Mayhem to Mindful:
Improving Medication Administration Safety through Action Research

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“It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm." (Nightingale 1859)

CERTIFICATE OF AUTHORSHIP ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of candidate:

Date: 25/5/2017

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GLOSSARY OF TERMS

Adverse event	any unintended harm caused by a medical intervention rather than the patient's underlying condition (Brennan et al. 1991)
Adverse drug event (ADE)	any unintended harm caused by a medicine or lack of an intended medicine (Holdsworth et al. 2003). Includes adverse drug reaction and medication error
Adverse drug reaction (ADR)	any undesirable effect of a medicine during clinical use beyond its anticipated therapeutic effect
Error	the failure of a planned action to be completed as intended (error of execution) or the use of a wrong plan to achieve an aim (error of planning)
Error of commission	doing the wrong thing (ACSQHC 2002)
Error of omission	failing to do the right thing (ACSQHC 2002)
Good catch	a potential adverse drug event which does not reach the patient due to active intervention by someone
Medication delivery process	stages of medication management; prescribing, dispensing, adminstering, documenting and monitoring
Medication error	a failure in the medication process that leads to, or has the potential to lead to, harm to the patient, and includes acts of omission or commission (ACSQHC 2002)
Medication safety	freedom from unintended injury during the course of medication use activities to avoid, prevent, or correct adverse drug events which may result from the use of medications (AHA, HRET & ISMP 2002)
Near miss	a potential adverse drug event which does not reach the patient due to chance
Potential adverse drug event (ADE)	occurrence of a medication error that could result in an adverse drug event but does not because of intervention or chance (Institute for Healthcare Improvement)
Root cause analysis (RCA)	a retrospective review of a patient safety incident to identify what happened and how and why

ABSTRACT

Keeping patients safe is a fundamental component of quality nursing care. Nevertheless medication delivery within a busy clinical environment continues to challenge patient safety and wellbeing. Nurses' central role in medication administration to inpatients puts them in the ideal position to safeguard patients from prescribing, dispensing and administration errors (Vaismoradi et al. 2016). However, the ward context can inadvertently support work practices that compromise patient safety (Balka, Kahnamoui & Nutland 2007), while the seemingly routine nature of medication administration can decrease nurses' attentiveness to the medication administration process (Dickinson et al. 2010).

An action research study, informed by theoretical constructs from critical social theory (Fay 1987; Habermas 1972; 1984), emancipatory practice development (Manley, McCormack & Wilson 2008) and the transtheoretical model of change (Prochaska, Prochaska & Levesque 2001), enabled frontline nurses to work together to understand and improve the safety of medication administration within one ward in a tertiary children's hospital in New Zealand. Data were collected from participants and the researcher throughout the research journey using multiple methods including; questionnaire, interview, observation, review of reported medication incident data, meeting notes and reflective notes. Qualitative data were subjected to iterative thematic analysis and quantitative data were analysed according to the data instrument instructions.

An exploration of the clinical context and practice demonstrated that nurses' medication administration was mayhem; a habitual, distracted and inconsistent process undertaken

in a chaotic and disruptive environment. For nurses, there was a tension between striving to adhere to best practice in the face of many contextual barriers resulting in inconsistency in the safety of medication administration practice. Mindfulness allowed nurses to make sense of the mayhem of practice. It enabled them to see the mayhem, question practice, and develop safer ways of working to move beyond the MAYHEM to ensure MINDFUL medication administration. The Model for Improving the Safety of Medication Administration (MISMA) was developed to illustrate how becoming mindful can be used as a strategy to improve the safety of medication administration. The model can be used to guide nurses to critically analyse their own and team practice and develop, implement and evaluate evidence based improvements in practice.

CHAPTER 1 INTRODUCTION

This thesis examines the implementation and evaluation of an action research study informed by emancipatory practice development (Manley, McCormack & Wilson 2008) and the transtheoretical model of change (Prochaska, Prochaska & Levesque 2001) within a ward in a tertiary children's hospital in New Zealand. The intent was to improve the safety of medication administration through engaging frontline nurses in participatory processes empowering them to transform their practice, context and culture (Garbett & McCormack 2004). I worked with a medication action group (MAG) and ward nursing team, enabling them to understand what needed to change and how they could change it through achievable action strategies. All participants worked collaboratively within the programme, whether researcher, member of the MAG or ward nursing team. My role within the MAG varied over the course of the programme of work depending on the group's needs and was either directive or co-operative (Heron 1999). For example, I determined which tool the MAG would use while undertaking the observation of practice and provided the necessary guiding information whilst we worked together to develop an understanding of the data obtained from the observation of practice.

