) technique was used as this produces less biased estimates than other techniques (Roth, 1994; Schafer & Graham, 2002). The range of missing data was from 0.0% to 3.4%, with a mean of 1.3% (SD = 0.7%). The Little's MCAR test resulted in a non-significant χ^2, suggesting that the data were missing at random, that is, there was no identifiable pattern in the missing data (Little, 1988).

Scales were formed from the individual items and these were tested for outliers. Box plots indicated a number of univariate outliers in the Violation Behaviour and Error scales. However, transformed data were not used for the reasons outlined below. Using Mahalanobis distance with $p < .001$, two cases were identified as multivariate outliers. Examination of these cases indicated they were not typical of the target population, that is, one respondent worked on a temporary part-time basis and the other worked as a casual. These cases were deleted leaving 174 cases for analysis.

Normality was tested using box plots and histograms, and the skewness and kurtosis statistics in SPSS. These indicated that all scales were normally distributed except for the Error scale (skewness 8.42; kurtosis 8.01) and the Violation Behaviour scale (skewness 8.48; kurtosis 12.49). As both were positively skewed, a log transformation was applied to each. Skewness and kurtosis were improved on both scales; however, the Error scale was still significantly positively skewed. It was decided not to use transformed data because these variables would not be expected

to be normally distributed in the population (Tabachnick & Fidell, 1996), and the Bollen-Stine adjusted *p*-value was used, when appropriate, to evaluate model fit in structural equation modelling (Byrne, 2001). This technique uses a post-hoc adjustment to account for non-normality in the underlying database.

3.6.3 Structural Equation Modelling - Evaluation of the Measurement Models

Prior to the evaluation of the full model, the measurement and structural model of the QPASS instrument was tested. Measurement models specify the relationships among the items and the latent constructs represented by the scales, and the structural model specifies the relations among the latent constructs. This two-step approach was recommended by Anderson and Gerbing (1988) who suggested that the construct validity of the scales is better assessed and the scale factors more easily interpreted if the measurement model is estimated, and respecified if necessary, prior to the evaluation of the full model. According to this approach, the first step should be the assessment of the measurement model of the whole QPASS instrument.

It is noted that, because of the large number of items used to measure Organisational Climate (50 items) and the unfavourable ratio of free parameters to cases, the subscales rather than the items were used in the measurement model for this latent construct. Gribbons and Hocevar (1998) refer to this as a partially aggregated model. This was considered appropriate as QPASS is a well validated instrument with reliable scales. The items were used for the measurement models for the Quality of Work Life, Individual Moral, and Individual Distress scales.

The model for the QPASS instrument is shown in Figure 3.2 below. For clarity, the error terms have not been included in this figure. Some fit indices indicated that the model was a poor fit to the data, χ^2 (400) = 867.69, p = .00; CMIN/DF = 2.17; TLI = .89; CFI = .90; RMSEA = .08. Modification indices

suggested that the model fit would be improved by allowing the correlation of the error terms for Workplace Distress and Excessive Work Demands, Workplace Distress and Workplace Morale, Individual Morale and Individual Distress, Item F2 (Feeling tense at work) and Item F8 (Feeling anxious at work), and Item F8 and Item F12 (Feeling uneasy at work). A number of other modifications were also suggested, however, these were not included as they did not make theoretical or practical sense (B. M. Byrne, 2001). The modified model provided improved fit statistics, χ^2 (395) = 695.10, p = .00; CMIN/DF = 1.76; TLI = .93; CFI = .93; RMSEA = .07.

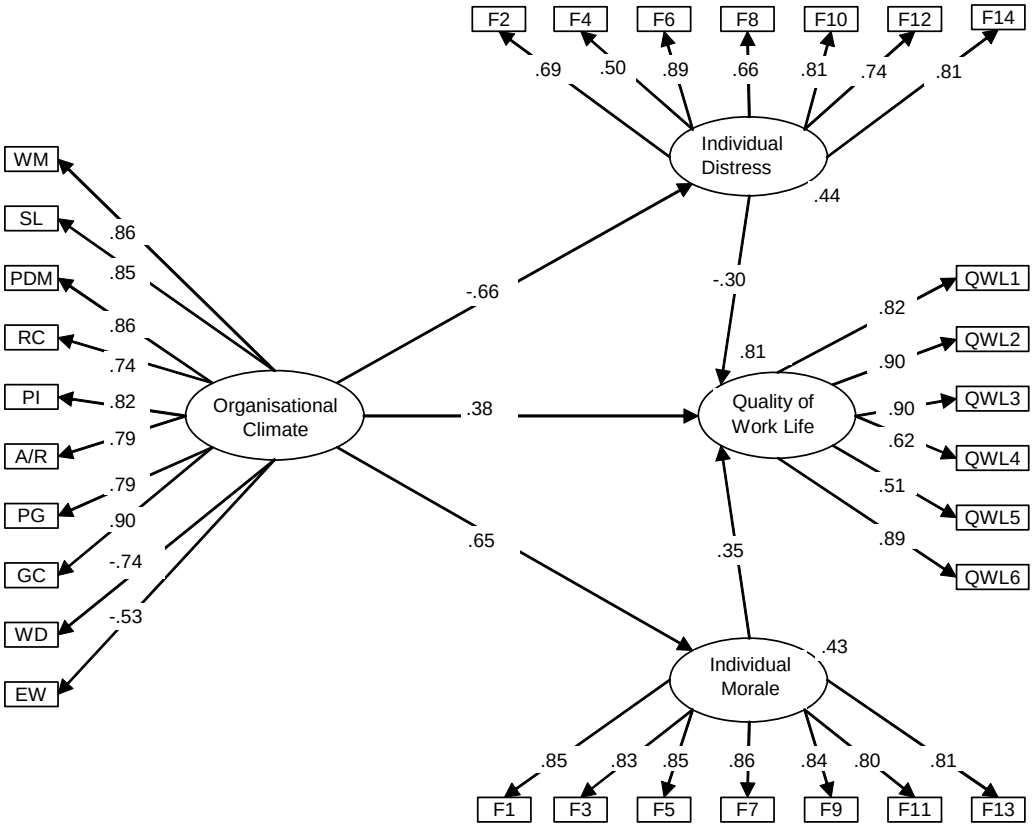

Figure 3.2 Measurement Model for QPASS Instrument

Note: WM = Workplace Morale, SL = Supportive Leadership, PDM = Participative Decision Making, RC = Role Clarity, PI = Professional Interaction, A/R = Appraisal & Recognition, PG = Professional Growth, GC = Goal Congruence, WD = Workplace Distress, EW = Excessive Work Demands

The measurement models for the Violation Behaviour and Error scales were also tested. As these were new scales which were developed for this study, an exploratory factor analytic approach was used in this case. The fit statistics for the initial Violation Behaviour model were as follows: χ^2 (65) = 137.26, [4]Bollen-Stine *p* = .46; CMIN/DF = 2.11; TLI = .81; CFI = .85; RMSEA = .08. Standardised parameter estimates for all pathways in this model were significant. However, the standardised regression estimate associated with the path from Violation Behaviour to the indicator item 2 (*Did not obtain the proper authority, e.g., order from doctor or signed protocol*) was the lowest in the model at .32. It was decided to exclude this item from further analyses because of this low regression weight. Evaluation of the amended model (see Figure 3.3) indicated that model fit was improved by the deletion of this item: χ^2 (54) = 94.64, Bollen-Stine *p* = .55; CMIN/DF = 1.75; TLI = .88; CFI = .90; RMSEA = .07.

[4] The Bollen-Stine adjusted *p* has been used instead of the usual maximum likelihood *p*-value when data do not conform to the assumption of multivariate normality.

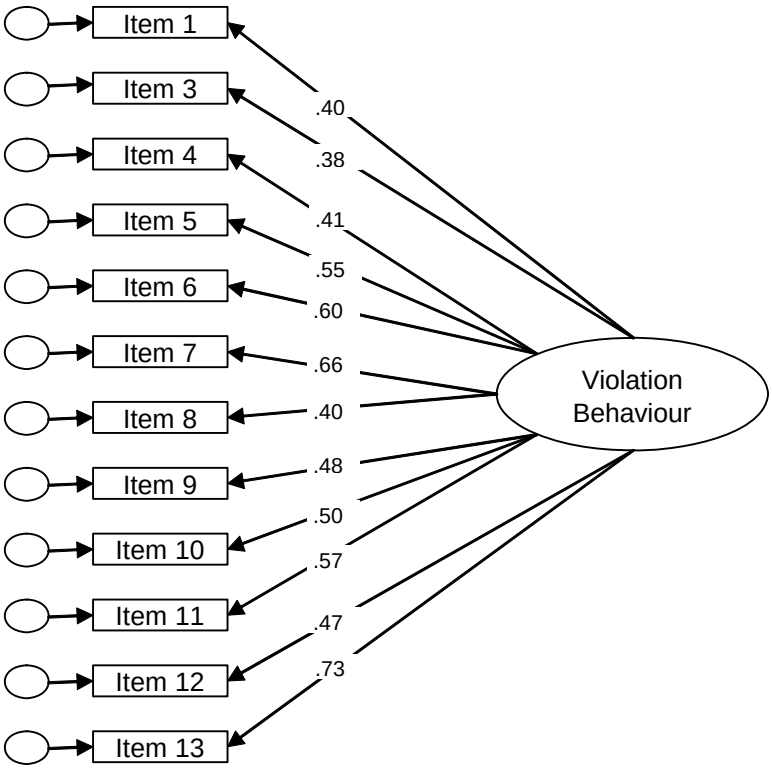

Figure 3.3 Measurement Model for Violation Behaviour Scale

The measurement model for the Error scale was a poor fit to the data: χ^2 (5) = 22.28, Bollen-Stine *p* = .20; CMIN/DF = 4.46; TLI = .64; CFI = .82; RMSEA = .14. In addition, the pathways from item 2 (*By the wrong ROUTE*), item 4 (*At the wrong TIME*), and item 5 (*At the wrong DOSE*) were not significant. A reliability analysis conducted on this scale revealed that the internal consistency estimate was low at .41. Two possibilities were considered, that is, that the scale was not a good measure of the construct because of the contentious nature of the questions and the "blame culture" present in the hospital system, or that it should be treated as a formative rather than reflective indicator (Diamantopoulos & Winklhofer, 2001; Nunnally & Bernstein, 1994). Items composing a scale (i.e., the measured variables) are usually perceived as reflective indicators of an underlying construct (i.e., the latent variable). However, an alternative measurement perspective involves the creation of an index

rather than a scale in which the observed variables are assumed to impact on the latent variable rather than the other way around. Formative indicators are not necessarily internally consistent (Nunnally & Bernstein). It was decided to include this variable as a formative index instead of a reflective scale, rather than delete it from the study.

3.6.4 Descriptive Statistics

Reliability analyses were conducted to provide information about the internal consistency of the scales. The results are shown in Table 3.1 below, together with the means, standard deviations, and alpha coefficients for the QPASS subscales, as reported in the manual (Hart et al., 1996).

These descriptive statistics were calculated using SPSS Version 11.5. The Quality of Work Life Scale and the Occupational Positive and Negative Affect Scales (Individual Morale and Individual Distress) were all measured on 7-point scales. Quality of Work Life was rated as average, however, the variance was large for this scale. When the individual responses were investigated it was found that the majority of respondents (approximately 50%) agreed (slightly to strongly) that their quality of work life was positive. Approximately 20% were neutral and 30% rated this aspect of their work life as low. The variances for the Individual Morale and Individual Distress scales were also high. Individual Morale was rated slightly above average suggesting that most nurses (approximately 45%) felt positive feelings at work more than moderately often. Approximately 30% indicated that they felt these positive feelings moderately often and 25% not at all to moderately often. The mean response to the Individual Distress scale suggests that most nurses (approximately 70%) did not experience high levels of negative feelings at work. However, a number did experience these feelings moderately often to all the time (approximately 30%).

Table 3.1
Means, Standard Deviations, and Alpha Coefficients for QPASS and Violation Behaviour Scales and Error Index (N = 174)

Scale	Subscale	No. of items	M	SD	α	α*
Quality of Work Life Scale		6	4.14	1.40	0.90	0.91
Occupational Positive & Negative Affect Scale	Individual Morale	7	4.38	1.30	0.94	0.92
	Individual Distress	7	2.96	1.25	0.90	0.88
Organisational Climate Scale	Workplace Morale	5	2.93	0.85	0.88	0.84
	Supportive Leadership	5	3.20	0.99	0.91	0.84
	Participative Decision Making	4	2.97	0.86	0.85	0.78
	Role Clarity	4	3.56	0.64	0.73	0.75
	Professional Interaction	7	3.49	0.62	0.82	0.83
	Appraisal & Recognition	6	3.03	0.81	0.87	0.88
	Professional Growth	5	3.26	0.76	0.79	0.79
	Goal Congruence	5	3.21	0.69	0.81	0.73
	Workplace Distress	5	3.36	0.87	0.91	0.83
	Excessive Work Demand	4	3.26	0.86	0.82	0.79
Violation Behaviour Scale		12	1.37	0.33	0.80	
Error Index		5	1.18	0.23	0.41**	

* Cronbach's Alpha as provided by Hart, Griffin, Wearing, and Cooper (1996) for QPASS instrument.
** Formative indicator rather than scale. Alpha coefficient reported for information only.

The subscales of the Organisational Climate scale were rated on a 5-point scale. Most of the positive aspects of Organisational Climate were rated above average. The exceptions were Workplace Morale and Participative Decision Making which were rated only slightly below average. This suggests that most nurses were reasonably happy with the different positive aspects of organisational climate. However, the two negative aspects, Workplace Distress and Excessive Work Demands, were also rated above average. While a large number of respondents chose the neutral response to both these scales (approximately 38%), the majority either agreed or strongly agreed that they were overworked and that others in the workplace were stressed (approximately 45% for both).

The Violation Behaviour scale was measured on a 5-point scale with the mean response indicating that most nurses reported following the procedures most of the time. The Error index was measured using a 4-point scale. The mean response suggested that most nurses reported rarely making errors.

3.6.5 Correlations

The correlation matrix showing relationships among the Quality of Work Life scale, the Occupational Positive and Negative Affect scales, the Organisational Climate scale, the Violation Behaviour scale, and the Error index is presented in Table 3.2 below.

Table 3.2
Correlation Matrix for Individual Variables, Organisational Climate, Violation Behaviour, and Errors (N = 174)

	1	2	3	4	5	6	7	8
1. Quality of Work Life	1.00							
2. Individual Morale	.73**	1.00						
3. Individual Distress	-.63**	-.55**	1.00					
4. Workplace Morale	.69**	.60**	-.57**	1.00				
5. Supportive Leadership	.69**	.52**	-.54**	.73**	1.00			
6. Participative Decision Mk	.58**	.52**	-.44**	.72**	.78**	1.00		
7. Role Clarity	.56**	.48**	-.43**	.61**	.66**	.61**	1.00	
8. Professional Interaction	.59**	.50**	-.50**	.77**	.68**	.68**	.61**	1.00
9. Appraisal & Recognition	.54**	.45**	-.46**	.61**	.66**	.71**	.61**	.67**
10. Professional Growth	.58**	.47**	-.44**	.61**	.62**	.71**	.53**	.66**
11. Goal Congruence	.68**	.56**	-.51**	.78**	.73**	.78**	.68**	.73**
12. Workplace Distress	-.66**	-.59**	.65**	-.74**	-.64**	-.58**	-.48**	-.56**
13. Excessive Work	-.50**	-.43**	.48**	-.47**	-.45**	-.44**	-.40**	-.31**
14. Violation Behaviour	-.25**	-.19**	.26**	-.22**	-.13*	-.21**	-.20**	-.20**
15. Errors	-.22**	-.21**	.17*	-.11	-.12	-.12	-.18**	-.06

	9	10	11	12	13	14	15
9. Appraisal & Recognition	1.00						
10. Professional Growth	.73**	1.00					
11. Goal Congruence	.69**	.72**	1.00				
12. Workplace Distress	-.54**	-.58**	-.68**	1.00			
13. Excessive Work	-.42**	-.49**	-.47**	.75**	1.00		
14. Violation Behaviour	-.20**	-.19**	-.26**	.24**	.23**	1.00	
15. Errors	-.06	-.06	-.18**	.16*	.16*	.49**	1.00

* Correlation is significant at the 0.05 level (1 tailed).
** Correlation is significant at the 0.01 level (1 tailed).

The Quality of Work Life scale and Occupational Positive and Negative Affect scales (Individual Morale and Individual Distress) were all significantly correlated with each other and with the ten Organisational Climate subscales. All correlations associated with these scales were in the expected directions.

Violation Behaviour was negatively and significantly correlated with Quality of Work Life, Individual Morale, and the eight positive aspects of Organisational Climate. Coefficients ranged from -.13 ($p < .05$) to -.26 ($p < .01$). Violation Behaviour was positively and significantly correlated with Individual Distress, the two negative aspects of Organisational Climate, and the Error index, with coefficients ranging from .23 to .49 ($p < .01$).

The Error index was negatively and significantly correlated with Quality of Work Life and Individual Morale, and with two of the positive aspects of Organisational Climate, that is, Role Clarity and Goal Congruence. These coefficients ranged from -.18 to -.22 ($p < .01$). Errors was also positively and significantly correlated with Individual Distress and the two negative aspects of Organisational Climate, that is, Workplace Distress and Excessive Work Demands, with coefficients ranging from .16 to .17 ($p < .05$).

3.6.6 Structural Equation Modelling - Evaluation of the Structural Model

AMOS 4 (Arbuckle & Wothke, 1999) using the maximum likelihood (ML) estimation method was employed to test the structural model to the covariance matrix generated from the set of variables. The model to be tested was presented earlier in a simplified conceptual form (see Figure 3.1). Although the hypothesised model fitted the data reasonably well, the pathways from the individual variables (Individual Distress, Individual Morale, and Quality of Work Life) to Errors were not significant. These pathways were deleted and the respecified model (see Figure 3.4)

was found to be a moderate fit to the data, χ^2 (454) = 765.49, Bollen-Stine p = .07; CMIN/DF = 1.69; TLI = .93; CFI = .93; RMSEA = .06.

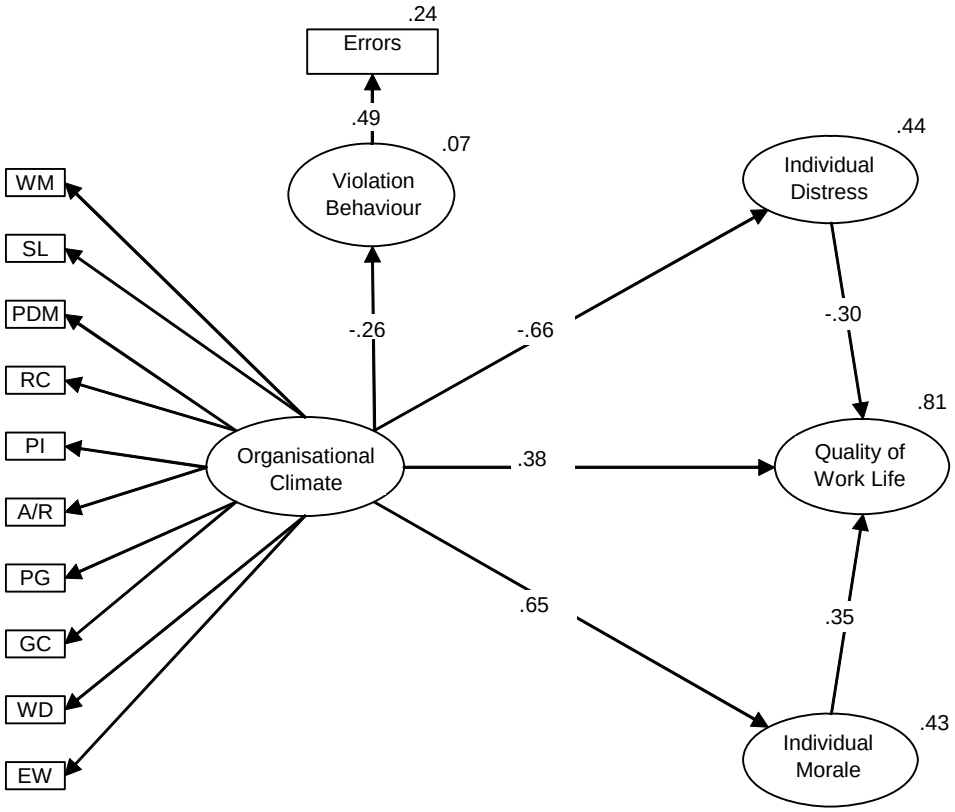

Figure 3.4 Structural Model of Relationships among Organisational Climate, Individual Factors, Violation Behaviour, and Errors

Note: WM = Workplace Morale, SL = Supportive Leadership, PDM = Participative Decision Making, RC = Role Clarity, PI = Professional Interaction, A/R = Appraisal & Recognition, PG = Professional Growth, GC = Goal Congruence, WD = Workplace Distress, EW = Excessive Work Demands

To enhance interpretation, the error terms and measurement models at the item level have been excluded from the diagram. This model accounted for 7% of the variance in Violation Behaviour and 24% of the variance in Errors. Contrary to expectations, no relationships were found between the individual variables and Errors.

3.6.7 Qualitative Analysis

Again qualitative data were collected with respondents being asked to comment on what they believed may have contributed to the errors and violations they had reported. These items can be found on pages 5 and 6 of the questionnaire in Appendix B.

A total of 83 respondents chose to make comments. The majority cited workload factors, that is, high workload, time constraints, interruptions/distractions, and staff shortages as the major contributors to errors and violations. Another major theme related to doctors' prescribing behaviour. Results are detailed below.

3.6.7.1 Contributors to Errors

According to this group, a major contributor to errors was workload issues with 14 mentioning high workload, 3 – time constraints, 8 – interruptions and distractions, and 5 – staff shortages. Other factors mentioned were stress (n = 3) and tiredness (n = 2). For example:

> *Workload too high. Staff expected to do too much thus resulting in mistakes.*
>
> *… Constant interruptions when giving out medications, i.e., phone ringing, doctors' demands, patients' demands, other staff asking for assistance.*

Matters relating to doctors' prescribing were also mentioned a number of times by these respondents. Seventeen identified unclear orders or medication sheets as being the contributor to an error, with illegible handwriting by the doctor specifically mentioned nine times. Examples include the following:

> *Instead of rewriting a medication sheet, Doctors cross out (or leave) then recommence or commence another drug.*
>
> *Busy workloads and messy prescribing by Doctors greatly contribute to medication errors.*

With regard to the specific error of giving a medication at the wrong time, nine respondents noted that this occurred often for various reasons, for example:

> *Giving a medication at a time that is written on the medication order sheet can sometimes be impossible.*
>
> *Time error caused by limited staff on duty at time of clinical emergency or heavy workload. Medications given later than when ordered.*

3.6.7.2 Contributors to Violation Behaviour

Workload factors were also cited by this group as contributing to violation behaviour, with time constraints being mentioned by 13 respondents. Four suggested high workload as a contributor and two, staff shortages. Two also noted that stress was a contributor to violation behaviour. Examples were as follows:

> *Time constraints make 5, 7 and 12* [i.e., checking reference materials, monitoring after administration, and giving education to patient] *impossible at times when limited staff on duty.*
>
> *Time constraints mean I don't always check MIMS to check for purpose of medications.*

Again a common theme involved doctors' issues with 14 respondents citing various matters as contributing to violation behaviour, for example:

> *Obtaining a signature from a Doctor for a V/T* [verbal telephone] *order is sometimes nigh impossible.*
>
> *Unavailability of Medical Officer makes it impractical to always check before changing route …*
>
> *… unwillingness to disturb Dr overnight may contribute in some cases.*
>
> *Difficulties in contacting MOs and difficult reception when dealing with MOs.*
>
> *Sometimes you felt you were bothering the doctor … because you felt they were too busy and stressed.*

With regard to the specific violation "did not check the patient's identity", four people made comments similar to the following:

> *…in a small town like this you get to know patients and don't always need to verify identity.*

3.7 Discussion

The aim of this study was to develop a model explaining the relationships among organisational and individual variables, violation behaviour, and errors during medication administration. It was hypothesised that organisational climate would have a direct impact on violation behaviour and the individual variables, and an indirect impact on errors through violation behaviour and the individual variables. Violation behaviour and the individual variables were expected to have a direct impact on errors.

As expected, Organisational Climate had a direct negative impact on Violation Behaviour. This outcome suggests that when the organisational climate is positive (for example, when nurses receive supportive leadership, are involved in decision making, are able to participate in professional development, and workloads are reasonable), then they are less likely to participate in unsafe behaviour when administering medications. Organisational Climate also had an indirect impact on medication Errors through the mediating variable Violation Behaviour. That is, when the climate is positive nurses are less likely to violate procedures, which in turn leads to less medication errors. The study was unable to support the hypothesised direct relationship between the individual variables and Errors, or the indirect relationship between Organisational Climate and Errors through the individual variables. It is unclear whether this outcome resulted because no relationship exists between the variables in this population or because the items used were not a valid measure of the

construct. The reliability and validity of this measure will be further investigated in the next study.

As anticipated, all pathways in the QPASS model were significantly related and in the expected direction. That is, Organisational Climate had a negative impact on Individual Distress and a positive impact on Quality of Work Life and Individual Morale. Individual Distress was negatively related to Quality of Work Life and Individual Morale was positively related to Quality of Work Life. The strongest direct pathways were the two from Organisational Climate to Individual Distress and Individual Morale. This outcome suggests that creating a more positive organisational climate will produce a direct improvement in the morale of nurses and a consequent improvement in their quality of work life, as well as a negative impact on their distress, thereby improving quality of work life.

3.7.1 Modifications for Study 3

The instrument chosen for Study 2 measured organisational climate and individual variables but was not able to explain more than 7% of the variance in violation behaviour. In addition, the hypothesised relationships between the individual variables and errors were not supported in this study, contrary to previous research (e.g., Dugan et al., 1996; Fogarty, 2004).

Schneider (1990) argued that measuring the climate of an organisation may require a strategic focus, that is, rather than investigating general organisational climate, it may be more appropriate to choose a focus of interest and measure the form of climate that is compatible with the outcomes being investigated. For example, if service is the criterion of interest, then measure the service climate; or if safety is of interest, measure the facets of the workplace related to a climate for safety. In support of this line of reasoning, research conducted by Neal et al. (2000)

found that a specific climate for safety was more strongly related to safety performance than the general climate of an organisation. Although general organisational climate had a significant impact on safety climate, which in turn was related to compliance with safety regulations and procedures, when the effects of safety climate were partialled out in this study, general organisational climate did not contribute to safety performance. The researchers suggested that this outcome encourages the use of specific forms of climate when specific outcomes are of interest.

For the above reasons, the next study measured the climate of the organisation relative to safety rather than the general climate of the organisation. The instrument was developed based on safety climate tools already in use in other complex industries, but was adapted to suit the medical domain. Similar variables to those included in Studies 1 and 2 were measured, that is, workload, training and competence issues, professional interactions, and unsafe acts, as well as a number of other issues relevant to safety climate (Flin et al., 2000).

In Study 2, the Violation Behaviour scale was written in the negative and comments from some nurses suggested that this made it difficult to answer. Therefore, in the next study this scale included positive statements associated with safety behaviour rather than violation behaviour. These statements again included generic behaviours based on nursing competencies with regard to medication administration. However, only behaviours that should be performed every time a nurse administers a medication were included. For example, behaviours like obtaining the proper authority or checking the patient's identity are always required to be performed under the legislation; however, actions such as recording side or

adverse effects are only required in special circumstances and therefore, do not apply all the time.

After the Violation Behaviour scale in Study 2 there was an open ended question asking for comments on what the respondents believed may have contributed to violation behaviour. In this study, this question was replaced by an additional measure of unsafe behaviour, that is, contributors to violations. These questions were used in an attempt to ask the question in a different way, perhaps eliciting more honest answers to a controversial set of questions.

The Error scale was again included but consisted of near misses as well as errors in an effort to improve reliability and validity and to obtain more variability from this scale. Reason (2000b, p.12) called near misses "free lessons" and argued that knowledge from inconsequential errors and near misses provides information about where problems exist in the system. In addition to the errors relative to the "five rights", two items were included covering missed doses and extra doses of medications. These were included as they are among the most commonly reported medication incidents (ACSQHC, 2002; Headford et al. 2001). As with the safety behaviour scale above, the open ended question asking about contributors was excluded from this study. Instead, statements concerning possible contributors to medication errors and near misses were included. Again this was an attempt to gain more honest answers to a less threatening set of questions.

Although individual variables did not impact on errors in the previous study, a measure of individual distress was again included as this link appears so regularly in the literature (e.g., Dugan et al., 1996; Fogarty & Worth, 2003). It was suspected that the nature of the error scale may have contributed to this lack of relationship rather than no relationship existing. As the error questions were modified in this

study to include near misses, it was expected the individual variable would have a direct impact on errors and near misses in this sample.

Qualitative questions were included at the end of the questionnaire. These were general questions asking respondents about how they would improve medication safety, as well as what they see as the major risk/problem with medication administration. The following chapter will give a detailed description of Study 3.

Chapter 4 – Study 3

The Influence of Safety Climate on Violations and Errors/Near Misses during Medication Administration

4.1 Introduction

The previous study investigated the impact of organisational climate and individual factors on violation behaviour and errors during medication administration by nurses in rural areas. The instrument chosen to measure organisational climate and the individual factors was the Queensland Public Agency Staff Survey (QPASS), which is a validated instrument authorised by the Queensland Government for use in public sector organisations. These variables accounted for 7% of the variance in Violation Behaviour, however, the hypothesised relationships between the individual variables and Errors were not supported in this study. It is unclear whether this outcome was because no relationship exists between the variables in this population or the result of methodological issues. This matter will be further investigated in the following study.

This chapter introduces Study 3. This study investigated the impact of individual factors and a specific type of climate, that is, safety climate, on violation behaviour and errors/near misses during medication administration. In addition, a new variable was introduced which investigated reporting behaviour. The following section will describe safety climate and the factors used to measure this construct. Reporting behaviour and the individual factor, psychological strain, will also be described.

4.2 Safety Climate

Organisational climate is a multidimensional construct that includes a wide range of individual evaluations of the general work environment (James & James, 1989). Organisational climate instruments typically measure aspects of the work environment, such as organisational policies, procedures, and practices (Reichers & Schneider, 1990). Evaluations of the climate may refer to general dimensions of the environment or to specific dimensions, such as the climate for service (Schneider, 1990) or the climate for safety (Griffin & Neal, 2000; Zohar, 1980). The climate for safety, or safety climate, describes perceptions of the value of safety in the work environment (Neal & Griffin, 2002). This is in contrast to the broader concept of safety culture which incorporates a number of additional constructs, such as attitudes, values, and behaviour. An organisation with a safety culture is one that willingly and enthusiastically works at safety (Hudson, 2000).

Safety climate is identified by the attitudes and perceptions of employees and represents the current surface features of the safety culture (Flin et al., 2000). Safety climate and safety culture are often used interchangeably by writers, with the distinction not as clear cut as it appears. Guldenmund (2000) suggested that safety climate describes the attitudes towards safety within an organisation, whereas safety culture refers to the underlying beliefs, convictions, and prevailing values of the social group. That is, safety climate can be seen as an indicator of the organisation's safety culture as perceived by employees at a given point in time (S. J. Cox & Flin, 1998).

The concept of safety culture was developed in response to major organisational accidents, the first being the nuclear reactor accident at Chernobyl, which led to the conclusion that the safety systems within the organisation had

broken down (Mearns et al., 2003; Pidgeon & O'Leary, 2000). Safety improvement in the past had concentrated on technical issues and individual human failures. However, these accidents highlighted the role that organisational, managerial, and human factors played in contributing to accidents (Weick, Sutcliffe, & Obstfeld, 1999). With each investigation, knowledge of the factors which make organisations vulnerable has increased (Pidgeon, 1997). This vulnerability does not just originate from human failures, chance environmental factors, or technological failures alone, but rather, it is the entrenched policies and standards of the organisation that have been shown to predate accidents (Pidgeon).

In recent years there has been a move away from relying on retrospective analyses of accidents and incidents, towards a more proactive approach such as safety audits and measurements of the safety climate of an organisation (Flin et al., 2000). These more predictive measures enable the monitoring of the safety condition of an organisation so that remedial action can be taken prior to an incident occurring (Flin, 1998).

Research suggests that perceptions of safety climate impact positively on safety compliance and are negatively associated with accidents and incidents (Hayes, Perander, Smecko, & Trask, 1998; Hofmann & Stetzer, 1996; Mearns et al., 2003; Zohar, 2000). Although there is little evidence to suggest that weaknesses in safety at the organisational level are associated with individual accidents, case studies of major disasters have provided evidence linking weaknesses in the safety culture of an organisation with organisational accidents (Mearns et al.; Reason, 1997).

In recent times, a number of assessment instruments have been developed in this field (e.g., S. J. Cox & Cheyne, 2000; Mearns et al., 2003; Zohar, 1980). However, there is little agreement as to the underlying structure of safety climate,

with factor analyses suggesting solutions ranging from two to nineteen key dimensions (Dedobbeleer & Beland, 1991; Flin et al., 2000; Williamson, Feyer, Cairns, & Biancotti, 1997). Drawing direct comparisons between safety climate measures is complicated by the fact that these instruments tend to vary significantly in content, style, statistical analyses, size and composition of workers and industries, and country of origin (Flin et al.).

However, although there is limited evidence for or against a common factor structure for safety climate, researchers are beginning to examine the thematic basis of a number of scales and have suggested that a basic set of features is beginning to emerge. For example, Flin et al. (2000) identified themes relating to management, safety systems, risk, training/competence, procedures, and work pressure in a number of safety climate instruments. In his evaluation of the safety climate literature, Guldenmund (2000) identified a similar set of factors, that is, management, risk, safety arrangements, procedures, training, and work pressure as the most frequently measured dimensions.

In the current research, variables relating to these themes were investigated, that is, managements' commitment to safety, training/competence, procedures and reference materials, and work pressure. In addition, reporting behaviour and individual psychological strain were examined. These variables were not included as part of safety climate but were expected to be influenced by the safety climate of the organisation. The rationale for the inclusion of the above variables will be discussed in the next section.

4.2.1 Management's Commitment to Safety

The role played by social forces within an organisation is emphasised by the safety culture approach to accident reduction, with these social forces acting upon the

individual employee's cognitions, perceptions, and behaviour regarding safety at work (Clarke, 1999). For example, Schein (1992) suggested that the way in which managers instruct, reward, allocate their attention, and behave under pressure, will be important in shaping the culture of an organisation. In his early work in this area, Zohar (1980) identified perceived management attitude towards safety as one of the two primary dimensions of safety culture. Zohar argued that, while perceptions of personal risk are fundamental to safety behaviour, the cognitions that guide behaviour "… are largely related to perceptions of management attitudes about safety" (p.101).

Subsequent research has revealed that employees' perceptions of management's attitudes and behaviours towards safety are the most useful measurement of an organisation's safety climate, with different levels of management influencing safety attitudes in different ways (S. J. Cox & Cheyne, 2000; Flin et al., 2000; Fogarty & Shaw, 2003). For example, in a study of Australian manufacturing companies, Griffin and Neal (2000) found that a key factor to the safety climate within an organisation was how managers viewed safety in the workplace. In addition, in a study of nurses in a large urban hospital in the US, Grosch, Gershon, Murphy, and DeJoy (1999) found that management's commitment to safety was one of the safety climate dimensions (together with job hindrances and feedback/training) that was positively associated with nurses' compliance with procedures prescribing safe working practices.

An issue in the research into management's commitment to safety is that in many studies the management label is used in an ambiguous fashion so that it is difficult to discern which level of management is being assessed (Flin et al., 2000). Clarke (1999) argued that levels of management have distinct roles and are perceived

differently by the workforce. Various management layers within an organisation affect safety issues in different ways. While senior management influences the tone and pace of the organisation, establishes priorities, and allocates resources, first-line supervisors play an important role in setting the work atmosphere and the safety climate for their workgroups (Flin et al.). For this reason, questions relating to management at the senior level and to the immediate supervisor were included in this study.

These scales replaced the item in Study 1 dealing with professional interactions between doctors and nurses (Expectation by Doctor), and the scales in Study 2 covering professional relationships with colleagues (Professional Interaction) and managers (Supportive Leadership). These scales covered matters such as senior management's and supervisors' attitude to patient safety and communication issues.

4.2.2 Training/Competence

Training/Competence refers to issues such as selection, training, and competence standards and includes employees' perceptions of the level of qualifications, and the skills and knowledge of the workforce at the task/job level and the safety level (Flin et al., 2000). As previously noted, nurses are expected to have up-to-date knowledge of the actions, side-effects, and dosage of any medication they administer (Delaune & Ladner, 1998), with a lack of medication knowledge being identified as one of the most common system failures contributing to medication errors (Leape et al., 1995; Meurier et al., 1997; O'Shea, 1999). Access to training was also included in this scale as this may be a problem in rural areas, particularly with issues such as distance, cost, and lack of sufficient replacement personnel to provide coverage when nurses are away from work (J. Anderson & Kimber, 1991).

This scale included level of knowledge or competence issues, as covered in Study 1 (Level of Knowledge), and availability of and access to ongoing training, as covered in Study 2 (Professional Growth). In addition, items relating to safety training were included.

4.2.3 Procedures

The Procedures factor relates to attitudes to safety rules and the quality of written procedures, that is, their accuracy, relevance, availability, and workability (Flin et al., 2000; Reason, 1990). Guldenmund (2000) identified this factor as one of the most frequently occurring themes in his review of safety questionnaires. In complex industrial settings that operate under hazardous conditions, human behaviour has to be limited not only to that which is efficient and productive, but also to that which is safe (Reason, Parker, & Lawton, 1998). One way of doing this and of maintaining a level of predictability is to use procedures and rules to regulate the behaviour of workers. However, if these rules are not practical and/or are complicated to follow, it is unlikely that they will produce the desired effect, that is, compliance (Reason, 1997).

This was a new scale, not included in the previous studies, and measured nurses' attitudes towards medication administration procedures. In particular, nurses were asked about the practicality and ease of use of procedures, as well as compliance issues.

4.2.4 Reference Material

As noted earlier, nurses are required to refer to reference material if they are unsure about the actions or dosage of a particular medication or its side-effects (Delaune & Ladner 1998). However, if reference materials are not readily accessible,

up-to-date, and easy to follow, this may impact on the nurse's ability to follow the rules for safe practice (Reason, 1997).

This scale was reintroduced from Study 1, with a few changes to provide more clarity. For example, in Study 1 nurses were asked if they "… *have easy access to up-to-date reference material with regard to the administration and supply of medications*". Upon reflection, this question may have caused confusion because of its "double-barrelled" nature. Therefore, in this study, this question was divided into two items, one asking about access to reference materials and the other asking whether these materials were up-to-date. In Study 1 another question was asked about the adequacy of reference materials to maintain competence. This was replaced with the less ambiguous item "*Reference materials in this hospital are easy to follow*". The Reference Material scale in Study 1 also included an item regarding easy access to the *Regulation.* In order to keep this scale purely about reference materials containing medication information, the item was dropped from this study.

4.2.5 Work Pressure

As noted earlier, it is widely accepted that susceptibility to unsafe acts is strongly affected by work pressures (Leape, 1994; Vincent et al., 1998). In the medical field, researchers have found that workload factors impact on unsafe behaviour by nurses during medication administration (Leape et al., 1995; O'Shea, 1999). Work pressure appears in a number of surveys investigated by Flin et al. (2000) and relates to work pace, workload, and the balance between pressure for production and safety.

This factor was again included and covered workload and staffing level issues as investigated in Studies 1 (Workload) and 2 (Excessive Work Demands). This scale also included an item about the effect of staffing levels on safety.