Data were collected from participants (researcher, member of MAG and ward nursing team) throughout the research journey using multiple methods; questionnaire, interview, participant and non-participant observation, review of medication incident data, MAG meeting notes and researcher reflective notes. Qualitative data were subjected to iterative thematic analysis as described by Braun and Clarke (2006) and quantitative data were analysed according to the data instrument instructions. Data analysis was undertaken in collaboration with the members of the MAG who reflected on the findings

as they were generated. These reflections were used to inform further action and data collection. The researcher synthesised the findings from the action research programme with current literature to develop an understanding of what happened during the action research process which resulted in improved medication safety.

1.1 Purpose of the Research

The aim of the research was to evaluate what effect a programme of action research incorporating emancipatory practice development methodology, would have on improving medication safety. To achieve this aim, the MAG investigated the ward context, explored current practice, analysed ward medication incident reports, and reviewed professional literature to enhance their understanding of the safety of their own and the nursing team's medication administration practice. This provided a starting point to develop, support and evaluate practice change.

1.1.1 Research objectives.

Specifically, the objectives of the action research programme were to:

1. Enable frontline nurses to critically analyse practice and implement change.
2. Further develop the body of knowledge on contextual factors that enhance or inhibit safe medication administration.
3. Develop a new model/approach to improving medication safety that is evaluated in practice.
4. Add to the evidence-base for emancipatory practice development as an approach for generating effective workplace cultures.

1.2 Significance of the Research

Medication administration errors remain a serious issue for patients, healthcare organisations and staff (AHRQ 2015; Hayes, Jackson, et al. 2015). The incidence worldwide of medication administration error varies between 10% to 45% of all doses administered by nurses to adults and children (Barker et al. 2002; Ghaleb et al. 2010; Greengold et al. 2003; Keers et al. 2013b; Koumpagioti et al. 2014; Lisby, Nielsen & Mainz 2005; Ozkan et al. 2011; Tissot et al. 2003; van den Bemt et al. 2002; van Gijssel-Wiersma, van den Bemt & Walenbergh -van Veen 2005). As medicines are the most common treatment used in healthcare, the incidence rate extrapolates to a very large number of patients. Barker et al. (2002) estimated that 7% of administration errors have the potential to seriously harm adult patients, such as permanent disability and death. Nearly a quarter of all medication administration errors in hospitalised children have the potential for serious harm (Holdsworth et al. 2003). In New Zealand, medication errors are the third leading cause of unintended serious patient harm (HQSC 2016). Several reviews highlight the extent of patient mortality from medication errors. One, conducted by the Institute of Medicine in 2004, estimated that in the United States of America, approximately 7000 patients die annually from medication errors (Bates 2007). A National Health Service Audit Commission report estimated that approximately 1200 patient deaths a year can be attributed to medication errors in England and Wales (Scott 2002). In New Zealand, a retrospective review of clinical records estimated that 150 patients die each year in hospitals from medication errors (Chuah 2009).

Medication administration errors impact the healthcare industry economically (Samp et al. 2014). Using a simulated model, Samp et al. (2014) estimated the mean cost of an individual medication error as US$88. By extracting and linking data from an

administrative database and a voluntary incident reporting system in 3 community hospitals in the United States of America, Paradis et al. (2009) identified that medication errors accounted for an estimated additional US$4 million in patient care costs and 2300 bed days over 2 years. The National Patient Safety Agency (NPSA) (2007) estimated that in the 2005-2006 financial year, inpatient medication errors cost the National Health Service £411 million. It has been suggested that up to 40% of the annual New Zealand healthcare budget is spent on patients who stay in hospital longer as a result of medication errors (Davis et al. 2002).

Furthermore, medication administration errors can have an effect on healthcare staff. Wu (2000) noted that doctors often feel distress and anger following a medication error and referred to themselves as a second victim. Nurses participating in a focus group acknowledged that they had suffered emotional and physical symptoms associated with making a medication error (Wolf et al. 2000). Treiber and Jones (2010) also noted that nurses commonly described emotionally devastating visceral responses to medication errors which were often incongruent with the severity of the error. Rassin, Kanti and Silner (2005) equated nurses responses to medication error, such as, a loss of professional respect, emotional distress, and feelings of anger, guilt, and inadequacy with post-traumatic stress disorder, while errors which result in serious patient harm have led to nurses leaving the profession (Schelbred 2007). Significantly, the majority of medication administration errors are preventable (Picone, Titler & Dochterman 2008). The incidence of medication administration errors and their consequences make this an important area for quality and safety improvement. Significant gains in patient safety within hospitals will only be achieved when the issues surrounding the safety of medication administration are tackled effectively.