4.3 Additional Scales

4.3.1 Reporting Behaviour

The dominant tradition in medicine when incidents occur is to blame the apparent perpetrator of the unsafe behaviour (Leape, 1994), with this behaviour often attributed to inattention, forgetfulness, or incompetence (Reason, 2000). However, Reason (1994) argued that, although blaming fallible individuals for incidents is universal, natural, emotionally satisfying, and legally convenient, this action has little or no remedial value. Most people who make even serious errors are conscientious and dedicated professionals who usually do their jobs well (Bates, 1999). Finding and punishing the individual who carried out the unsafe act has not reduced the frequency of error in medicine (Leape, 1994). Reason (1994) also suggested that blaming can lead to countermeasures, such as retraining, disciplinary action, and new procedures, that may be ineffective when dealing with a well-qualified and highly motivated work force such as in the medical environment.

A study evaluating adverse incident reporting in the UK found that staff in two obstetric units reported less than a quarter of designated incidents to the units' risk managers (Stanhope, Crowley-Murphy, Vincent, O'Connor, & Taylor-Adams, 1999). Further research exploring the reasons for the low reporting rate found that the main reasons for not reporting were fears that junior staff would be blamed, high workload, and the belief that the circumstances or outcome did not warrant a report (Vincent, Stanhope, & Crowley-Murphy, 1999). The nursing literature suggests that nurses deliberately choose not to report errors because of the potential professional and personal ramifications (D. J. Anderson & Webster, 2001; Cheek & Gibson, 1996). A nurse who makes an error is often viewed as a "bad nurse", with this simplistic view resulting in a person-centred investigation and blame being focussed

solely at the nurse directly involved. This has resulted in a reluctance by nurses to report incidents, with the consequence being the perpetuation of the system which contributed to the unsafe behaviour (Leape, 1994; Meurier, 2000).

A reporting culture is a crucial component required for a good safety culture (Reason, 1997). The safety of an organisation depends on the willingness of members to report incidents and near misses so that lessons can be learned, and future incidents averted. The way in which an organisation deals with blame and punishment of errors and violations is a critical factor in the development of an effective reporting culture (Reason).

This scale covered issues such as respondents' perceptions of the reporting culture in their hospitals, for example, reporting policies, feedback channels, and punishment issues. In addition, items were included covering knowledge about the correct reporting procedures and willingness to report incidents or near misses.

4.3.2 Psychological Strain

As noted earlier, stress is recognised as one of the most significant and fastest growing health hazards in the workplace (Chu & Dwyer, 2002; Spector, 2002). Stress influences human behaviour because it tends to induce "tunnel vision", that is, an inability to deal simultaneously with multiple stimuli, which is a characteristic of most tasks in complex systems (Petersen, 1996).

Work-related stress has been shown to impact on unsafe behaviour in high-risk industries such as offshore oil (Mearns, Flin et al., 2001), and aviation (Fogarty, 2004; Fogarty & Worth, 2003). Moreover, in a study of nurses in the US, psychological strain of nurses was found to be associated with a number of patient incidents including falls and medication errors (Dugan et al., 1996). Researchers in the UK suggested that the causes of stress in nursing appear to originate from two

primary sources, that is, organisational factors and the caring element of nursing work (Taylor, White, & Muncer, 1999). The highest rated organisational factors contributing to stress noted in that study were staffing levels, inadequate support, multiple roles, and the behaviour of managers.

This scale replaced the individual variables, Quality of Work Life, Individual Morale, and Individual Distress from Study 2. In the interests of parsimony, this study included only the negative emotional and physical responses nurses have to their workplace, rather than looking at job satisfaction (Quality of Work Life) and the positive responses (Individual Morale). The scale covered a number of issues relating to the well-being of nurses, for example, feeling unwell or emotionally drained at work.

4.3.3 Violation Behaviour

Violation Behaviour was made up of two subscales, that is, Safety Behaviour and Violation Contributors. The Safety Behaviour scale was similar to the Violation Behaviour scale from the previous study, however, as the name implies, items were written in the positive rather than the negative. For example, rather than statements such as *Did not check the patient's identity*, the item was rephrased to *Checked the patient's identity*. This modification was made because some nurses from the previous study commented that these questions were difficult to answer when written in the negative. The questionnaire was shorter than the previous scale and included only those behaviours that are required whenever a medication is administered, for example, obtaining the proper authority. Five items were excluded because these behaviours are required in specific situations only and their inclusion would confound results. For example, the *never* response to these items could indicate either that the respondent violates procedures in this way or that they have never

faced this type of situation. These behaviours included verifying illegible orders, verifying verbal/telephone orders, checking reference materials for unfamiliar medications, recording side or adverse effects, and checking with a doctor before changing the route of administration.

Violation Contributors was a new scale and replaced the open ended question from the previous study asking respondents to comment on what they considered contributed to violation behaviour. Instead, respondents were given a short list of five possible contributors, for example, *I bend the rules to get the job done.* This scale was included to provide further information about unsafe behaviour.

4.3.4 Errors/Near Misses

Errors/Near Misses was made up of two subscales, that is, Error Category and Error/Near Miss Contributors. The scale used to measure errors in the previous study proved to be problematic and it is unclear whether the hypothesised relationship between errors and the individual variables was not found because of the scale or because no relationship exists in this population. The Error Category scale in this study was similar to the error index from the previous study in that it included errors relative to the "five rights". However, it was modified in this study to include near misses as well as errors in an effort to improve reliability and validity and to obtain more variability from this scale. Reason (2000b, p.12) referred to near misses as "free lessons" and argued that they provide information about where problems may exist in the system. In addition, two extra items were included in this scale covering missed doses and extra doses of medications as these errors are among the most commonly reported medication incidents (ACSQHC, 2002; Headford et al. 2001).

As with the safety behaviour scale above, the open ended question asking about contributors was excluded from this study. Instead it was replaced by a new

scale, Error Contributors, which included statements concerning possible contributors to medication errors and near misses. It was hoped that this set of items would elicit more honest answers to a less threatening set of questions.

4.4 The Conceptual Model

Figure 4.1 presents a conceptual model illustrating graphically the relationships to be evaluated in Study 3. The proposed model presents the relationships among Safety Climate, Psychological Strain, Reporting Behaviour, Violation Behaviour, and Errors/Near Misses.

This conceptual model is proposed and tested based on the following hypotheses:

1. Safety climate will have a direct negative impact on violation behaviour, that is, a more positive safety climate will decrease violation behaviour (Grosch et al., 1999; Neal et al., 2000; Reason, 1997).
2. Safety climate will have a direct positive impact on reporting behaviour, that is, a more positive safety climate will increase reporting behaviour (D. J. Anderson & Webster, 2001; Cheek & Gibson, 1996; Edmondson, 1996; Leape, 1994).
3. Safety climate will have a direct negative impact on strain, that is, a more positive safety climate will decrease the levels of strain (Clarke, 1999; Fogarty, 2004; Fogarty & Worth, 2003).
4. Violation behaviour will have a positive impact on errors/near misses, that is, higher levels of violation behaviour will be associated with more errors and near misses (Lawton, 1998; Reason, 1997).
5. Violation behaviour will have a negative impact on reporting behaviour, that is, more violation behaviour will be associated with less reporting (D.

J. Anderson & Webster, 2001; Cheek & Gibson, 1996; Leape, 1994; Reason, 1994).

6. Strain will have a direct positive impact on reporting behaviour, that is, more strain will produce less reporting behaviour (D. J. Anderson & Webster, 2001; Cheek & Gibson, 1996; Vincent et al., 1999).
7. Strain will have a direct positive impact on errors and near misses, that is, higher strain will be associated with more errors/near misses (Dugan et al., 1996; Fogarty, 2004; Mearns, Flin et al., 2001).
8. Safety climate will have an indirect effect on errors/near misses through violation behaviour and strain (Fogarty, 2004; Fogarty & Worth, 2003).

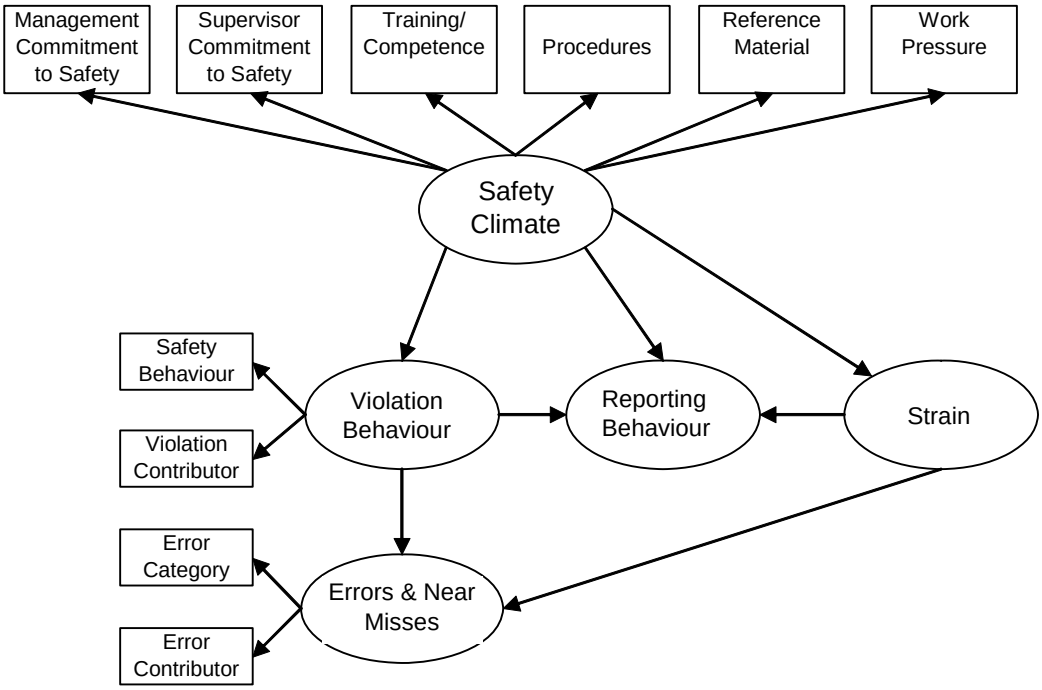

Figure 4.1 Conceptual Model of Relationships among Safety Climate, Reporting Behaviour, Strain, Violation Behaviour, and Errors/Near Misses

4.5 Method

4.5.1 Participants

Participants included 106 nurses working in a public sector hospital in a large rural centre in South-East Queensland. Most respondents were registered nurses (*n* = 99, 93.4%), with 6 (5.7%) being enrolled nurses with medication endorsement, and 1 respondent not indicating his/her registration category. There were 96 (90.6%) females, 9 (8.5%) males, and 1 unidentified. Most were employed on a permanent full-time (*n* = 34; 32.1%) or permanent part-time basis (*n* = 50; 47.2%). The majority of participants were over the age of 30 (*n* = 81; 76.4%) with the largest group being between 31 and 40 years (*n* = 33; 31.1%). Most participants had more than 6 years experience with Queensland Health (*n* = 77; 72.6%), with a number (*n* = 21; 19.8%) having worked for the organisation for more than 20 years.

4.5.2 Materials

The scales used in the current study were Safety Climate (subscales included Supervisor's/Management's Commitment to Safety, Training/Competence, Procedures, Reference Material, and Work Pressure), Reporting Behaviour, Psychological Strain, Errors/Near Misses, and Violation Behaviour. These variables were chosen with reference to nursing and safety literature as discussed in the previous section. The items used to measure the safety climate scales were adapted to the medical environment from items included in the Summary Guide to Safety Climate Tools prepared by the Health and Safety Executive (Davies, Spencer, & Dooley, 2001). Although the emphasis of these tools is mainly for use in the oil and gas industry, the items were adapted by the developers so that they could be applied to any industry. A description of each scale is listed below.

4.5.2.1 Safety Climate Questionnaire

All scales in the Safety Climate Questionnaire were measured on a 5-point scale ranging from *strongly disagree* to *strongly agree*. These items can be found on pages 6 and 7 of the Safety Climate section of the questionnaire in Appendix C. Some items were reverse-scored. With the exception of Work Pressure, which was negatively associated with Safety Climate, higher scores on scales represented a more positive safety climate.

Training/Competence: This scale included seven items (items 1 to 7) asking respondents about safety issues in training programs, ongoing training, and their level of knowledge of their responsibilities, medications, and the *Regulation*. Higher scores indicated higher levels of training and competence. Example: *Patient safety issues are given high priority in medication training programs.*

Management's Commitment to Safety: This was broken down into two sets of five items each, that is, immediate supervisor's commitment to safety (items 8 to 12) and senior management's commitment to safety (items 13 to 17). Items 11 and 12 from the supervisor scale, and 16 and 17 from the management scale were reverse-coded so that higher scores on both scales indicated higher commitment to safety. Example: *Management really cares about patient safety in this hospital.*

Procedures: This scale included four items (items 18 to 21) relating to medication administration procedures, that is, their practicality and whether most nurses followed these procedures. Items 19 and 20 were reverse-coded so that higher scores on this scale indicated higher levels of practicality and simplicity of procedures, and higher compliance. Example: *Medication administration procedures in this hospital reflect how the job is usually done.*

Reference Material: Three items (items 22 to 24) were used to ascertain respondents' perceptions about the accessibility and ease of use of up-to-date reference material. Higher scores indicated higher levels of access and ease of use of reference materials. Example: *Reference materials in this hospital are easy to follow*.

Work Pressure: The scale included four items (items 25 to 28) asking about workload, staffing levels, and expectations on nurses. Items 26 and 27 were reverse-coded so that higher scores on this scale indicated higher work pressure. This scale was negatively related to Safety Climate. Example: *Nurses are overloaded with work in this hospital*.

4.5.2.2 Additional Scales

Reporting Behaviour: Seven items (items 29 to 35) were used to ascertain respondents' perceptions of the reporting environment and their willingness to report incidents and near misses. Item 35 was reverse-coded so that scores on this scale indicated a more positive attitude towards the environment and reporting. Example: *I am willing to report incidents in which I am involved.*

Psychological Strain: This scale included five items (items 36 to 40) asking about the respondents' level of well-being at work. Item 40 was reverse-coded so that higher scores on the scale reflected higher levels of strain. Example: *I feel emotionally drained at work.*

4.5.2.3 Medication Administration Questionnaire

This questionnaire included the outcome variables Violation Behaviour (made up of Safety Behaviour and Violation Contributors) and Errors/Near Misses (made up of Error Category and Error/Near Miss Contributors).

Safety Behaviour: These items can be found on page 4 of the Medication Administration section of the questionnaire in Appendix C. This scale replaced the Violation Behaviour scale from the previous studies. Eight items were used to measure how often in the past 12 months respondents had followed procedures when administering medications. The scale was measured on a 5-point scale from *never* to *always*. Example: *Checked the patient's identity*.

Violation Contributors: These items can be found on page 4 of the Medication Administration section of the questionnaire in Appendix C. This was a new scale and was included to elicit further information about safety/violation behaviour, that is, respondents' perception of factors contributing to violation behaviour. It was anticipated that this way of asking may be less threatening to respondents. Respondents were asked, using five items, their reasons for bending rules. The items were chosen based on the literature and the answers to the qualitative questions in Study 2. The scale was measured on a 5-point scale from *never* to *always*. Example: *I bend the rules to get the job done*.

Error Category: This 7-item scale can be found on page 5 of the Medication Administration section of the questionnaire in Appendix C. This scale replaced the Error index from the previous study. Respondents were asked to indicate how often in the past 12 months they had been involved in an incident or near miss when administering a medication. This scale was measured on a 4-point scale (*never, once*

or twice, three or four times, more often). Higher scores indicated higher numbers of errors and/or near misses. Example: *I gave, or very nearly gave, the wrong drug*.

Error/Near Miss Contributors: These items can be found on page 5 of the Medication Administration section of the Questionnaire in Appendix C. Five items were used to elicit perceptions of the contributing factors to errors and near misses. These items were chosen based on the answers to the qualitative questions in Study 2. This was a new scale and was used as an additional measurement of errors and near misses as it was anticipated that this way of asking the questions may be less threatening to respondents. The scale was measured on the same 4-point scale as the Error Category subscale. Example: *I have made, or very nearly made, an error because of fatigue*.

4.5.3 Procedure

A Health Service District in a large rural centre in South-East Queensland was invited to take part in this study. Questionnaires were delivered to the District Office and questionnaires were distributed via this office. Staff were allocated work time to complete their questionnaires. Questionnaires were either collected at a central point by the hospital and picked up by the researcher, or mailed individually by respondents to a reply-paid address. Of the 482 questionnaires distributed, 106 were completed and returned for analysis giving a response rate of 22%. This response rate may have been deflated by the fact that the figure of 482 included enrolled nurses (without medication endorsement) who were not eligible to participate in the survey.

4.6 Results

4.6.1 Statistical Analyses

Data were screened prior to the main analyses to examine for accuracy of data entry, missing values, and fit between distributions and the assumptions of multivariate analysis. The construct validity of each scale was tested using a combination of confirmatory factor analysis and exploratory factor analysis with structural equation modelling. These techniques were used in this case as the instrument was a new questionnaire developed for this study. Reliability analyses (Cronbach's alpha) were calculated on the items in each subscale to test the internal consistency of the scales. Structural equation modelling (AMOS 4) was then used to test the fit of the structural model.

4.6.2 Data Screening

The accuracy of the data file was verified by using the Frequencies command in SPSS Version 11.5 to detect any out of range values. None were found. This verification was considered sufficient as the questionnaire was in a scannable format (Optical Mark Recognition) which increases the accuracy of data entry.

The data were then checked for missing values. All missing values on individual items were replaced using the Missing Value Analysis (SPSS) prior to scale formation. The expectation maximization (EM) technique was used as this produces less biased estimates than other techniques (Roth, 1994; Schafer & Graham, 2002). The range of missing data was from 0.9% to 4.4%, with a mean of 2.3% (SD = 1.2%). The Little's MCAR test resulted in a non-significant χ^2, suggesting that the data were missing at random, that is, there was no identifiable pattern in the missing data (Little, 1988).

Scales were formed from the individual items and these were tested for outliers. Box plots indicated that a number of univariate outliers were present in some scales. However, data were not transformed for the reasons outlined below. Using Mahalanobis distance with $p < .001$, two cases were identified as multivariate outliers. Examination of these cases indicated they were typical of the target population, that is, both were female, registered nurses, 31-40 years, and worked on a permanent part-time basis. Therefore, both cases were included in further analyses.

Normality was tested using the skewness and kurtosis statistics in SPSS. These indicated that all scales were normally distributed except for Safety Behaviour, (skewness -11.10; kurtosis 31.04), Violation Behaviour (skewness 4.40; kurtosis 4.48), Error Category (skewness 4.22), and Error/Near Miss Contributors (skewness 3.68). It was decided not to use transformed data because these variables would not be expected to be normally distributed in the population (Tabachnick & Fidell, 1996), and the Bollen-Stine adjusted *p*-value was used in structural equation modelling to correct for non-normality (Byrne, 2001).

4.6.3 Structural Equation Modelling – Evaluation of the Measurement Models

Prior to the evaluation of the structural model, the one-factor congeneric[5] measurement models for each scale were examined separately using AMOS 4 (Arbuckle & Wothke, 1999). Adopting this procedure highlights any potential problem areas in each scale prior to the analysis of the larger measurement models for the latent constructs. These analyses revealed that the models for Management, Supervisor, Reference Material, Procedures, Work Pressure, Strain, Violation Contributors, Error/Near Miss Contributors all fit the data well. The model for

[5] A set of measures is said to be congeneric if each item assesses the same construct (B. M. Byrne, 2001).

Training/Competence indicated that the pathways from item 3 and item 4 were not significant. When these items were deleted the model was a good fit to the data. The pathway from item 6 in the Safety Behaviour measurement model was low at .31. This item was deleted and the modified model fit the data well. The model for Error Category revealed that the pathways from item 2, item 5, and item 7 were all low at .33 .32, and .29 respectively. These items were deleted and the modified model fitted the data well. The similar Error index in Study 2 was problematic; however, a reliability analysis revealed that the new scale reached acceptable reliability at .72.

The analysis of the model for Reporting Behaviour indicated that the pathways from items 29, 30, and 31 were not significant. Further investigation using factor analysis in SPSS suggested that the scale was made up of two factors; one including items 29, 30, 31 which seemed to measure the reporting environment, while items 32, 33, 34 seemed to be measuring willingness to report. The reverse-scored item 35 loaded equally onto each factor. Reliability analysis suggested that the reporting environment factor was unreliable with an alpha coefficient of .43. Therefore this scale was not included in any further analyses. Analysis of the willingness to report factor, with item 35 included, was reliable but this was improved with item 35 removed. Alpha for the three-item scale was acceptable at .72. Therefore this item was renamed Willingness to Report and included items 32, 33, and 34.

The measurement models for the Safety Climate, Violation Behaviour, and Errors/Near Misses scales were analysed next. The Safety Climate model included the variables Management, Supervisor, Training/Competence, Reference Material, Procedures, and Work Pressure. The fit statistics for the initial model were poor. Examination of the model revealed that the regression estimate associated with the

path from Work Pressure was low at -.27. This factor was excluded from the measurement of Safety Climate but was included in the structural model to be tested later. Even with this factor excluded, some initial fit statistics (i.e., TLI and CFI) for the modified model indicated that the fit was still poor: χ^2 (204) = 329.65, p = .00; CMIN/DF = 1.62; TLI = .84; CFI = .85; RMSEA = .08.

Modification indices suggested that fit would be improved if a number of error terms were correlated. These error terms related to the factors Management Commitment to Safety and Supervisor Commitment to Safety. These included the pathways between the error terms for item 11 (*My supervisor turns a blind eye if patient safety procedures are not followed*) and item 16. As item 16 was the same question directed at Management, this pathway was included to account for common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). A pathway was also included between the error terms for item 12 (*My supervisor is more concerned with financial considerations than patient safety*) and item 17 for the same reason.

Pathways were also suggested between items 10 and 11, and between items 15 and 16. These pathways seemed plausible and were included because item 10 (*My supervisor acts decisively when a patient safety concern is raised*) and item 11, which is reverse-scored (*My supervisor turns a blind eye if patient safety procedures are not followed*), and items 15 and 16, which are the same items directed at Management, are eliciting similar information. The fit statistics for the modified model (see Figure 4.2) indicated that the model was a good fit to the data: χ^2 (200) = 268.92, p = .00; CMIN/DF = 1.35; TLI = .91; CFI = .92; RMSEA = .06.

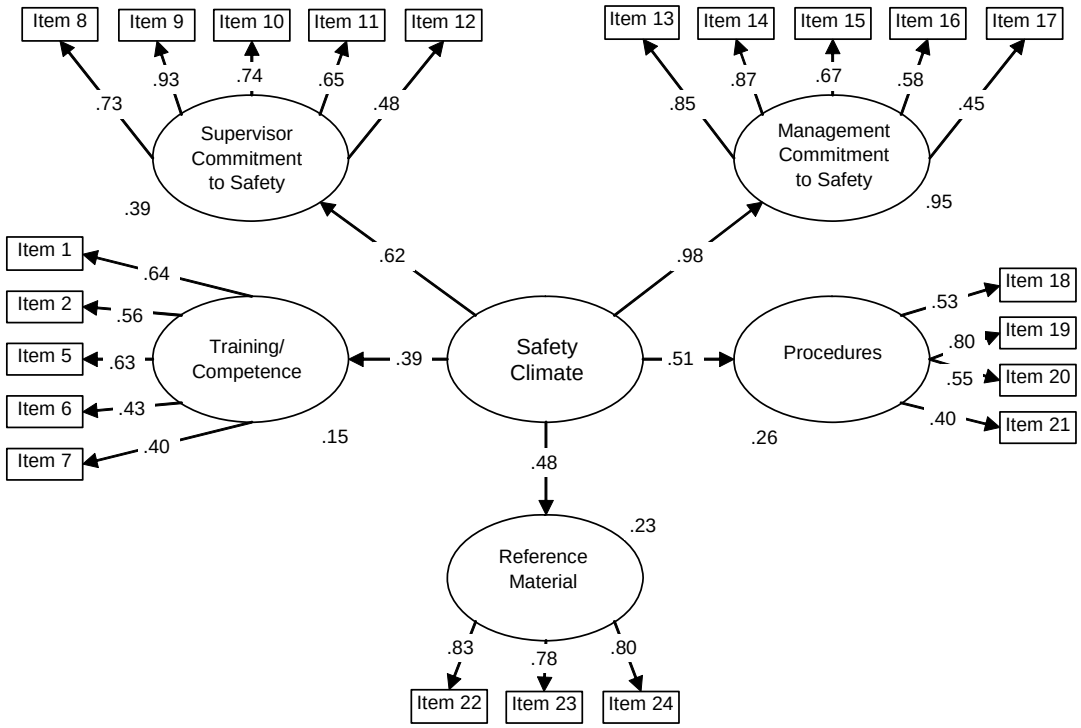

Figure 4.2 Measurement Model for Safety Climate Scale

Note: Error terms and covariance pathways between error terms for items 10 and 11, 15 and 16, 11 and 16, and 12 and 17 not illustrated in model.

The Violation Behaviour measurement model included the variables Safety Behaviour and Violation Contributors. The fit statistics for this model (see Figure 4.3) indicated that the fit was good: χ^2 (53) = 76.07; [6]Bollen-Stine p = .57; CMIN/DF = 1.44; TLI = .92; CFI = .93; RMSEA = .06.

[6] The Bollen-Stine adjusted p has been used instead of the usual maximum likelihood p-value when data do not conform to the assumption of multivariate normality.

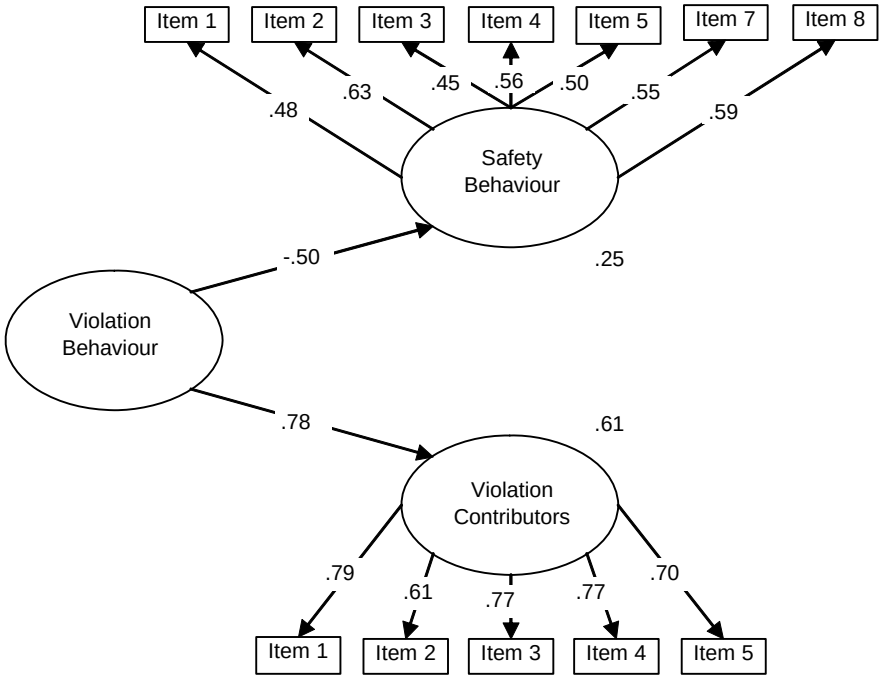

Figure 4.3 Measurement Model for Violation Behaviour Scale

The Errors/Near Misses measurement model included Error Category and Error/Near Miss Contributors. The fit statistics for this model (see Figure 4.4) were good: χ^2 (26) = 29.01, Bollen-Stine p = .90; CMIN/DF = 1.12; TLI = .99; CFI = .99; RMSEA = .03.

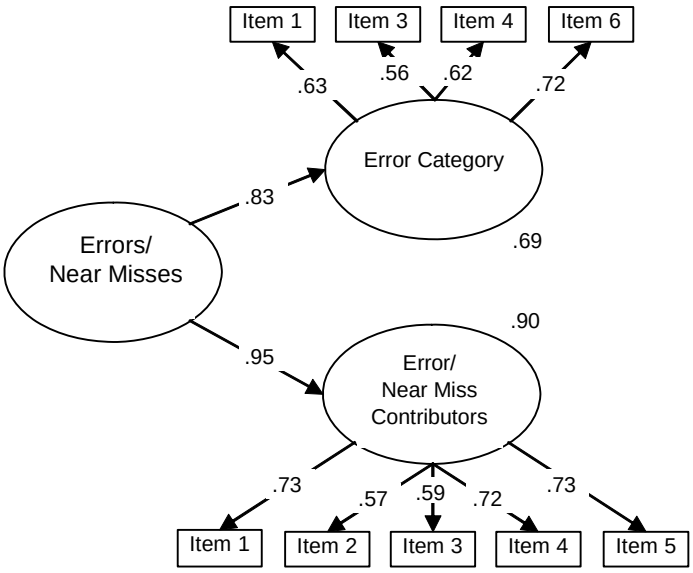

Figure 4.4 Measurement Model for Errors/Near Misses Scale

4.6.4 Descriptive Statistics

Reliability analyses were conducted to provide information about the internal consistency of the scales. The alpha coefficients are shown in Table 4.1 below together with the number of items, means, and standard deviations for each scale. These descriptive statistics were calculated using SPSS Version 11.5. All scales were measured using a 5-point scale, except Error Category and Error/Near Miss Contributors which were measured on a 4-point scale.

All Safety Climate subscales were rated as average to above average, which suggests that most respondents perceived the safety climate in their hospitals as more positive than negative. Investigation of individual responses revealed that, in general, respondents perceived their supervisors to be more committed to safety than senior management. That is, while 33% agreed that management was committed to safety, over 70% agreed that their supervisor was committed to safety. The mean for Training/Competence was high suggesting that most nurses perceived few problems in this area. That is, approximately 80% felt competent with regard to medication administration and agreed that patient safety issues were covered in training programs. Most nurses (approximately 70%) also agreed that Procedures were practical and uncomplicated to follow and that compliance rates were high. The mean for Reference Material was lower and the variance higher, however, with only about 50% agreeing that reference materials were accessible, up-to-date, and easy to follow.

The mean for Work Pressure was high with no one disagreeing and approximately 85% of nurses agreeing that they were overworked and that there were not enough nurses to do the job safely. The mean for Willingness to Report was also high with around 88% of respondents agreeing that they know the correct

reporting procedures and would be willing to report incidents and near misses. The mean for Strain was rated as average. Approximately 24% disagreed, 40% were neutral, and 36% agreed that they felt strain as a result of conditions at work.

The mean for Safety Behaviour was high with around 99% of nurses reporting that they followed procedures most of the time or always. The responses to the Violation Contributors scale supported this result with approximately 92% reporting that they never to sometimes violated procedures. From the list of possible contributing factors, around 25% of respondents reported that they sometimes bend the rules because everyone else does, 35% perceived management pressure as a contributor, 50% cited impractical rules, 53% referred to their workload, and 56% bent the rules to get the job done. Approximately 13% reported that they often to always bend the rules because of their workload.

The Errors/Near Misses scales were measured using a 4-point scale. The means for both were low suggesting that most nurses reported never to rarely making errors. The category of errors/near misses most endorsed was a missed dose with approximately 53% of nurses responding that they had done so once or twice and 22%, three or more times. From the list of contributing factors, around 42% reported that they had made, or very nearly made an error once or twice because of someone else's mistake, 44% because of unclear, illegible, or incomplete documentation, 52% because of their workload, 55% because of fatigue, and 63% because of distractions. Approximately 10% reported that they had made, or very nearly made an error three or more times because of distractions or someone else's mistake, 11% because of fatigue, 19% because of their workload, and 30% because of unclear, illegible, or incomplete documentation.

Table 4.1
Means, Standard Deviations, and Alpha Coefficients for Safety Climate, Work Pressure, Strain, Willingness to Report, Violation Behaviour, and Errors/Near Misses Scales (N = 106)

Scale	Subscale	No. of items	M	SD	α
Safety Climate	Management's Commitment to Safety	5	3.20	0.76	0.83
	Supervisor's Commitment to Safety	5	3.81	0.79	0.84
	Training/Competence	5	3.94	0.56	0.65
	Procedures	4	3.67	0.53	0.66
	Reference Material	3	3.36	0.93	0.85
Work Pressure		4	4.10	0.66	0.75
Strain		5	3.14	0.83	0.84
Willingness to Report		3	4.03	0.55	0.72
Violation Behaviour	Safety Behaviour	7	4.45	0.47	0.73
	Violation Contributors	5	1.56	0.50	0.85
Errors/Near Misses	Error Category	4	1.61	0.47	0.72
	Error/Near Miss Contributors	5	1.89	0.59	0.80

4.6.5 Correlations

The correlation matrix showing relationships among the Safety Climate scales, Work Pressure, Strain, Willingness to Report, the Violation Behaviour scales, and the Errors/Near Misses scales is presented in Table 4.2 below.

All the Safety Climate scales were positively and significantly related to each other with the exception of Supervisor's Commitment to Safety and Reference Material. Coefficients ranged from .18 ($p < .05$) to .60 ($p < .01$). Safety Behaviour was not significantly related to any of the Safety Climate scales. Violation Contributors and Error Category were significantly related to Management's

Commitment to Safety, Supervisor's Commitment to Safety, and Procedures. Error/Near Miss Contributors was related only to Management's Commitment to Safety.

Work Pressure was not significantly related to any of the Violation Behaviour or Errors/Near Misses scales. However, it was significantly negatively correlated with Management's Commitment to Safety with a coefficient of -.23 ($p < .01$), and significantly positively correlated to Strain at .44 ($p < .01$). Strain was also significantly negatively related to Management's Commitment to Safety, Procedures, Reference Material, and Willingness to Report with coefficients ranging from -.22 ($p < .05$) to -.34 ($p < .01$). Strain was also significantly positively related to Violation Contributors (.24; $p < .01$), Error Category (.20; $p < .05$), and Error/Near Miss Contributors (.23; $p < .01$).

Willingness to Report was significantly positively related to all the Safety Climate scales with the exception of Reference Material. Coefficients ranged from .16 ($p < .05$) to .34 ($p < .01$). Willingness to Report was also significantly positively related to Safety Behaviour (.25; $p < .01$) and negatively related to Violation Contributors (-.29; $p < .01$), Error Category (-.19; $p < .05$), and Error/Near Miss Contributors (-.26; $p < .01$).

Safety Behaviour was significantly negatively related to Violation Contributors, Error Category, and Error/Near Miss Contributors with coefficients ranging from -.27 ($p < .01$) to -.44 ($p < .01$). Violation Contributors, Error Category, and Error/Near Miss Contributors were all significantly positively related to each other. Coefficients ranged from .38 ($p < .01$) to .59 ($p < .01$).

Table 4.2
Correlation Matrix for Safety Climate, Work Pressure, Strain, Willingness to Report, Violation Behaviour, and Errors/Near Misses Scales (N = 106)

	1	2	3	4	5	6
1. Management's Commitment to Safety	1.00					
2. Supervisor's Commitment to Safety	.60**	1.00				
3. Training/Competence	.25**	.20*	1.00			
4. Procedures	.41**	.18*	.34**	1.00		
5. Reference Material	.39**	.13	.30**	.31**	1.00	
6. Work Pressure	-.23**	-.01	.04	-.15	-.06	1.00
7. Strain	-.34**	-.16	-.14	-.22*	-.26**	.44**
8. Willingness to Report	.20*	.16*	.34**	.17*	.15	-.09
9. Safety Behaviour	.16	.12	.12	.05	.10	.04
10. Violation Contributors	-.35**	-.22*	-.13	-.27**	-.14	.08
11. Error Category	-.26**	-.30**	-.05	-.18*	-.11	-.06
12. Error/Near Miss Contributors	-.17*	-.15	.09	-.16	-.13	-.08

	7	8	9	10	11	12
7. Strain	1.00					
8. Willingness to Report	-.30**	1.00				
9. Safety Behaviour	-.07	.25**	1.00			
10. Violation Contributors	.24**	-.29**	-.32**	1.00		
11. Error Category	.20*	-.19*	-.44**	.38**	1.00	
12. Error/Near Miss Contributors	.23**	-.26**	-.27**	.45**	.59**	1.00

* Correlation is significant at the 0.05 level (1 tailed).
** Correlation is significant at the 0.01 level (1 tailed).

4.6.6 Structural Equation Modelling – Evaluation of the Structural Model

AMOS 4 (Arbuckle & Wothke, 1999), using the maximum likelihood (ML) estimation method, was employed to test the structural model to the covariance matrix generated from the set of variables. The model to be tested was presented earlier in a simplified conceptual form (see Figure 4.1). As noted in section 4.6.3, however, the Work Pressure scale was not included in the Safety Climate measurement model because the parameter estimate was low. This factor was included in the structural model and was expected to impact on Strain (Hegney, Plank et al., 2003; McVicar, 2003) and Willingness to Report (Stanhope et al., 1999; Vincent et al., 1999). It is noted that the subscales rather than the items were used in this model because of the unfavourable ratio of free parameters to cases if measurement models were used. Gribbons and Hocevar (1998) refer to this as a partially aggregated model.

Although the initial model was an acceptable fit to the data, the pathways from Strain to Errors/Near Misses, Safety Climate to Willingness to Report, and Work Pressure to Willingness to Report were not significant. These pathways were deleted and the respecified model (see Figure 4.5) was found to be a good fit to the data: χ^2 (50) = 62.92; Bollen-Stine p = .64; CMIN/DF = 1.26; TLI = .93; CFI = .95; RMSEA = .05.

To enhance interpretation, the error terms have been excluded from the diagram. In addition, the covariance between the error terms for Management's Commitment to Safety and Supervisor's Commitment to Safety is not shown. This covariance was considered appropriate because of common method variance, that is, variance that is attributable to the measurement method rather than to the constructs being measured (Podsakoff et al., 2003), as the same items were used to measure

each construct. The model accounted for 27% of the variance in Violation Behaviour, 61% of the variance in Errors/Near Misses, and 20% of the variance in Willingness to Report. No relationships were found between Strain and Errors/Near Misses, Safety Climate and Willingness to Report, and Work Pressure and Willingness to Report.

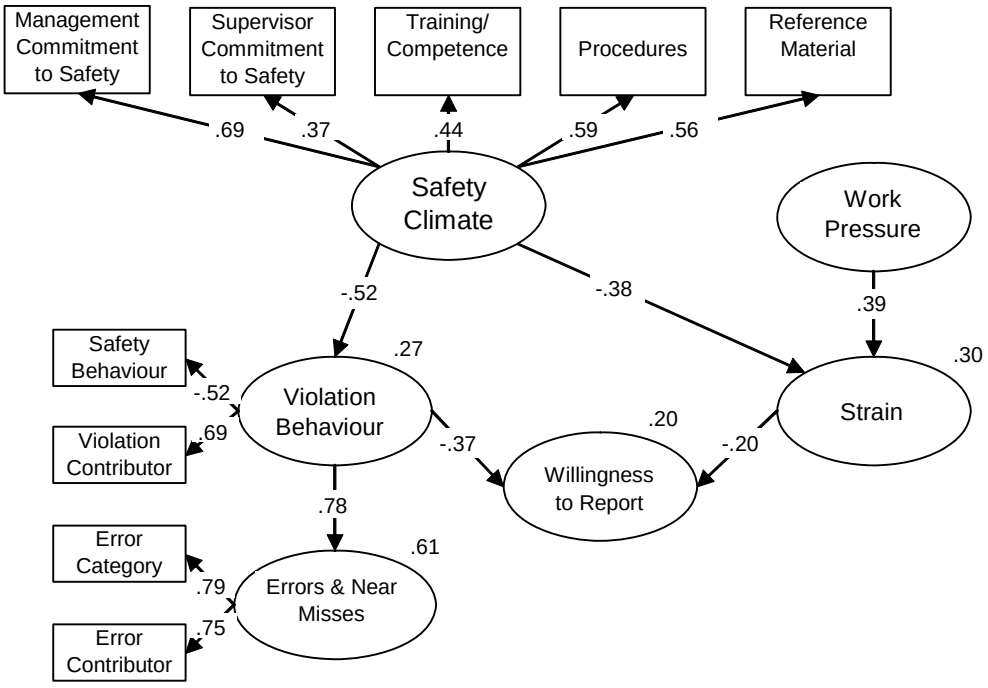

Figure 4.5 Structural Model of Relationships among Safety Climate, Workload, Strain, Willingness to Report, Violation Behaviour, and Errors/Near Misses

4.6.7 Qualitative Analysis

Again qualitative data were collected with respondents being asked to comment on what they believed would improve medication safety and the major risk/problem associated with medication administration. These items can be found on page 8 of the questionnaire in Appendix C. A total of 64 respondents chose to make comments.