Patient safety is a fundamental component of quality nursing care. Nevertheless medication administration within a busy clinical environment continues to test patient safety and wellbeing. Challenges to medication administration safety are frequently multifactorial in nature and embedded within the system (Brady, Malone & Fleming 2009). In other words, medication administration errors are rarely due to an isolated cause, or one person, but a cascade of events that collectively result in an error occurring (Walsh, Kaushal & Chessare 2005). Although individuals make mistakes, the characteristics of the healthcare system make this more likely, creating opportunities for medication administration errors to occur (Keers et al. 2013a). Increasingly complicated medication usage, complex healthcare systems and human factors increase the risk of something going wrong (Pape 2003). Medication administration complexity (Nolan 2000), nursing workload (Balas, Scott & Rogers 2004; Fry & Dacey 2007b; Stratton et al. 2004; Tang et al. 2007) and interruptions (Biron, Loiselle & Lavoie-Tremblay 2009; Westbrook et al. 2010) have been proposed as contributing to medication administration errors.

A large number of innovative interventions have been developed in attempts to reduce medication errors (Bates 2007; Keers et al. 2014). While some of these interventions work well within the controlled environment of a clinical trial or evaluation, there are few interventions that have been designed and evaluated within the complexity of everyday practice. Nurses' adherence with medication safety practices continues to be a problem (Gill et al. 2012; Kim & Bates 2013; Raban & Westbrook 2014) because of the perceived and real impact on their daily practice (Halbesleben et al. 2010) resulting in a progressive drift in practice (Amalberti et al. 2006). Interventions to improve medication

safety are needed that are explicitly aimed at addressing the issues that occur in the 'real world' (Vincent & Amalberti 2016).

Nurses' central role in medication administration puts them in the ideal position to intercept prescribing and dispensing errors in addition to administration errors (Alsulami, Choonara & Conroy 2014; Dowdell 2004). Indeed, nurses have been shown to be the most likely health professional to stop medication errors reaching the patient (Halbesleben et al. 2008; Kohn, Corrigan & Donaldson 2000). However, inadequacies in nurses' checking systems during administration can enable errors from the earlier stages of the process to reach the patient undetected (Stratton et al. 2004). Administration of medicines is a complex process involving selecting, calculating, mixing, measuring and ensuring that the right person receives the right medicine in the right dose, at the right time, by the right route, and for the right reason (Manias 2014). To administer medications safely, traditionally nurses are taught the five rights (right medicine, right dose, right time, right route, and right patient) of medication administration, however the ability of the five rights to keep medication administration safe is questionable. Indeed the seemingly routine nature of medication administration can decrease nurses' attentiveness to the medication administration process (Dickinson et al. 2010). Nurses provide a safety defence against medication errors but, at the same time, have the potential to place patients at risk (Pape et al. 2005).

Nurses' contribution to the medication process is often not considered when examining ways to improve medication safety. Patient safety outcomes have been shown to be related to the quality of the nursing practice work environment (Laschinger & Leiter 2006) with empowering work conditions inspiring nurses engagement with practice

(Laschinger, Finegan & Wilk 2009). Thus medication safety improvement which focuses on empowering nurses through collaboration, inclusion and participation in the change process hold some promise.

1.3 Background

When used safely, medicines contribute to significant improvements in the health and well-being of patients. However, medication errors have been identified as the single most preventable cause of patient harm (Kohn, Corrigan & Donaldson 2000). Thus improving medication safety has become a priority for healthcare organisations. Despite considerable effort devoted to medication errors since the publication of the Institute of Medicine seminal patient safety reports; To Err is Human (Kohn, Corrigan & Donaldson 2000) and Crossing the Quality Chasm (Institute of Medicine 2001), most of the literature is still largely focused on describing the problem rather than presenting effective solutions (Stryer 2004).