4.6.7.1 Improving Medication Safety

The majority noted that safety would be enhanced by improving doctors' handwriting, increasing staffing levels, and providing ongoing education. Other themes mentioned to improve safety were accessibility of reference materials, standardisation of procedures, and communication.

Twenty-three respondents mentioned issues with doctors as impeding improvements to medication safety, with the majority (n = 20) citing illegible handwriting as a concern. Four nurses believed this situation would be improved if doctors were encouraged to print. Examples include the following:

> *Clearer documentation by doctors would increase our work time and reduce the risk of errors.*
>
> *Clear written orders. Handwriting is not easy to read in most cases. If you are not familiar with that drug, it's not easy to make out most Drs' writing.*

Communication issues with doctors were also noted by 3 nurses with one suggesting that doctors should be encouraged to "*… talk to their clients about ordering new medication instead of relying on nursing staff*". Another believed that *"Drs need to liaise with primary nurse on changes to pt care and medications"*.

Another major theme to improve medication safety mentioned by 18 respondents involved staffing levels and work pressure. Eleven of these specifically noted that an increase in nursing staff levels would be beneficial to safety. For example:

> *Small staff-patient ratios to reduce rushing through medications.*
>
> *Reduce staff workloads especially on the wards, to facilitate better/improved quality of care. And to decrease risk of drug errors.*

Seventeen nurses cited the lack of on-going training as impacting on medication safety. All of these suggested that more education regarding medications was necessary to ensure safety. Seven suggested there should be more inservice training or time off in work time to pursue training. For example:

> *Allow time for nurses in "work time" to continually up-date on all medication procedures and administration. This should be policy in all nursing areas …*

A lack of standardisation of procedures was cited by 9 respondents as impacting on safety. Four of these suggested that having *" … personal medication cupboards beside each bed"* would benefit safety. Other suggestions included:

> *Ensure that medication administration is same across hospital.*
>
> *… management must insist that all medication orders be printed clearly by all doctors.*

Reference materials were mentioned by 6 respondents, with 5 noting that access to these materials was a problem and 2 a lack of up-dated materials as the issue. For example:

> *Have written (i.e., on paper) reference material on ward. Having to look up MIMS on computer is a bunch of crap as computer not easily accessible, especially while doing medication rounds. Each nurse should be able to access a copy of MIMS at the bedside.*

4.6.7.2 Major Risk/Problem Areas with Medication Administration

The major risk/problem areas cited by nurses were decreasing nursing staff levels and workload issues, illegible, unclear, or incorrect information on orders, and lack of knowledge/training. Also mentioned were issues with reference materials and procedures.

Thirty-one nurses noted nursing shortages, time constraints, and work pressure as major risk areas to safety. Heavy or high workload was mentioned by 15

nurses, lack of time or time constraints by 12, nursing shortages by 9, and stress by 4. For example:

> *Insufficient time, increased workload with no increase in staffing leads to shortcuts to get the job done.*
>
> *Time and overworked staff. Everyone knows the rules, however, sometimes you get things wrong when you are pressured.*

A number of nurses (*n* = 27) cited issues with doctors' orders as the major problem area with medication administration. That is, 21 specifically noted illegible or poor handwriting on orders, with 10 citing unclear, incorrect, or unfinished orders as an issue. Examples are as follows:

> *Drs not correctly writing up medications – need to type or print drugs.*
>
> *Incorrect orders / unfinished orders e.g., route not written, no times written, start date not written.*
>
> *Poor doctor's handwriting makes it difficult to read medication orders.*

Fifteen nurses mentioned lack of knowledge and training as problem areas. Thirteen respondents noted a lack of knowledge of medications (*n* = 11) or a lack of knowledge of medications and policy (*n* = 2) as a major risk area. Five of these referred to doctors' lack of knowledge or inexperience and 2 referred to *"… transient"* or *"… redeployed staff"* being unfamiliar with certain medications. Three nurses mentioned *"…poor"* or *"…not enough education"*. For example:

> *Inexperienced are not checking medications/patients properly. Insufficient knowledge about some medications.*

Other issues mentioned were to do with reference materials and procedures. One nurse noted that there was a need to have *"… more copies of MIMS available for use <u>at the bedside</u>, not just computer"*. Another suggested that *"Policies* [are] *too wordy. Need to be concise and to the point"*.

4.7 Discussion

The aim of this study was to develop a model explaining the relationships among safety climate variables, willingness to report, strain, violation behaviour, and errors/near misses during medication administration. It was hypothesised that safety climate would have a direct impact on violation behaviour, willingness to report, and strain, and that violation behaviour and strain would have a direct impact on willingness to report and errors/near misses.

In the original conceptual model, Work Pressure was included as part of the measurement of Safety Climate as suggested by previous research (Flin et al., 2000). However, the measurement model for Safety Climate revealed that the regression estimate associated with the path to Work Pressure was low and this factor was excluded from the model. Therefore, the measurement of Safety Climate in this study included Management's Commitment to Safety, Supervisor's Commitment to Safety, Training/Competence, Procedures, and Reference Material. Work Pressure was included in the structural model, however, and was expected to directly impact on Strain (Hegney, Plank et al., 2003; McVicar, 2003) and Willingness to Report (Stanhope et al., 1999; Vincent et al., 1999).

As expected, Safety Climate had a direct negative impact on Violation Behaviour. This outcome suggests that when the safety climate of the organisation is positive (e.g., staff perceive management to be committed to safety, procedures are practical, reference materials are accessible, competence levels are high, and safety issues are included in training), then nurses are less likely to participate in unsafe behaviour when administering medications. Safety Climate also had a direct negative impact on Strain, indicating that when the climate of the organisation is positive, nurses experience less strain. Safety Climate had an indirect impact on Errors/Near

Misses through Violation Behaviour. This outcome suggests that creating a more positive safety climate will produce less violation behaviour in nurses, which in turn will lead to less medication errors/near misses.

Also as expected, Work Pressure had a direct positive impact on Strain, and an indirect impact on Willingness to Report through Strain. However, contrary to previous research (Vincent et al., 1999), the hypothesised direct relationship between Work Pressure and Willingness to Report was not supported. It appears that reporting behaviour was better explained in this case by the influence of the mediating variable Strain. That is, when nurses are subjected to high work pressures, they experience more strain, which in turn makes it less likely that they will report incidents in which they are involved. Violation Behaviour also had a direct negative impact on Willingness to Report. That is, the likelihood of reporting incidents is lower when nurses are violating procedures more often.

The study was unable to support the hypothesised direct relationship between Safety Climate and Willingness to Report. This result is contrary to previous research which suggests that the working environment influences reporting behaviour. For example, Edmondson (1996) found that shared perceptions about the consequences of making errors influenced the climate and reporting behaviours within hospital work teams. In this research, the quality of relationships within the unit and the leadership behaviours of nurse managers influenced the number of errors reported. For example, authoritarian leadership within a unit generated a climate of fear which tended to suppress reporting or discussion of errors.

Of interest, the mean for the Willingness to Report scale was high suggesting that most nurses agreed that they would report incidents and near misses in which they were involved, and that they were aware of the correct reporting procedures.

However, this is in contrast to the literature which indicates that nurses are reluctant to report errors because of the "blame" culture that exists in the hospital environment and the fear of potential professional and personal ramifications (Cheek & Gibson, 1996; Leape, 1994). It has also been suggested that reporting behaviour is influenced by the lack of agreement among health care professionals as to what constitutes an error (A. F. Cook et al., 2004).

This study was also unable to support the hypothesised direct relationship between Strain and Errors/Near Misses. This link has previously been found in the aviation industry (e.g., Fogarty, 2004) and in the hospital environment (e.g., Dugan et al., 1996). For example, Dugan et al. investigated the relationship between increased levels of stress and burnout and increased nurse injuries and patient incidents. Although the relationship between stress and nurse injuries was weak, the researchers identified a moderately strong relationship between self-reported stress and patient incidents. That is, hospital units reporting higher levels of stress were more likely to exhibit increased patient incidents, with this relationship most evident with medication errors and patient falls. It is unclear why this relationship was not found in this study but it is hypothesised that the measurement of error/near misses may need to be further refined in future research.

Taken together, the results from Studies 2 and 3 support Schneider's (1990) argument that measuring the climate of an organisation requires a strategic focus. These studies also verified the research conducted by Neal et al. (2000) who found that a specific climate for safety was more strongly related to safety performance than the general climate of an organisation. However, it is acknowledged that the scales used to measure the outcome variables, violation behaviour and errors, were improved in Study 3 and this may have contributed to the different outcomes. In any

case, it does appear that, when safety outcomes are of interest, it is more beneficial to measure the safety climate of the organisation rather than the general organisational climate. Future research may be able to provide more support for this hypothesis in the hospital system by measuring safety outcomes and both organisational climate and safety climate in the one study.

4.7.1 Limitations

A major limitation of this study was that the response rate was low at 22%. When a high proportion of the sample do not respond, researchers must be cautious about generalising from the results (Neuman, 1997). In addition, if non-respondents differ from those who responded, low response rates can create bias and weaken validity (Neuman).

It is anticipated that the sensitive nature of this research may have contributed to this low response rate, even though respondents were assured of the confidentiality of information. The use of scannable questionnaires may also have contributed. These forms require numbering and a bar code to appear on each page of the questionnaire to enable the scanner to read the information. Although this increases the accuracy of data entry and respondents cannot be traced by this numbering, respondents may not feel confident enough to reveal such sensitive information if they believe there is any possibility of being identified. In fact, one questionnaire was returned with this numbering cut off and the comment *"CONFIDENTIAL HEY?"* printed next to the removed numbering.

This explanation may not account for all non-respondents, however, as this same scannable format questionnaire was used in Study 2. The response rate for this study was much higher at 63%. It is noted, however, that an extensive promotional campaign was conducted by the researcher and the representatives from the hospital

districts that participated in Study 2. This was not possible in the hospital district that participated in Study 3, although every attempt was made to inform prospective respondents of the reasons for the research. In addition, the timing of this study may not have been ideal as the researcher is aware of an extensive hospital-wide survey being conducted in this hospital district prior to Study 3.

4.7.2 Conclusion

In summary, the model developed from this study explained how safety climate and individual factors work together to influence safety outcomes. However, the measurement of safety climate did not include work pressure in this population. Future research is required to investigate this further as this factor appears in a number of surveys measuring safety climate (Flin et al., 2000). As expected, safety climate had a direct impact on violation behaviour and strain, violation behaviour directly impacted on errors/near misses and willingness to report, and work pressure impacted on strain, which in turn impacted on willingness to report.

Contrary to previous research, however, the study was unable to support the direct impact of work pressure and safety climate on willingness to report, or strain on errors/near misses. Further investigation is required to establish whether these links do not exist in this population or whether the measuring instruments require further refinement.

It appears that the results from Study 2 and Study 3 taken together support the research by Neal et al. (2000) that it is more beneficial to measure the safety climate of an organisation rather than the general organisational climate when safety outcomes are of interest. Future research, incorporating a measure of both organisational climate and safety climate and the safety outcomes may provide additional support in the medical environment.

Chapter 5 – General Discussion and Conclusion

5.1 Introduction

This thesis began with a summary of the extent of the problem of hospital-based errors both in Australia and internationally. It was noted that, although the health system delivers safe and effective health care to millions of patients each year, it is well accepted that modern healthcare is increasingly complex with inevitable risks for patients as a result of this complexity (ACSQHC, 2001b). In fact, research indicates that adverse events involving medical errors are a major contributor to death and injury in the hospital system (Brennan et al., 1991; Kohn et al., 1999; Wilson et al., 1995). Available international data suggest that probably around 10% of admissions to hospitals are associated with some form of adverse event and that this is likely to be similar in health systems in most developed countries (ACSQHC, 2001c; Neale et al., 2001; Vincent et al., 2001).

Medication errors are recognised as a leading cause of unintended harm to hospital patients (Kohn et al., 1999; Wilson et al., 1995). It has been estimated that between 10% and 20% of all adverse events are drug related (Bates, 1999). The current research focused on the administration stage of the medication process. Medication administration is a complex and time-consuming task that forms a major part of the nurse's role (O'Shea, 1999). The complexity of the medication process increases the potential for error. If an error occurs, the nurse often assumes or is assigned responsibility for the error even though the actions of others involved in the system and the system design itself may have contributed to the situation (Wakefield et al., 1998).

Errors were defined as the failure of planned actions to achieve their intended consequences (Reason, 1990, 1997). Errors can involve the involuntary deviation of action from intention (slips and lapses) or the departure of planned actions from some satisfactory path towards a desired goal (mistake). Our understanding of human functioning and errors has been enhanced by theory development and research in the areas of cognitive psychology and human factors. Psychologists investigate mental functioning and the possible causes of error at an individual/cognitive level, whereas, human factors experts look at the issue of error from a social/organisational perspective. The management of error requires both perspectives. For although the management of error in complex systems is an organisational task that cannot be managed by dealing with psychological issues alone (Helmreich & Merritt, 1998), errors by individuals and teams have their roots in human cognitive limitations, restricted memory, and information processing capacity (Reason, 1997).

Analysis of incidents in medicine and elsewhere has led to a much broader understanding of accident causation, and a greater appreciation of the complexity of the chain of events that may lead to an adverse event (R. I. Cook & Woods, 1994). The health care system is now taking advantage of the research carried out in other complex industries. Historically, the focus of safety research was the individual, as if he or she were the only faulty part of the process (D. J. Anderson & Webster, 2001). However, there is now a growing emphasis among safety researchers to look beyond the individual contributors to human error to the social and organisational factors that influence unsafe behaviour (Lawton & Parker, 1998). These include attitudinal and behavioural factors which can lead to the deliberate deviation from safe working practices, that is, violation behaviour. Violations were defined as behaviours that

involve the deliberate deviation from rules that describe the safe or approved method of performing a particular task or job (Lawton, 1998; Reason, 1990).

This series of studies used Reason's (1990) model of accident causation as the basis for the search into possible contributing factors to unsafe behaviour by nurses during medication administration. Reason's model has been used throughout complex industries to investigate the way in which threats penetrate the extensive defensive barriers protecting such industries, and this model has now been adopted by health care researchers interested in improving patient safety.

Reason (2000a) suggested that the human error issue could be viewed in two ways: the individual approach or the system approach. The individual approach concentrates on the unsafe behaviour, whereas the system approach focuses on the human component within complex systems, with less emphasis on the individual and more on pre-existing organisational factors that provide the conditions in which unsafe behaviour occurs (Reason, 1990). Reason's model includes the organisational context by linking failure in organisational processes to individual actions and, ultimately, accidents. Reason (1997) argued that organisational failures contribute to accidents by creating the kind of workplace conditions that provoke unsafe behaviour by the individual or team, or by creating deficiencies in system defences.

There is now a substantial body of empirical support from the safety and nursing literature demonstrating the impact of individual and organisational factors on safety outcomes as proposed by Reason. This research suggests that, although human decisions and actions play a leading role in nearly all accidents, identifying human error as the ultimate cause of a system failure is of limited use unless the context in which the error occurred is well understood (McCarthy et al., 1997).

The current research used the technique called structural equation modelling to operationalise Reason's theory by developing a model linking organisational and individual factors to unsafe behaviour in the hospital system. The principal objective of structural equation modelling is to fit the hypothetical model to a set of sample data and examine how well the model fits the data. If the fit is adequate, the model supports the hypothesised relation among variables (B. M. Byrne, 2001).

Study 1 in the series investigated the impact of organisational issues on procedural violations by nurses in rural and remote areas. The aim of Study 1 was to identify organisational factors that create conditions wherein violation behaviour is more likely to occur. The variables measured in this study were Level of Knowledge, Reference Material, Workload, Expectation by Doctor, and Violation Behaviour. The results indicated that Violation Behaviour was directly influenced by Level of Knowledge, Expectation by Doctor, and Workload. In addition, two indirect pathways were found, that is, Expectation by Doctor mediated between Workload and Violation Behaviour and between Reference Material and Violation Behaviour. The hypothesised direct relationship between Reference Material and Violation Behaviour was not supported in this study. The model accounted for 23% of the variance in Violation Behaviour and 22% of the variance in the mediating variable, Expectation by Doctor. In addition to testing the conceptual model in this study, a cross-validation analysis was carried out by randomly splitting the dataset into two parts. This analysis indicated that the causal structure was equivalent across the two samples. A comparison was also made between models for rural and remote communities to investigate the possible contributing factor of isolation as a moderating variable. The results of this analysis suggested that there was no

difference between the rural and remote samples. Therefore, subsequent studies included only rural communities.

Study 2 expanded on the first study by including individual factors, that is, Individual Morale, Individual Distress, and Quality of Work Life, and more organisational factors, that is, a measure of Organisational Climate. The instrument used to measure these factors was a validated instrument widely used in public sector hospitals in Queensland. The Violation Behaviour scale was modified in this study to include only those violations originating with nurses rather than behaviours not directly under their control. That is, it excluded doctors' behaviours. In addition to violation behaviour, another measurement of unsafe behaviour, medication errors, was included. The model predicted 7% of the variance in violation behaviour and 24% of the variance in errors. Contrary to expectations, however, the main contributor to errors was violation behaviour, with no direct or indirect input from individual factors. This outcome is at odds with well-replicated findings in aviation psychology (e.g., Fogarty, 2004).

Study 3 again investigated the impact of organisational and individual factors on unsafe behaviour, however, in this study, a specific type of organisational climate, that is, safety climate, was examined. In addition, the Violation Behaviour and Error instruments were modified and improved, for example, the Error scale was expanded to include near misses as well as errors. Although individual variables did not impact on errors in the previous study, this relationship was tested again as methodological issues may have influenced previous results. A new variable measuring reporting behaviour was developed and included, as Reason (1997) argued that a reporting culture is a crucial component required for a good safety culture. The results of the analysis of the measurement model suggested changes to this scale which was

renamed Willingness to Report after modifications. The analysis of the measurement model for Safety Climate indicated that Work Pressure should not be included as part of the measurement of Safety Climate. This variable was excluded from the measurement of Safety Climate but included in the structural model as a separate factor and was expected to directly impact on Strain and Willingness to Report. As expected, the results indicated that Safety Climate had a direct impact on Violation Behaviour and Strain, and an indirect impact on Errors/Near Misses through Violation Behaviour. Violation Behaviour had a direct impact on Errors/Near Misses and Willingness to Report, and Work Pressure had a direct impact on Strain and an indirect impact on Willingness to Report through Strain. The hypothesised direct relationships between Safety Climate and Willingness to Report, Work Pressure and Willingness to Report, and Strain and Errors/Near Misses were not supported by the study. The model accounted for 27% of the variance in Violation Behaviour, 61% of the variance in Errors/Near Misses, and 20% of the variance in Willingness to Report.

In summary, the aim of the current series of studies was to identify organisational issues in the hospital environment that create conditions wherein unsafe behaviours occur. Reason (2000a) argued that it is important to investigate the factors that contribute to these unsafe acts. This series of studies has made a start in that direction in the rural medical environment by demonstrating the links among organisational and individual factors and safety outcomes. It was argued that, in order to understand these interactions, a model was required of how the components of the system work together to influence outcomes. This research project has provided such a model using the technique, structural equation modelling.

Study 1 was a preliminary exploration into this area. Study 2 extended the first study by using a validated instrument to measure organisational climate and individual variables. This instrument is widely used in public sector hospitals in Queensland and, if strong links were found with safety outcomes, would have provided a potentially valuable source of information for safety researchers. However, the results from this study proved to be disappointing. Instead, the results of Study 3 suggested that it may be more beneficial to measure the safety climate of an organisation rather than the general organisational climate, as this measure was able to provide stronger links among factors, and predict a higher percentage of the variance in the safety outcomes. These results are encouraging; however, it is acknowledged that future research is required to refine the measuring instruments and to validate the current results using a larger sample of respondents.

5.2 Implications

Leape et al. (1995) argued that the concept of system failures as underlying causes of unsafe behaviour has not been widely accepted in the medical environment, although accident causation is more likely to be prevented by changing the system rather than the individual. The usual approach to reducing the frequency of errors in medicine has been to find and punish the individual considered responsible for the unsafe behaviour (Leape, 1994). Reason (1994) suggested that this approach leads to interventions, such as retraining or disciplinary action, that may be ineffective when dealing with a well-qualified and highly motivated work force such as in the medical environment. This approach isolates the person and the unsafe behaviour from their system context and has little or no remedial value (Reason, 1994, 1997).

Organisations that follow the above approach tend to direct most of their management resources at trying to make individuals less fallible (Reason, 1997).

However, blaming individuals for incidents that are not due to negligence or lack of care has not helped to improve the health system or ensure that lessons are learned when things go wrong (Leape, 1994). A more holistic management approach is required that aims at several different areas, that is, the individual, the team, the task, the workplace, and the institution as a whole (Reason, 2000a). Interventions in this case are based on the assumption that, although we cannot change the human condition, we can change the conditions under which humans work.

The results of the current research support this view and suggest that it would be more beneficial for safety researchers to engage in a systematic organisational diagnosis, rather than providing interventions at an individual level. The practical implication of safety research is predominantly concerned with highlighting courses of action that will reduce the risk of incidents. In recent years there has been a move away from relying on retrospective analyses of accidents and incidents, towards a more proactive approach (Flin et al., 2000). These more predictive measures enable the monitoring of the safety condition of an organisation so that remedial action can be taken prior to an incident occurring (Flin, 1998).

The current research also highlights the role of geographical context, a factor which often fails to receive adequate recognition. The rural and remote area nurses who participated in these studies often work under constraints that are not found in larger, urban health centres (Hegney et al., 1997). The lack of availability of doctors in some areas is foremost among these constraints. This shortage of doctors in rural Australia is a widely recognised problem in the health sector. As in other developed countries, there has been plenty of discussion in this country on the impact of this shortage on the health system, especially in terms of availability of services and the need to introduce an advanced practice role for nurses (G. Byrne, Richardson,

Brunsdon, & Patel, 2000; Caplin-Davies & Akehurst, 1999; Hegney, 1998). What also needs to be acknowledged, however, is the impact that this shortage has on work practices. Given the longevity of the doctor shortage problem and the improbability of this issue being solved in the near future, nurses should be given specific advice on how to handle the kinds of situations that are highlighted in this series of studies.

In 1997, the Queensland Government changed the *Regulation* in rural and remote areas in an attempt to deal with the issue of unavailability of doctors and the practice by nurses of carrying out procedures without approval. This change allows rural and remote area nurses who have undergone additional training to administer and supply restricted and controlled drugs, as listed in a drug formulary, without the need to contact a doctor. This change is a step in the right direction. However, at least at the time of the first study in this series, there were few registered nurses who had attained this rural and isolated practice endorsement. Perhaps the reasons for this low level of endorsement need to be investigated further to ascertain what is happening in the system to prevent nurses from taking advantage of this opportunity.

In summary, research such as the current project is able to identify underlying contributing factors, indicate the strength of the relationships among the various elements, and illustrate how the various parts of the system link together to influence outcomes. By identifying which elements are important by the use of structural equation modelling, this research provides the basis for predicting unsafe organisational conditions. Because the antecedents of unsafe behaviour are under varying degrees of organisational control, management will be able to decide where remedial action is best directed, thus aiding in the design of suitably targeted intervention programs to reduce unsafe behaviour and adverse incidents.

5.3 Methodological Issues and Future Research

Several methodological issues are present in the current series of studies and will need to be addressed in future research. These limitations suggest ways in which the research can be extended and validated and do not reduce the importance of the aims of this series of studies.

The most obvious methodological issue is the use of a cross-sectional design. As noted by Rundmo (2001), cross-sectional studies are not able to conclusively identify causes of risk behaviours or other antecedents to safety. Future researchers would be advised to conduct longitudinal studies in this area as this would provide further validation of specific relationships.

In addition, the use of structural equation modelling does not fulfil the strict experimental conditions necessary for inferring cause. The purpose of this modelling technique is to compare the fit of models. If the theoretical model does not deviate significantly from the data, the model is said to be consistent with reality. Rundmo (2000) argued that this gives support to the causal relationships specified in the theoretical model. Loehlin (1998) also argued that a strict or narrow definition of cause is not necessary in path models. He believes the "essential feature for the use of a causal arrow in a path diagram is the assumption that a change in the variable at the tail of the arrow will result in a change in the variable at the head of the arrow, all else being equal, that is, with all other variables in the diagram held constant" (p. 4). The use of unidirectional arrows in the hypothesised models in the current series of studies is supported by theoretical arguments suggesting temporal ordering of the variables.

The use of self-report measures for all variables is also a methodological issue in this research as these measures may not correspond with objective measures

of performance. For example, self-reported errors may not reflect the actual number of errors in the workplace. However, using objective measures of unsafe behaviour may also be problematic as research suggests that information derived from incident reporting systems in the medical environment cannot yet be considered a reliable index of the true rate of incidents (e.g., Stanhope et al., 1999). In support of self-report measures, a number of studies have demonstrated that a correlation does exist between safety measures and objective indicators of safety performance (e.g., Hofmann & Stetzer, 1996; Zohar, 1980, 2000). In addition, theoretical descriptions of the links between attitudes, intentions, and behaviours also lend support to the use of self-report measures in safety research (Ajzen, 1991; Fogarty & Shaw, 2003).

Models developed using an exploratory approach, as in the current research, should be considered as a tentative solution because re-specifications of the model may be based on circumstances relating uniquely to that particular data set (Hoyle, 1995). This series of studies was unable to support a number of hypothesised pathways, for example, the link between work pressure and safety climate, individual factors and errors, and safety climate and willingness to report. These links have previously been found in other research (e.g., Dugan et al., 1996; Edmondson, 1996; Flin et al., 2000; Fogarty, 2004) and further investigation is required to determine whether the relationships do not exist in this population or whether the measuring instruments require further refinement.

The results of Studies 2 and 3 support the argument that the measurement of the climate of an organisation requires a strategic focus (Neal et al., 2000; Schneider, 1990). That is, when safety outcomes are of interest, it is more beneficial to measure the safety climate of the organisation rather than the general organisational climate. Future research is required in the hospital system to verify this finding by measuring

safety outcomes, and both organisational climate and safety climate in the one study. Cooper (2000) suggested that, because safety climate is a sub-feature of organisational climate, it is appropriate to compare the results of existing organisational climate measurement instruments with those obtained from safety climate measuring instruments.

Future research is also required to establish whether these findings can be generalised to other hospital environments. This research was carried out predominately in rural public sector hospitals. However, this is a diverse population as is highlighted in Table 5.1, which outlines the key demographic and sampling details for each study.

Table 5.1
Key Demographic and Sampling Details for the Three Studies

Demographic/Sampling Details	Study 1	Study 2	Study 3
Sample Size	N = 652	N = 176	N = 106
Site	Rural/remote Queensland	11 Rural Hospitals	1 Rural Hospital
Registered Nurses	76%	77%	93%
Permanent Full-Time	46%	36%	32%
Permanent Part-Time	38%	48%	47%
Modal Age	40 to 49 years	41 to 50 years	31 to 40 years
Years of Service	84% > 10 years 56% > 20 years	59% > 10 years 22% > 20 years	73% > 6 years 20% > 20 years
Response Rate	38%	63%	22%

The information presented in this table emphasises the differences between the three study populations and the samples drawn from them. For example, the samples were drawn from increasingly homogeneous populations with decreasing levels of age and

experience. This introduces potential bias in the generalisability of results and potential confounders, particularly age and experience levels. Results from these studies should be treated with caution until future research explores these issues further.

Coyle et al. (1995) found that safety climate factors are unstable across organisations. It may be that safety climate factors are not only organisation specific but also hospital specific. Future research may be able to establish which factors are important to the safety climate of different types of hospitals and whether these factors generalise across different regions, for example, when comparing small rural hospitals with large metropolitan hospitals, and public sector hospitals with private sector hospitals.

Another issue that needs consideration in future is that the measurement of error is confounded by the lack of agreement among healthcare workers as to what constitutes an error (A. F. Cook et al., 2004). In addition, because errors are unintentional behaviours, individuals are not always aware that they have made an error, especially if it takes the form of a memory lapse. These facts are particularly relevant, for example, when considering a "wrong time error". Is this always an error or could it sometimes be a violation of procedures? The qualitative comments by nurses in the current research seem to suggest that giving a medication at the wrong time is common practice and, rather than an error, is more likely to be a deliberate action. This fact does not rule out, however, that memory lapses do occur. This confusion as to what we are measuring will need to be considered in future research. The inclusion of "near misses" in Study 3 (i.e., *I gave, or very nearly gave, the right drug at the wrong time*) has helped to make it clearer that this is a mistake rather than a deliberate action. However, perhaps including the word "mistakenly" in all items in

the scale (i.e., *I mistakenly gave, or very nearly gave* …) will clarity further what the items are measuring.

The current research was deliberately narrow in focus and did not look at a number of issues that could be investigated in future projects. Clearly, medication administration is a complex process involving multiple interactions among patients, nurses, doctors, pharmacists, management, and the healthcare system itself (Wakefield et al., 1998). This series of studies touched on the effect that some parts of the system have on safety behaviour, however, undoubtedly other factors greatly impact on clinical practice. For example, how do patient characteristics such as the complexity and seriousness of the illness, language and communication skills, and personality factors impact on medical personnel's ability to provide safe healthcare? What about aspects of the work environment such as the design, availability, and maintenance of equipment, staffing structures and levels, administrative and managerial support, and the use of locums? Individual factors, such as personality and experience, also influence outcomes. For example, risk is attached to being nervous and unsure, as well as to being overconfident and arrogant (Vincent et al., 1998). Other issues that were not included in this research include diagnostic errors, calculation errors and mathematical skills, the impact of shift rosters, confusion due to similarity of medication names and the quality of prescriptions, and the reciprocal relationship between organisational and individual variables. In addition, the issue of self-presentation of respondents was not investigated. Therefore, the inclusion of a social desirability measure may be an important addition in future research when dealing with such sensitive issues as violations and errors, and the willingness to report this unsafe behaviour.

5.4 Conclusion

In conclusion, this series of studies give encouraging support to the benefits of proceeding with further investigations of the impact of organisational and individual factors on unsafe behaviour in the medical environment. These studies have attempted to further safety research and aid in the prediction of unsafe behaviour in this environment. The usefulness of the modelling technique used in these studies is that it enhances the ability to target incident prevention. This technique could form part of a proactive management tool as suggested by Coyle et al. (1995) whereby the antecedents of unsafe behaviour are identified and targeted for intervention. It is hoped that these findings can be used and expanded upon in future research to increase knowledge of the factors influencing violations and errors, and in so doing, contribute to a safer healthcare system.

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Appendix A

USQ

AUSTRALIA

Dear Participant

Thanks for taking the time to read this letter. We hope that you will be able to help us with our research into the practice of rural and remote nurses with regard to medication administration and supply.

"What do I get out of it?" you ask.

- Firstly, a free cuppa using the enclosed teabag!
- Secondly, your input may change medication policies making them more relevant to your work context, and ensuring the safety of yourself and your patients.

What do we get out of it?

- A correct picture of what rural and remote area nurses are actually doing with regard to medication practice.
- 'True' data, including your practical suggestions to guide amendments to the Health (Drugs & Poisons) Regulation 1996.

If you would like to assist us with this research we ask that you follow the instructions below, using the enclosed materials:

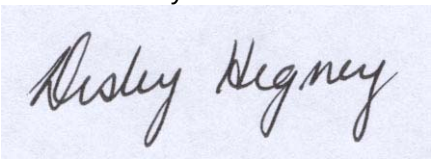
Step 1 Please take the time to read the **Plain Language Statement** before deciding whether to participate. Keep this Statement as a record of how to contact us in future.

Step 2 Make a 'cuppa' with the **teabag** provided and take a 'breather' while completing the enclosed **questionnaire**. It should take you approximately 20-30 minutes to complete**.** Please remember that the aim of the study is to find out what your *current* medication practices are, not what you understand the correct practice should be. However, there are no right or wrong answers. As the Plain Language Statement says, all your responses will be kept confidential. If you need more space to answer a question, please feel free to attach additional pages with the extra information.

Step 3 Once you have completed the questionnaire, please return it in the **reply paid envelope** within **two (2) weeks.**

If you have any queries, please don't hesitate to contact us using the details below. We look forward to your response, and thank you for your assistance with this study.

Yours sincerely



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Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Plain Language Statement

The University of Southern Queensland (USQ) has been successful in obtaining funding from the Queensland Nursing Council (QNC) for a research project that will investigate the administration and supply of controlled and restricted medications by rural and remote nurses. Our aim is to provide a benchmark with which to measure practice at a later date, which will indicate the impact of amendments to the Queensland Health (Drugs & Poisons) Regulation 1996, such as the EN Medication Endorsement and the Rural and Isolated Practice Endorsement for RNs. All enrolled and registered nurses from rural and remote areas will be eligible to participate.

We ask you to participate in this important study so that Queensland will have the information on which to base future policy. It is therefore important that your responses are based on your **current** medications practice, rather than what you understand the correct practice should be. Your participation will involve the completion of the enclosed questionnaire.

To ensure absolute confidentiality, each questionnaire has been coded. These coded questionnaires have been sent by USQ to the QNC who have agreed to post the questionnaire to you by matching each code with a name. Only the QNC will hold the names, addresses and their codes - USQ does not have access to your name or address details. Three weeks after the first mail-out of the questionnaire, USQ will notify the QNC of the code numbers of the questionnaires not returned to us. The QNC will then post a reminder package to these people. If you do not wish to participate in the study, then please ignore this reminder notice.

Should you wish to withdraw from the study at any time, USQ will notify the QNC of your name and they can advise us of your code. We can then remove your questionnaire from the study.

When the questionnaires are returned to USQ, the data will be analysed by the Project Team. Your comments will be kept completely confidential, with no identifying information appearing with them. At no time will the QNC have access to any information that could identify your survey responses. We guarantee that any comment made about Queensland Health will not be passed onto Queensland Health in a way that could identify the nurse or the facility making the statement. All of the questionnaires will be kept in a locked filing cabinet at USQ for a period of five years, after which they will be shredded and disposed of as confidential waste.

The research team, led by Professor Desley Hegney, Chair of Rural Nursing, comprises a range of professionals, including Dr Jennifer Watson, Dr Ashley Plank (Senior Lecturer in Statistics – USQ), Ms Christine McKeon and Ms Lisa Raith (Psychologists/Research Assistants).

If you have any questions with regard to this project please feel free to contact Professor Desley Hegney on the number listed below. Participation is completely voluntary. You should understand that your decision to participate in this study will not affect your future prospects of employment in any way. If you wish to participate could you please return the enclosed questionnaire in the reply-paid envelope provided in this package. Return of the completed questionnaire provides your consent to participate in this study. Please retain this Plain Language Statement for future reference.

Any questions with regard to this project may be directed to:
Professor Desley Hegney, Chair of Rural Nursing, University of Southern Queensland, Department of Nursing, Toowoomba QLD 4350. Telephone: 4631 5456; Fax: 4631 5452; Email: hegney@usq.edu.au

Ms Christine McKeon or Ms Lisa Raith, Research Assistants, Centre for Rural and Remote Area Health, University of Southern Queensland, Toowoomba QLD 4350. Telephone: 4631 5458; Fax: 4631 5452; Email: mckeon@usq.edu.au or raith@usq.edu.au

Any concerns regarding the project implementation may be directed to:
The Secretary, Human Research Ethics Committee USQ or telephone (07) 4631 2956.

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Please circle **ONE** number in response to each question or statement, unless otherwise indicated.

MEDICATIONS QUESTIONNAIRE

SECTION 1: WORK HISTORY AND PLACE OF WORK

1.1 What type of health service are you working in?

- Hospital only 1
- Hospital and Community Health 2
- Community Health only 3
- Multi-purpose health service 4
- Residential Care Facility only 5
- Other (please specify) 6

1.2 Are you employed in the ... ?

- Public sector 1
- Private sector 2

1.3 Are you employed ... ?

- Permanent full-time[1] 1
- Permanent part-time[2] 2
- Casual[3] 3
- Temporary full-time[4] 4
- Temporary part-time[5] 5

1.4 How long, in total, have you worked with your current employer?

- Less than twelve months 1
- One year to less than two years 2
- Two years to less than five years 3
- Five years to less than ten years 4
- Ten years to less than twenty years 5
- Twenty years to less than thirty years 6
- Thirty years to less than forty years 7
- Forty years or more 8

1.5 How long, in total, have you worked in rural/remote area nursing?

- Less than twelve months 1
- One year to less than two years 2
- Two years to less than five years 3
- Five years to less than ten years 4
- Ten years to less than twenty years 5
- Twenty years to less than thirty years 6
- Thirty years to less than forty years 7
- Forty years or more 8

1.6 How long, in total have you worked in nursing?

- Less than twelve months 1
- One year to less than two years 2
- Two years to less than five years 3
- Five years to less than ten years 4
- Ten years to less than twenty years 5
- Twenty years to less than thirty years 6
- Thirty years to less than forty years 7
- Forty years or more 8

1.7 Which of the following endorsements do you have? (circle all that apply)

- Rural & Isolated Practice 1
- Sexual Health 2
- Immunisation 3
- Enrolled Nurse Medication 4
- Midwifery 5
- Mental Health 6
- None of the above 7

[1] Permanent full-time: an employee who is engaged in a permanent capacity for 38 hours per week.
[2] Permanent part-time: an employee who is engaged in a permanent capacity for less than 38 hours per week.
[3] Casual: an employee who is engaged on a daily basis (i.e., generally does not appear on a roster).
[4] Temporary full-time: an employee who is engaged on a fixed term contract for 38 hours per week.
[5] Temporary part-time: an employee who is engaged on a fixed term contract for less than 38 hours per week.

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

1.8 Please indicate how often you believe the following are true.

	Always	Most of the Time	Sometimes	Never	N/A
a) Other health professionals in my community (e.g., GPs, nurses, and pharmacists) understand the role difference between an endorsed and unendorsed nurse.	1	2	3	4	5
b) My patients/clients understand the role difference between an endorsed and unendorsed nurse.	1	2	3	4	5

1.9 If you believe there is a lack of understanding of the role difference between endorsed and unendorsed nurses, please comment on the issue and suggest any strategies you believe could be introduced to overcome this problem.

[2]

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SECTION 2: PROFESSIONAL DEVELOPMENT FOR MEDICATION PRACTICE

This section gathers information relating specifically to your **medication practice** (i.e., initiation, administration, and supply of medications), and the education and training you have received for this role.

2.1 Please indicate how valuable the following have been to your preparation for medication practice.

	Extremely Valuable	Very Valuable	Moderately Valuable	Somewhat Valuable	Not Valuable	N/A
a) Experience	1	2	3	4	5	6
b) Formal Education (undergraduate course, postgraduate course)	1	2	3	4	5	6
c) Training (in-service, short courses)	1	2	3	4	5	6
d) Mentor/Preceptor	1	2	3	4	5	6
e) An endorsement course (e.g., Isolated practice endorsement)	1	2	3	4	5	6
f) Other (please specify)	1	2	3	4	5	6

2.2 In the table below, please name medication courses you have undertaken in the last 3 years, and indicate their usefulness to your current medication practice.