1.3.1 Identifying medication error.

The Institute of Medicine estimates that every inpatient is subjected to at least one medication error per day (Bates 2007). Published medication error rates, in diverse study contexts, vary substantially depending on how the authors have identified the errors (Gandhi, Seger & Bates 2000), collected and reported the data. The most common methods used to identify medication error are direct observation, chart review, and voluntary incident reporting. In a large study involving over 2500 doses of medication across 36 U.S. hospitals, Flynn et al. (2002) demonstrated that direct observation was a more rigorous method than chart review and voluntary reporting. Direct observation detected 457 errors (11.7% error rate) compared with 17 errors detected by chart review

(0.7% error rate), and one error detected by incident report review (0.04% error rate) (Flynn et al. 2002). In a study involving 3160 medication prescriptions for hospitalised children in New Zealand, Kunac and Reith (2008) demonstrated that chart review was the most effective method of identifying medication error compared with attendance at multidisciplinary ward meetings, voluntary staff reports and the hospital incident reporting system. Chart review identified 83% of medication errors compared with only 0.5% via the hospital incident reporting system. However a further 14.6% of errors were identified by hospital staff using the study voluntary reporting process, but not submitted to the hospital routine incident reporting system (Kunac & Reith 2008). Thus it appears that direct observation is the superior method of detecting medication error followed by chart review and then voluntary reporting.

The low rate of medication error captured by hospital voluntary reporting systems distorts the picture of medication errors. Prescribing and administration errors are frequently not captured in hospital voluntary incident reporting systems (Westbrook et al. 2015). Westbrook et al. (2015) compared the findings of an audit of 3291 patient records and an observational study of 7451 medication administrations with medication incident reports for two Australian hospitals. Of 12567 identified prescribing errors, only 1.2/1000 errors had been reported. None of the 2043 errors observed drug administration had an associated incident report. Despite voluntary reporting significantly understating rates and patterns of medication error, this is the most commonly used method of detecting medication error in daily practice. As chart review and direct observation are more costly and time consuming, they tend to be used as research tools (Gandhi, Seger & Bates 2000). The low error rates produced by voluntary reporting in clinical practice

may partially explain why, in my experience, nurses commonly perceive that medication error is not really a big problem and the challenge of 'getting the job done' takes priority.

A factor which may contribute to underreporting in clinical practice is how medication errors are managed. Management of medication errors are influenced by the prevailing culture within healthcare organisations (Khatri, Brown & Hicks 2009). Prior to the 1990s, nurse leaders managed medication errors by urging individuals to work more carefully. Perfect performance was expected, and felt to be achievable through education, vigilance, and professional care. The threat of disciplinary action for medication errors was believed to be necessary to maintain safety vigilance (ISMP 2006). The prevailing thought at the time was that individual workers were fully and solely accountable for medication errors. The effect of this punitive culture was to push medication errors underground (Institute of Medicine 2001). Frontline nurses were afraid to report their own errors or those of colleagues. In response to the shortcomings of a punitive culture, by the mid-1990s, a 'no-blame' response to medication errors was advocated. This response recognised that most unsafe acts were the result of mental slips or lapses or honest mistakes that were rooted in system weaknesses (Reason 1990). However, a 'no-blame' culture can inadvertently lead to lack of accountability if nurse leaders do not tackle individuals or practices which use unsafe behavioural choices. Thus, a wholly blame-free culture is not desirable (Walton 2004; Waring 2007). A new, 'just culture' with 'balanced accountability' is advocated (Pronovost et al. 2003). In other words, the contribution of both human and system weakness in medication error is acknowledged. Individual practitioners should not be held accountable for mistakes made in a system that they have no control over.

Differences in the practice culture may explain some of the variance in published error rates. A culture of blame continues to prevail in some healthcare organisations (Khatri, Brown & Hicks 2009) and punitive responses to errors remain commonplace (Cooke 2006). Medication errors are less likely to be reported in organisations with a blame culture due to the fear of punishment (Mayo & Duncan 2004). Within New Zealand, there are three key pieces of legislation that influence healthcare culture relative to medication error; the Accident Compensation Act 2001 (*Accident Compensation Act 2001*), the Health and Disability Commissioner Act 1994 (*Health and Disability Commissioner Act 1994*) and the Health Practitioners Competence Assurance Act 2003 (*Health Practitioners Competence Assurance Act 2003*). The Accident Compensation Act permits the Accident Compensation Corporation (ACC) to provide comprehensive, no-fault personal injury cover for all New Zealand residents and visitors. The legislation includes claims for treatment injuries, that is, costs associated with injuries resulting from healthcare treatment. As a result, no one can sue an individual healthcare professional for harm arising from a medication error. However, this is not synonymous with a 'no-blame' culture.

The Health and Disability Commissioner (1996) published the Code of Health and Disability Services Consumers' Rights, which grants ten rights to all consumers of health and disability services in New Zealand and places corresponding obligations on providers of those services. Particularly relevant to medication error are *Right 6: the right to be fully informed and Right 4: the right to services of an appropriate standard.* Right 6 of the Code provides the expectation that healthcare professionals will openly disclose any medication errors to healthcare consumers. Healthcare consumers may register a complaint regarding a medication error with the Health and Disability

Commissioner's office. The Commissioner's staff will review and investigate the complaint. The healthcare organisation or professional may be found to be in breach of Right 4 of the Code. The recommended actions may include notification to the relevant professional organisation, in the case of a nurse this would be the Nursing Council of New Zealand. Under the Health Practitioners Competence Assurance Act, the Nursing Council will review the case against its Code of Conduct (Nursing Council of New Zealand 2012), in particular *Principle 4: maintain health consumer trust by providing safe and competent care* and decide if any further action is required, such as putting limitations on the nurses practising certificate. Clinical leaders in the healthcare organisation may also refer an individual to their professional body for review of competence. Thus New Zealand legislation supports a just culture, which is further promoted by the executive leadership of the healthcare organisation where the action research study presented in this thesis took place.

1.3.2 Defining medication error.

In addition to the issues associated with reporting, the variation in medication error rates between studies can, in part, be explained by the use of different definitions. Studies which use a restrictive definition of medication error identify lower rates of error while studies with less restrictive definitions identify higher rates of error. Many researchers consider the severity of the errors which are important from the patient's perspective (Kelly & Wright 2011). For instance, a study which only focused on serious adverse medication events showed that these occurred in 0.9% of hospital admissions (Hoonhout et al. 2010) compared with 50% of hospital admissions associated with any adverse medication event in another study (Dequito et al. 2011). Definitions of medication error vary across the literature (Ackroyd-Stolarz, Hartnell & MacKinnon 2006). This is

particularly highlighted when it comes to medication administration. Some studies include time errors, e.g. the medicine is given one hour earlier or later than it was prescribed for, while other studies ignore them. As the majority of medication administration errors are either omissions or wrong time of administration (Fontan et al. 2003), the studies which include time errors will have a larger rate of error compared with studies which ignore them. In a study evaluating the rates and types of medication administration errors on a paediatric ward, comparing handwritten prescriptions and ward stock dispensing system, with computerised prescription and unit dose dispensing system, the administration error rate fell from 23.5% to 11.7% when administration time errors were excluded (Fontan et al. 2003).

Early definitions of medication error identified an error as any deviation from the physician's order (Cooper 1995). This definition promoted the view that nurses have sole responsibility for error and clearly excluded prescription errors. The substantial evidence which recognises that a large proportion of errors occur during prescribing (e.g. Kaushal et al. 2001; Kunac & Reith 2008; Miller et al. 2007) has required further refinement of the definition. Some definitions of medication error have, in addition to deviation from the prescription, included deviation from hospital policies or manufacturer's instructions (Taxis & Barber 2003). Other definitions have attempted to include all stages of the medication delivery process and the influence of systems and processes in errors, in an attempt to move the focus of errors from the actions of individuals to a systems focus.

The Australian Council for Safety and Quality in Healthcare[1] (2002, p. 84) has defined medication error as "a failure in the (drug) treatment process that leads to, or has the potential to lead to, harm to the patient and includes an act of omission or commission'. Subsequently, this definition has been tested and found to correctly categorise medication error (Yu, Nation & Dooley 2005). This is the definition used within this thesis and incorporates medication error which occurs when the medication delivery process does not reach an attainable standard. This includes any stage of the process from, prescribing, dispensing, and administration through to subsequent monitoring of medication effects. Medication error can result in an actual or a potential adverse drug event (ADE). An adverse drug event is unintended harm associated with medication use rather than the patient's underlying condition (Brennan et al. 1991). A potential adverse drug event is where a medication error occurs but results in no patient harm either, because of chance, or the error is recognised and action taken before the error reaches the patient. For example, if a patient was prescribed a medication they were allergic to but the nurse discovered the allergy and withheld the medication. Some adverse drug events can happen when there has been no medication error and these are called adverse drug reactions (ADR), such as an allergic reaction to a medication in someone not previously given the medication.