Course and Provider (e.g., USQ)	Extremely Useful	Very Useful	Moderately Useful	Somewhat Useful	Not Useful
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

[3]

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

2.3 If you wish, please comment on the strengths and weaknesses of the medication courses you listed in Q2.2.

_____

_____

_____

_____

_____

2.4 Which of the following reference materials do you use with regard to the administration and supply of medications? (circle all that apply)

Current MIMS Annual (i.e., 2002) 1
MIMS CD-ROM 2
On-line MIMS 3
A pharmacology textbook published/updated in the last 2 years 4
Current Monthly MIMS 5
Other (please specify) _____ 6

2.5 Please indicate the extent to which you agree/disagree with the following statements.

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
a) My knowledge of medications and how they work is adequate for my current level of practice.	1	2	3	4	5
b) I am able to explain to my patients, in terms they can understand, how the medications they receive work.	1	2	3	4	5
c) I am able to explain to my patients, in terms they can understand, the major *side effects* of the medications they receive.	1	2	3	4	5
d) I have easy access to up-to-date reference material with regard to the administration and supply of medications.	1	2	3	4	5
e) The reference material supplied in my health facility is adequate to maintain my competence with regard to the administration and supply of medications.	1	2	3	4	5
f) In my workplace, I have easy access to the *Queensland Health (Drugs and Poisons) Regulation 1996* and its amendments.	1	2	3	4	5
g) Annual medication calculation tests are worthwhile with regard to maintaining my medication practice competence.	1	2	3	4	5

[4]

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2.6 If you wish, please comment on any issues arising from your responses to Q2.5.

2.7 If you have an endorsement, please indicate your agreement/disagreement with the following statements. If you don't have an endorsement, please go to Q3.1.

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	N/A
a) The endorsement I hold for **rural and isolated practice** is sufficient for my current scope of nursing practice.	1	2	3	4	5	6
b) The endorsement I hold for **immunisation** is sufficient for my current scope of nursing practice.	1	2	3	4	5	6
c) The endorsement I hold for **sexual health** is sufficient for my current scope of nursing practice.	1	2	3	4	5	6
d) The endorsement I hold as an **enrolled nurse** to administer and supply medications is sufficient for my current scope of nursing practice.	1	2	3	4	5	6

2.8 If you wish, please comment on any issues arising from your responses to Q2.7.

[5]

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SECTION 3: LEGAL AND BEST PRACTICE ISSUES

In this section we ask questions about the management of restricted (S4) and controlled (S8) medications under the regulations.

3.1 Please indicate how often the following statements apply to you.

	Always	Most of the Time	Sometimes	Never	N/A
a) I take telephone orders for S4 and S8 medications from a medical practitioner.	1	2	3	4	5
b) The medical superintendent or registrar in this health facility signs for telephone-ordered medications within the statutory time period of 24 hours.	1	2	3	4	5
c) The general practitioner(s) within the town signs for telephone ordered medications within the statutory time period of 24 hours.	1	2	3	4	5
d) If I cannot contact the medical officer (MO) for a telephone order for an S4 or S8 medication not on a protocol, I administer and/or supply the medication and then get the order at a later date.	1	2	3	4	5
e) The MOs' names and signatures are legible on medication orders, regardless of whether they are known to staff.	1	2	3	4	5
f) The MO signs and dates cessation of medication orders in the medication chart/patient notes.	1	2	3	4	5
g) Any S2 and S3 medications I initiate are entered onto medication charts or the nurses' notes in patient charts.	1	2	3	4	5
h) Any S2 and S3 medications I initiate are signed for.	1	2	3	4	5
i) My name and signature are legible regardless of whether they are known to staff.	1	2	3	4	5
j) I use the QNC's[6] Scope of Nursing Practice Decision Making Framework to guide me when delegating medication practice to ENs and carers.	1	2	3	4	5
k) I explain to patients all the relevant information about the medications I administer/supply to them.	1	2	3	4	5
l) When available, I provide Consumer Product Information to patients regarding the medications I administer/supply to them.	1	2	3	4	5
m) When applicable, I access Indigenous Health Workers or interpreters to provide patient education regarding the medication **administered**.	1	2	3	4	5
n) When applicable, I access Indigenous Health Workers or interpreters to provide patient education regarding the medication **supplied.**	1	2	3	4	5

[6] Queensland Nursing Council's

[6]

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3.2 If you initiate, administer and/or supply medications without a medical practitioner's authorisation, please outline any issues or concerns you may have about that practice.

_____

_____

_____

_____

_____

_____

_____

3.3 If you are an EN, please indicate how often the following statements apply to you. If you are not an EN, please proceed to Q3.4.

	Always	Most of the Time	Sometimes	Never	N/A
a) I have initiated prn medications in the absence of a registered nurse.	1	2	3	4	5
b) I have initiated S2 and S3 medications in the absence of a registered nurse.	1	2	3	4	5
c) I have initiated S4 medications in the absence of a registered nurse.	1	2	3	4	5
d) I have initiated S8 medications in the absence of a registered nurse.	1	2	3	4	5
e) I have supplied prn medications in the absence of a registered nurse.	1	2	3	4	5
f) I have supplied S4 medications that have been signed for by a registered nurse.	1	2	3	4	5
g) I have supplied S8 medications that have been signed for by a registered nurse.	1	2	3	4	5
h) I have administered prn medications that have been signed for by a registered nurse.	1	2	3	4	5
i) I have administered S4 medications that have been signed for by a registered nurse.	1	2	3	4	5
j) I have administered S8 medications that have been signed for by a registered nurse.	1	2	3	4	5

[7]

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3.4 Please indicate your level of agreement with the following statements.

My ability to comply with the Queensland Health (Drugs and Poisons) Regulation 1996 is adversely affected because…

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	N/A
a) My facility or district has not adopted the PCCM[7] for their Health Management Protocols.	1	2	3	4	5	6
b) The medical practitioners in my health facility/town expect me to work outside the Regulation.	1	2	3	4	5	6
c) The workload in my facility is excessive.	1	2	3	4	5	6
d) The staffing levels in my facility are inadequate.	1	2	3	4	5	6
e) My knowledge of my endorsed role is inadequate.	1	2	3	4	5	6
f) I am unable to access education and training programs.	1	2	3	4	5	6
g) The skill mix in my facility is inadequate.	1	2	3	4	5	6

3.5 If you wish, please comment on the above, or any other issues or concerns regarding your ability to comply with the Regulations.

[7] Primary Clinical Care Manual

[8]

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

3.6 One of the aims of this study is to ascertain if the Drug Therapy Protocols are sufficient for rural and remote nursing practice. In the table below, please list any S4 or S8 medications, which you initiate, administer or supply regularly in your practice, that should be on the Drug Therapy Protocol, or that require expanding (e.g., Pethidine for other than trauma pain).

Medication (generic name)	Reason Medication Required

3.7 Do you supply medications from a hospital dispensary in the absence of a hospital pharmacist?

Yes 1
No (go to Q3.10) 2

3.8 Do you feel confident supplying these medications?

Yes 1
No 2

3.9 Please indicate how often you would supply medications.

Every day 1
Weekly 2
Fortnightly 3
Monthly 4
Other (please specify)_____ 5

3.10 Do you label medications?

Yes 1
No (go to Q3.12) 2

[9]

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

3.11 With regard to medication labelling, please indicate how often you record...

	Always	Most of the Time	Sometimes	Never
a) The name of the patient.	1	2	3	4
b) The date dispensed.	1	2	3	4
c) The directions for use (e.g., take before or after food, take until completed).	1	2	3	4
d) Warning statements, such as "may cause drowsiness".	1	2	3	4
e) The initial of the RN dispensing the medication.	1	2	3	4
f) The words 'keep out of reach of children' printed in red on a background of contrasting colour and in bold face sans serif capital letters with a height of at least 1.5mm.	1	2	3	4
g) The doctor's, nurse's, or health facility's name and address.	1	2	3	4
h) A description of the contents (e.g., medication name and dose).	1	2	3	4

3.12 Please indicate how often the medications in your health facility comply with the *Queensland Health (Drugs and Poisons) Regulations 1996* and amendments in the way they are...

	Always	Most of the time	Sometimes	Never	Don't Know
a) Ordered	1	2	3	4	5
b) Stored	1	2	3	4	5
c) Transported	1	2	3	4	5
d) Dispensed	1	2	3	4	5
e) Disposed of	1	2	3	4	5

3.13 If you wish, please comment on any issues arising from your responses to Q3.12.

[10]

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

SECTION 4: POLICIES AND PROCEDURES

This section asks questions relating to medication practice policies and procedures within your health facility.

4.1 Are the policies and procedures regarding medication practice in your health facility ... ? (circle all that apply)

Standing orders that are specific to a patient/client 1
Global standing orders signed by the medical superintendent 2
Health management protocols (i.e., PCCM) 3
Other (please specify)_____ 4
Not applicable 5

4.2 Do you use the PCCM in your practice? Yes 1
No (go to Q4.4) 2

4.3 If you answered yes above, please indicate your level of agreement with the following statements. ***The Primary Clinical Care Manual...***

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
a) Supports my practice as a rural and isolated practice nurse.	1	2	3	4	5
b) Is readily accessible within my health facility.	1	2	3	4	5
c) Clearly outlines the referral processes for all of the patients/clients to whom I provide care.	1	2	3	4	5
d) Clearly outlines the minimum requirements for documentation of medication practices in the patient's/client's notes.	1	2	3	4	5
e) Has been endorsed by the facility or the Health District.	1	2	3	4	5
f) Contains material that is up-to-date.	1	2	3	4	5
g) Is an easily useable resource.	1	2	3	4	5

4.4 If you wish, please comment on any issues regarding the PCCM for medication practice in your health facility.

_____

_____

_____

_____

_____

[11]

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

SECTION 5: DEMOGRAPHICS

5.1 Are you ... ?

- Male 1
- Female 2

5.2 What is your age?

- 20-24 years of age 1
- 25-29 years of age 2
- 30-34 years of age 3
- 35-39 years of age 4
- 40-44 years of age 5
- 45-49 years of age 6
- 50-54 years of age 7
- 55-59 years of age 8
- 60-64 years of age 9
- 65 years of age or greater 10

5.3 Please indicate the level of your CURRENT substantive[8] position.

- Registered Nurse Level 1 1
- Registered Nurse Level 2 2
- Registered Nurse Level 3 3
- Registered Nurse Level 4 4
- Registered Nurse Level 5 5
- Enrolled Nurse 6

5.4 If you wish, please discuss further any issues raised in this survey, or comment on any other issues or concerns you may have regarding the administration and supply of medications in rural and remote areas.

[8] The position to which you are permanently appointed, NOT ACTING IN.

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Appendix B

USQ
AUSTRALIA

The University of Southern Queensland

TOOWOOMBA QUEENSLAND 4350
AUSTRALIA
TELEPHONE (07) 4631 2100
www.usq.edu.au

To: **RNs & ENs (with Medication Endorsement) involved in medication administration**
From: **Christine McKeon, Doctoral Research Studies, Psychology Department, University of Southern Queensland**

Dear Nurse,

Thank you for considering completing this survey. My research interest is safety and errors, with my doctorate focusing on identifying pre-existing organisational factors that may be contributing to unsafe practice. In this survey, I am seeking your support to discover what is happening in the hospital system that may be contributing to errors and violations of safe practice when administering medications. Research indicates that medication errors are common. All people make mistakes … this is normal and part of being human. In the hospital system, however, perfect performance is expected at all times and when a medication error is made, it is the usual practice to place the "blame" on the person directly involved in the incident, even though medication errors can originate anywhere along the continuum from prescribing to administration. A nurse will often assume or be assigned responsibility for an error even though the actions of everyone involved in the system and the system design itself may have contributed to that error.

Research in other complex industries has found that the system in which people work has an impact on their performance, and when conditions in the organisation are improved, the number of errors decreases. The purpose of my research is to contribute to Queensland Health's organisational improvement strategy, that is, to move away from a culture of blame and toward a culture of safety, by identifying factors in the organisation that may be making it difficult for individuals to follow procedures or avoid errors. To achieve this, the answers you give to the medication administration questionnaire will be compared with the information you provide in the questionnaires about your workplace to give a clearer picture about what is happening in the hospital system that may be contributing to medication errors.

I also want to know if it is necessary for you to "bend" the rules to get your job done. Medication administration involves following guidelines that are in place to maintain quality outcomes. However, because of conditions in the workplace (for example, workload, unavailability of doctors, impractical procedures etc.), it may not always be possible to follow all the "rules". Your answers to these questions will also be compared with your answers about your workplace to give an indication of what is happening in the organisation that makes it difficult for you to follow the procedures.

Please Note: At no time will your responses be available to anyone except the researchers at USQ and you are assured that they will be treated as **STRICTLY CONFIDENTIAL**. If you have any queries or concerns, please do not hesitate to contact me on mckeon@usq.edu.au or phone 46 311613. Thank you in anticipation of your valuable assistance in helping to build a safer health care system.

GOOD UNIVERSITIES GUIDES
Australia's University of the Year 2000 - 2001
DEVELOPING THE e-UNIVERSITY
Developing the e-university
Joint Winner

Sincerely

Christine McKeon

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QPASS Survey

for the

[redacted] Health Service District

USQ
AUSTRALIA

University of Southern Queensland

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Part 1 - Background Information

The information you provide in this section will be used to assist in drawing more meaningful conclusions from the survey results. Your responses will remain STRICTLY CONFIDENTIAL. Your survey will be sent directly to the University of Southern Queensland for processing.

Please place a **cross (X)** in ***dark blue or black ink*** in ONE box for each question as shown in the example below.

Example: **Gender** ☒ Female ☐ Male

1. **Gender**
   ☐ Female ☐ Male

2. **Age Group (in years)**
   ☐ Under 21 ☐ 21 - 30 ☐ 31 - 40 ☐ 41 - 50 ☐ 51 - 60 ☐ Over 60

3. **How long have you worked in your current role?**
   ☐ Less than 1 year ☐ 3 to 5 years ☐ 11 to 15 years ☐ More than 20 years
   ☐ 1 to 2 years ☐ 6 to 10 years ☐ 16 to 20 years

4. **How long have you worked for Queensland Health?**
   ☐ Less than 1 year ☐ 3 to 5 years ☐ 11 to 15 years ☐ More than 20 years
   ☐ 1 to 2 years ☐ 6 to 10 years ☐ 16 to 20 years

5. **What is your current employment status?**
   ☐ Permanent full-time ☐ Temporary full-time ☐ Casual
   ☐ Permanent part-time ☐ Temporary part-time

6. **What is your preferred employment status?**
   ☐ Permanent full-time ☐ Temporary full-time ☐ Casual
   ☐ Permanent part-time ☐ Temporary part-time

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Background Information cont.

7. What is your occupation stream?

- ☐ Administration Officer AO1 - AO3
- ☐ Administration Officer AO4 - AO7
- ☐ Allied Health/Professional Officer
- ☐ Medical Officer
- ☐ Nursing - RN Level 3 & above
- ☐ Nursing - RN Level 2
- ☐ Nursing - RN Level 1
- ☐ Nursing - EN with Medication Endorsement
- ☐ Nursing - EN
- ☐ Nursing - AIN
- ☐ Technical Officer
- ☐ Operational Service Officer
- ☐ Other _____

8. Do you work in any of the following Units?

- ☐ Oral Health
- ☐ Indigenous Health
- ☐ None of these Units
- ☐ Mental Health
- ☐ HACC

9. Where do you work? (Please tick *one* box only i.e. your main place of work, as your answers to later questions will refer to this location).

- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]

10. Do you identify as a member of an equal employment opportunity (EEO) group?

☐ Yes ☐ No ☐ Prefer not to indicate

If you answered YES, please cross the appropriate box below:

- ☐ Women
- ☐ People with a disability
- ☐ Aboriginal and Torres Strait Islanders
- ☐ Australian South Sea Islander ancestry
- ☐ People from a non-English speaking background

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Part 2 - How you feel about your job

In this part we ask you to rate various statements that describe how you might feel about your job or your life in general. Please read the instructions for each part carefully, and answer EACH question.

Listed below are various statements with which you may agree or disagree. For each one, would you indicate your level of agreement by placing a cross in the appropriate box on the following scale:

		Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
1	In most ways my work life is close to my ideal	☐	☐	☐	☐	☐	☐	☐
2	The conditions of my life at work are excellent	☐	☐	☐	☐	☐	☐	☐
3	I am satisfied with my life at work	☐	☐	☐	☐	☐	☐	☐
4	So far, I have obtained the important things I want in my work life	☐	☐	☐	☐	☐	☐	☐
5	If I were able to live my work life over again, I wouldn't change anything	☐	☐	☐	☐	☐	☐	☐
6	The quality of my work life is excellent	☐	☐	☐	☐	☐	☐	☐

We would now like you to indicate how often over the past MONTH you have experienced the following feelings whilst at work by placing a cross in the appropriate box on the following scale:

		Not at all			Moderately often			All the time
1	Feeling positive at work	☐	☐	☐	☐	☐	☐	☐
2	Feeling tense at work	☐	☐	☐	☐	☐	☐	☐
3	Feeling enthusiastic at work	☐	☐	☐	☐	☐	☐	☐
4	Feeling afraid at work	☐	☐	☐	☐	☐	☐	☐
5	Feeling proud at work	☐	☐	☐	☐	☐	☐	☐
6	Feeling unhappy at work	☐	☐	☐	☐	☐	☐	☐
7	Feeling cheerful at work	☐	☐	☐	☐	☐	☐	☐
8	Feeling anxious at work	☐	☐	☐	☐	☐	☐	☐
9	Feeling happy at work	☐	☐	☐	☐	☐	☐	☐
10	Feeling negative at work	☐	☐	☐	☐	☐	☐	☐
11	Feeling delighted at work	☐	☐	☐	☐	☐	☐	☐
12	Feeling uneasy at work	☐	☐	☐	☐	☐	☐	☐
13	Feeling energised at work	☐	☐	☐	☐	☐	☐	☐
14	Feeling depressed at work	☐	☐	☐	☐	☐	☐	☐

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Part 3 - Your view of how your work place operates

Listed below are a number of statements that could be used to describe some aspects of your work place. Please read each statement carefully. Indicate the extent to which you **AGREE** that the statement actually applies to your work unit where you spend most of your time. Do this by placing a cross in the appropriate box. Where reference is made to your supervisor, this means your immediate supervisor (the person you report to and who signs your timesheet).

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	I am encouraged to pursue further training and development	☐	☐	☐	☐	☐
2	I am able to approach the supervisors in this work place to discuss concerns and grievances	☐	☐	☐	☐	☐
3	I am always clear about what others expect of me	☐	☐	☐	☐	☐
4	I feel accepted by other staff in this work place	☐	☐	☐	☐	☐
5	There is too much expected of staff in this work place	☐	☐	☐	☐	☐
6	I am encouraged in my work by praise, thanks or other recognition	☐	☐	☐	☐	☐
7	There is a good team spirit in this work place	☐	☐	☐	☐	☐
8	There are forums in this work place where I can express my views and opinions	☐	☐	☐	☐	☐
9	The staff are committed to the work place's goals and values	☐	☐	☐	☐	☐
10	Staff in this work place experience a lot of stress	☐	☐	☐	☐	☐
11	I have the opportunity to be involved in cooperative work with other members of staff	☐	☐	☐	☐	☐
12	I have the opportunity to discuss and receive feedback on my work performance	☐	☐	☐	☐	☐
13	Others in this work place take an active interest in my career development and professional growth	☐	☐	☐	☐	☐
14	The supervisors don't really know the problems faced by staff in this work place	☐	☐	☐	☐	☐
15	My work objectives are always well defined	☐	☐	☐	☐	☐
16	There is good communication between groups in this work place	☐	☐	☐	☐	☐
17	Staff in this work place are overloaded with work	☐	☐	☐	☐	☐
18	I am regularly given feedback on how I am performing in my role	☐	☐	☐	☐	☐
19	There is a lot of energy in this work place	☐	☐	☐	☐	☐
20	I am happy with the decision-making processes used in this work place	☐	☐	☐	☐	☐
21	The goals of this work place are not easily understood	☐	☐	☐	☐	☐
22	Staff in this work place are frustrated with their job	☐	☐	☐	☐	☐
23	The training and development planning in this work place takes into account my individual needs and interests	☐	☐	☐	☐	☐

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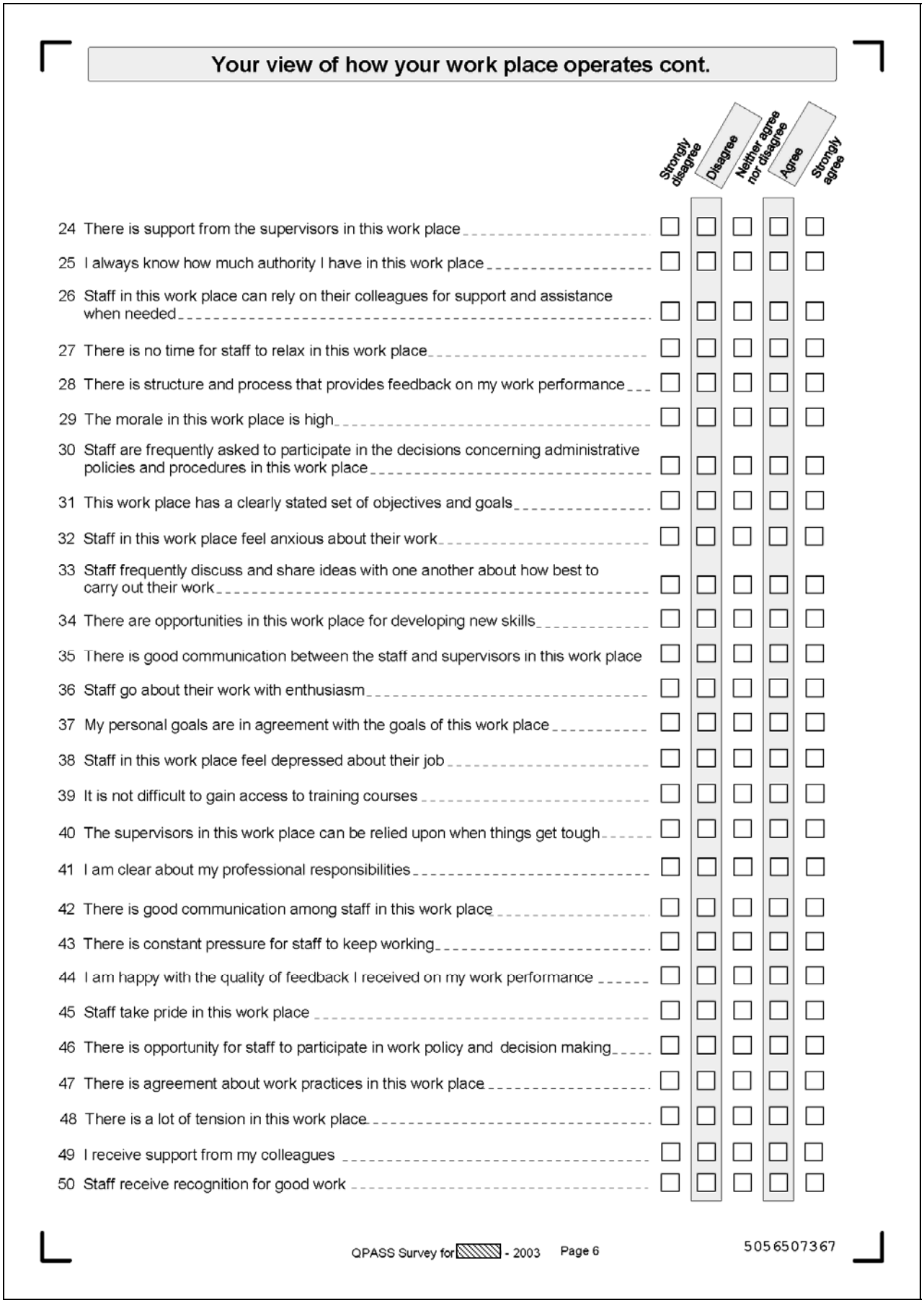

Your view of how your work place operates cont.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
24 There is support from the supervisors in this work place	☐	☐	☐	☐	☐
25 I always know how much authority I have in this work place	☐	☐	☐	☐	☐
26 Staff in this work place can rely on their colleagues for support and assistance when needed	☐	☐	☐	☐	☐
27 There is no time for staff to relax in this work place	☐	☐	☐	☐	☐
28 There is structure and process that provides feedback on my work performance	☐	☐	☐	☐	☐
29 The morale in this work place is high	☐	☐	☐	☐	☐
30 Staff are frequently asked to participate in the decisions concerning administrative policies and procedures in this work place	☐	☐	☐	☐	☐
31 This work place has a clearly stated set of objectives and goals	☐	☐	☐	☐	☐
32 Staff in this work place feel anxious about their work	☐	☐	☐	☐	☐
33 Staff frequently discuss and share ideas with one another about how best to carry out their work	☐	☐	☐	☐	☐
34 There are opportunities in this work place for developing new skills	☐	☐	☐	☐	☐
35 There is good communication between the staff and supervisors in this work place	☐	☐	☐	☐	☐
36 Staff go about their work with enthusiasm	☐	☐	☐	☐	☐
37 My personal goals are in agreement with the goals of this work place	☐	☐	☐	☐	☐
38 Staff in this work place feel depressed about their job	☐	☐	☐	☐	☐
39 It is not difficult to gain access to training courses	☐	☐	☐	☐	☐
40 The supervisors in this work place can be relied upon when things get tough	☐	☐	☐	☐	☐
41 I am clear about my professional responsibilities	☐	☐	☐	☐	☐
42 There is good communication among staff in this work place	☐	☐	☐	☐	☐
43 There is constant pressure for staff to keep working	☐	☐	☐	☐	☐
44 I am happy with the quality of feedback I received on my work performance	☐	☐	☐	☐	☐
45 Staff take pride in this work place	☐	☐	☐	☐	☐
46 There is opportunity for staff to participate in work policy and decision making	☐	☐	☐	☐	☐
47 There is agreement about work practices in this work place	☐	☐	☐	☐	☐
48 There is a lot of tension in this work place	☐	☐	☐	☐	☐
49 I receive support from my colleagues	☐	☐	☐	☐	☐
50 Staff receive recognition for good work	☐	☐	☐	☐	☐

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If you are a nurse involved in medication administration, please continue onto Part 4.

All other participants: you have now completed the questionnaire. Thank you for your assistance. Your co-operation is greatly appreciated.

Part 4 - Medication Administration Questionnaire

To be completed by RNs and ENs (with Medication Endorsement) who are currently involved in medication administration.

In this section, we are seeking your support to discover what is happening in the hospital system that is contributing to medication errors. Research indicates that medication errors are common. Research in other complex industries has found that the system in which people work has an impact on their performance, and when conditions in the organisation are improved, the number of errors decreases. Your answers to the following will be compared with the answers you gave about the organisation to give a clearer picture about what is happening in the system that is contributing to mistakes in medication administration.

PLEASE NOTE: At no time will your responses be available to anyone except the researchers at USQ and you are assured that they will be treated as **STRICTLY CONFIDENTIAL**. To ensure anonymity, the results for this and the following section will be analysed and reported for the District as a whole only and not by individual hospitals.

To the best of your knowledge, in the last <u>12 months</u>, have you ever mistakenly done any of the following when administering a medication?

	Never	Once or twice	Three or four times	More often
1. Given the wrong DRUG	☐	☐	☐	☐
2. By the wrong ROUTE	☐	☐	☐	☐
3. To the wrong PATIENT	☐	☐	☐	☐
4. At the wrong TIME	☐	☐	☐	☐
5. At the wrong DOSE	☐	☐	☐	☐

If you wish, please comment on what you believe may have contributed to the above.

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Medication Administration Questionnaire cont.

In this section, we want to know if it is necessary for you to "bend" the rules to get your job done. Medication administration involves following guidelines that are in place to maintain quality outcomes. However, because of conditions in the workplace (for example, workload, unavailability of doctors, impractical procedures etc.), it may not always be possible to follow all the "rules". Your answers to the following will be compared with the answers you gave about the organisation to give an indication of what is happening in the system that makes it difficult for you to follow the procedures.

Again, you are assured that your responses will be treated as **STRICTLY CONFIDENTIAL,** with results being analysed and reported for the District as a whole only and not by individual hospitals.

Please indicate how often in the past <u>12 months</u> you have had to bend the rules in the following ways when administering a medication:

	Never	Sometimes	Often	Frequently	Most of the time
1. Did not verify with a doctor, an order that was illegible, unclear, incomplete, or that seemed inappropriate or unreasonable for the patient	☐	☐	☐	☐	☐
2. Did not obtain the proper authority (e.g., order from doctor or signed protocol)	☐	☐	☐	☐	☐
3. Did not complete appropriate documentation	☐	☐	☐	☐	☐
4. Did not verify a verbal/telephone order and its transcription according to hospital policy	☐	☐	☐	☐	☐
5. Did not check reference material (e.g., MIMS) when unsure about or unfamiliar with a medication	☐	☐	☐	☐	☐
6. Did not check for allergies or previous adverse reactions	☐	☐	☐	☐	☐
7. Did not monitor the effects of the drug after administration	☐	☐	☐	☐	☐
8. Did not record/report side or adverse effects	☐	☐	☐	☐	☐
9. Did not check with a doctor before changing the route of administration	☐	☐	☐	☐	☐
10. Did not check the patient's identity	☐	☐	☐	☐	☐
11. Did not check the patient's chart	☐	☐	☐	☐	☐
12. Did not give relevant education and information to the patient (e.g., information sheet and/or clear explanation of procedure, side effects etc.)	☐	☐	☐	☐	☐
13. Did not observe the patient taking the medication	☐	☐	☐	☐	☐

If you wish, please comment on what you believe may have contributed to the above.

Thank you for your assistance in helping to build a safer health care system.

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Appendix C

Note: Font size for the main text of all documents was at least 10 (Arial) or 12 (Times New Roman) points.

Have Your Say On Safety

Safety Survey

for the

[redacted] Health Service District

Centre for Organisational Research and Evaluation

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Why are we doing this survey?

- This survey is to assist [redacted] Health Service District to provide a safer health care system.
- We are seeking your support to discover what is happening in the hospital system that is contributing to medication errors and near misses. Research in other complex industries has found that the system in which people work has an impact on their performance, and when conditions in the organisation are improved, the number of errors decreases.
- We also want to know if it is necessary for you to "bend the rules" to get your job done. Medication administration involves following guidelines that are in place to maintain quality outcomes. However, because of conditions in the workplace, it may not always be possible to follow all the "rules".
- Your answers to the Medication Administration questionnaire will be compared with your answers about the Safety Climate in your hospital to give an indication of what is happening in the system that is contributing to mistakes and what is making it difficult for you to follow the procedures.
- **All RNs and EENs who are currently involved in medication administration are invited to participate in this survey**.
- Although we strongly encourage you to complete the survey, your participation is voluntary.

How do I complete the survey?

- Please complete the survey during work time.
- Please follow the instructions at the top of each section and answer all the questions as openly as possible.
- Please answer every question.
- There are no "right" or "wrong" answers to the questions.
- When you have completed the survey, seal it in the envelope and place it in the box provided. If you prefer, you can mail it (no stamp required) directly to:

Christine McKeon
Centre for Organisational Research & Evaluation
Department of Psychology
University of Southern Queensland
REPLY PAID 67736
DARLING HEIGHTS QLD 4350

What will happen to my answers?

- At no time will your responses be available to anyone except the researchers at USQ.
- The information you give is **STRICTLY CONFIDENTIAL.**
- Your answers will be scanned into the USQ computer data-base with those of all other respondents.
- **No individual can be identified.**

If you have any concerns or questions about the survey, please contact [redacted] Health Service District [redacted], or Christine McKeon, University of Southern Queensland, phone 4631 1613 or email mckeon@usq.edu.au

Thank you for your participation

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Background Information

The information you provide in this section will be used to assist in drawing more meaningful conclusions from the survey results. Your responses will remain STRICTLY CONFIDENTIAL. Your survey will be sent directly to the University of Southern Queensland for processing.

Please place a mark in ***dark blue or black ink*** in ONE box for each question as shown in the example below.

Example: **Gender** ☒ Female ☐ Male

1. **Gender**
   ☐ Female ☐ Male

2. **Age Group (in years)**
   ☐ Under 21 ☐ 21 - 30 ☐ 31 - 40 ☐ 41 - 50 ☐ 51 - 60 ☐ Over 60

3. **How long have you worked in your current role?**
   ☐ Less than 1 year ☐ 3 to 5 years ☐ 11 to 15 years ☐ More than 20 years
   ☐ 1 to 2 years ☐ 6 to 10 years ☐ 16 to 20 years

4. **How long have you worked for Queensland Health?**
   ☐ Less than 1 year ☐ 3 to 5 years ☐ 11 to 15 years ☐ More than 20 years
   ☐ 1 to 2 years ☐ 6 to 10 years ☐ 16 to 20 years

5. **What is your current employment status?**
   ☐ Permanent full-time ☐ Temporary full-time ☐ Casual
   ☐ Permanent part-time ☐ Temporary part-time

6. **What is your employment level?**
   ☐ NO3/NO4
   ☐ NO2
   ☐ NO1
   ☐ EEN

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Medication Administration Questionnaire

In this section, we want to know if it is necessary for you to "bend the rules" to get your job done. Your answers to the following will be compared with your answers about the organisation to give an indication of what is happening in the system that makes it difficult for you to follow procedures.

Please note: At no time will your responses be available to anyone except the researchers at USQ and you are assured that they will be treated as **STRICTLY CONFIDENTIAL.**

Please indicate how often in the past *12 months* you did the following when administering medications:

	Never	Sometimes	Often	Most of the time	Always
1. Obtained the proper authority (e.g., order from doctor or signed protocol).	☐	☐	☐	☐	☐
2. Checked the patient's identity.	☐	☐	☐	☐	☐
3. Checked the patient's chart.	☐	☐	☐	☐	☐
4. Checked for allergies or previous adverse reactions.	☐	☐	☐	☐	☐
5. Gave relevant education and information to the patient (e.g., information sheet and/or clear explanation of procedure, side effects etc.)	☐	☐	☐	☐	☐
6. Observed the patient taking the medication.	☐	☐	☐	☐	☐
7. Completed appropriate documentation.	☐	☐	☐	☐	☐
8. Monitored the effects of the drug after administration.	☐	☐	☐	☐	☐

The following statements concern possible *contributor*s to "rule bending". Please mark the appropriate box:

	Never	Sometimes	Often	Most of the time	Always
1. I bend the rules **to get the job done**.	☐	☐	☐	☐	☐
2. I bend the rules because **everyone else does**.	☐	☐	☐	☐	☐
3. I bend the rules because of **my workload**.	☐	☐	☐	☐	☐
4. I bend the rules due to **management pressure**.	☐	☐	☐	☐	☐
5. I bend the rules because **the rules are impractical**.	☐	☐	☐	☐	☐

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Medication Administration Questionnaire cont.

In this section, we are seeking your support to discover what is happening in the hospital system that is contributing to medication errors and near misses. Your answers to the following will be compared with your answers about the organisation to give a clearer picture of why medication errors occur.

Again, you are assured that your responses will be treated as **STRICTLY CONFIDENTIAL.**

To the best of your knowledge, please indicate how often in the past *12 months* you have been involved in an *incident or near miss* when administering a medication, by marking the appropriate box below:

	Never	Once or twice	Three or four times	More often
1. I gave, *or very nearly gave*, the **wrong drug**	☐	☐	☐	☐
2. I gave, or *very nearly gave*, the right drug to the **wrong patient**	☐	☐	☐	☐
3. I gave, or *very nearly gave*, the right drug at the **wrong dose**	☐	☐	☐	☐
4. I gave, or *very nearly gave*, the right drug at the **wrong time**	☐	☐	☐	☐
5. I gave, or *very nearly gave*, the right drug by the **wrong route**	☐	☐	☐	☐
6. I missed, or *very nearly* **missed, a dose**	☐	☐	☐	☐
7. I gave, or *very nearly gave*, an **extra dose**	☐	☐	☐	☐

The following statements concern possible *contributors* to medication errors and near misses. Please mark the appropriate box:

I have made, or very nearly made, an error because of …	Never	Once or twice	Three or four times	More often
1. … fatigue	☐	☐	☐	☐
2 … distractions	☐	☐	☐	☐
3. … someone else's mistake	☐	☐	☐	☐
4. … my workload	☐	☐	☐	☐
5. … unclear, illegible, or incomplete documentation	☐	☐	☐	☐

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Safety Climate Questionnaire

Please indicate your level of agreement with the following by marking the appropriate box:

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
1. Patient safety issues are given high priority in medication training programs.	☐	☐	☐	☐	☐
2. My training covered all the patient safety risks associated with medication administration.	☐	☐	☐	☐	☐
3. Nurses have sufficient access to ongoing training to update medication administration skills and knowledge.	☐	☐	☐	☐	☐
4. Nurses have sufficient time to access ongoing training.	☐	☐	☐	☐	☐
5. I am clear about my responsibilities for safe medication administration in this hospital.	☐	☐	☐	☐	☐
6. I have a good understanding of medications and how they work.	☐	☐	☐	☐	☐
7. I have a good working knowledge of the Queensland Health (Drugs & Poisons) Regulation 1996 and its amendments.	☐	☐	☐	☐	☐
8. My supervisor really cares about patient safety in this hospital.	☐	☐	☐	☐	☐
9. My supervisor encourages open communication about patient safety concerns and issues.	☐	☐	☐	☐	☐
10. My supervisor acts decisively when a patient safety concern is raised.	☐	☐	☐	☐	☐
11. My supervisor turns a blind eye if patient safety procedures are not followed.	☐	☐	☐	☐	☐
12. My supervisor is more concerned with financial considerations than patient safety.	☐	☐	☐	☐	☐
13. Management really cares about patient safety in this hospital.	☐	☐	☐	☐	☐
14. Management encourages open communication about patient safety concerns and issues.	☐	☐	☐	☐	☐
15. Management acts decisively when a patient safety concern is raised.	☐	☐	☐	☐	☐
16. Management turns a blind eye if patient safety procedures are not followed.	☐	☐	☐	☐	☐
17. Management is more concerned with financial considerations than patient safety.	☐	☐	☐	☐	☐
18. Medication administration procedures in this hospital reflect how the job is usually done.	☐	☐	☐	☐	☐
19. Medication administration procedures in this hospital are not really practical.	☐	☐	☐	☐	☐
20. Medication administration procedures in this hospital are complicated to follow.	☐	☐	☐	☐	☐

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Safety Climate Questionnaire cont.

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
21. Most nurses in this hospital follow the medication administration procedures.	☐	☐	☐	☐	☐
22. Reference materials (e.g., MIMS) are easy to access in this hospital.	☐	☐	☐	☐	☐
23. Reference materials in this hospital are up to date.	☐	☐	☐	☐	☐
24. Reference materials in this hospital are easy to follow.	☐	☐	☐	☐	☐
25. Nurses are overloaded with work in this hospital.	☐	☐	☐	☐	☐
26. You can take it easy and still get your work done.	☐	☐	☐	☐	☐
27. There are enough nurses available to get the job done safely.	☐	☐	☐	☐	☐
28. There is too much expected of nurses in this hospital.	☐	☐	☐	☐	☐
29. There is a consistent policy for reporting and responding to incidents in this hospital.	☐	☐	☐	☐	☐
30. Mistakes are corrected without punishment in this hospital and treated as a learning opportunity.	☐	☐	☐	☐	☐
31. I am given feedback on incidents that occur in this hospital.	☐	☐	☐	☐	☐
32. If I make a mistake, I know the correct reporting procedures.	☐	☐	☐	☐	☐
33. I am willing to report incidents in which I am involved.	☐	☐	☐	☐	☐
34. I am willing to report near misses in which I am involved.	☐	☐	☐	☐	☐
35. I am concerned that if I report an incident or near miss, I will be punished.	☐	☐	☐	☐	☐
36. At work, I find myself getting upset about things that would not normally bother me.	☐	☐	☐	☐	☐
37. I have felt unwell because of work pressures.	☐	☐	☐	☐	☐
38. I find it difficult to leave work concerns at work.	☐	☐	☐	☐	☐
39. I feel emotionally drained at work.	☐	☐	☐	☐	☐
40. I feel in control and on top of things at work.	☐	☐	☐	☐	☐

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Medication Safety

What would you do to improve medication safety?

What do you view as the major risk/problem in your experiences with medication administration?

Thank you for your assistance in helping to build a safer health care system.

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