1.3.3 Medication safety.

Medication safety is more than the absence of medication error. Medication safety comprises the use of activities which aim to prevent inadvertent harm to patients as a

[1] Former name of the Australian Commission of Safety and Quality in Health Care

result of the use of medications (AHA, HRET & ISMP 2002). This means that the choices related to medications, such as the medicine itself, dose, frequency of administration, and route of administration are appropriate for the individual patient. For inpatients, medication safety also means that medications are administered using safe medication administration practices. A number of interventions have been developed in attempts to improve medication safety (Bates 2007; Miller et al. 2007). Some interventions are expensive and technologically complex, while others are less complex and aimed at individual behaviour change. The interventions have been tried with varying success and sustainability in improving practice (Wulff et al. 2011). The literature on medication safety interventions is explored in chapter two.

In summary, medication administration errors continue to be a major cause of concern within clinical practice. There is a large variation in published medication error rates due to differences in how errors are defined and identified, how data is collected and reported, and the diversity of study contexts. Evidence suggests that medication errors are more harmful for children. A lack of sustainable improvement in medication safety confirms the critical need to find new ways of generating medication safety practices that fit with the day-to-day realities of clinical practice. Nurses are the final step in the medication administration process to inpatients and are in an ideal position to lead medication practice improvement (Cullen, Bates & Leape 2000; Rothschild, Landrigan, et al. 2005).

1.3.4 Positioning of the researcher.

When considering potential research topics for doctoral study, I sought counsel from a number of colleagues. I was consistently advised to select a topic that had personal

interest and in which I had a passion to see practice change. This advice helped to clarify my focus. I realised that the research topic had in fact chosen me and that my research journey had started long before my enrolment in a professional doctoral programme. The personal and professional experiences that have shaped my nursing practice over the previous twenty years has long inspired my curiosity into how to improve medication safety. I first became aware of the effects of medication administration errors on children, their families and nurses as a new nurse in practice. Despite many changes in clinical practice over the intervening years, one thing remains the same, medication administration errors continue to occur with potentially devastating effect.

The action research study reported in this thesis was part of a continuation of a programme of work within a tertiary children's hospital in New Zealand aimed at improving medication administration. Previously, I developed and led an annual educational campaign to raise awareness of medication safety. An educational improvement strategy was selected as it was perceived to be a relatively inexpensive initiative which could reach the maximum number of healthcare professionals, with considerable potential to reduce the risk for patient harm caused by medication errors. In addition, the strategy fitted in with the organisation's approach to quality improvement at the time. The annual campaigns had either a general focus, such as the five rights of medication administration or a specific focus, such as an independent double check as best practice. As part of developing the independent double check campaign, a qualitative descriptive study was undertaken to ascertain local nurses' current understanding and practice in regard to double checking medications (Dickinson et al. 2010). This revealed that while paediatric nurses viewed independent double check as best practice, there was confusion around what constituted an independent double

check. A number of environmental factors which interfered with the nurses' ability to prepare and administer medications according to best practice and hospital policy were also identified. The findings of this work were used to develop a standard approach to independent double checking which was added to the hospital policy and used in the development of the educational campaign.

Unsurprisingly, the annual education campaigns have met with limited success. While there have been initial changes in practice, demonstrated through clinical practice audits, neither the changes to practice nor the impact on medication errors have been sustained (McCall 2008, 2009, 2010, 2011). A similar finding has been described in the literature. Dennison (2007) found no change in nurses' behaviour or the number of reported medication errors following a medication safety education programme. I have come to realise that the approach that I have used to date has largely been concerned with disseminating information (evidence) to nurses and expecting practice change without necessarily thinking about how practice change is actually achieved. As I reflected on these experiences and my understanding of the medication safety literature, I started to question why change is so difficult to achieve, and what approach might be effective in achieving sustainable change. About this time I attended a Practice Development Conference and became interested in potentially using emancipatory practice development processes to achieve sustained improvements in medication safety and started on my doctoral journey.

McCormack and Garbett (2003) suggest that 'credibility' of practitioner-researchers is a key factor in the success or otherwise of practice development projects. My clinical credibility was based on extensive experience as a paediatric nurse and educator of the

day to day reality of medication practice. In my current position of Clinical Nurse Consultant, I am responsible for supporting nursing practice improvement. The opportunity of working with different groups of nursing staff on different practice projects afforded by this role supported my standing as a facilitator amongst the nursing staff. Thus my experience and knowledge had ideally positioned me to undertake this research.

I am neither insider nor outsider, neither a clinical bedside nurse nor manager, and yet in the role of Clinical Nurse Consultant I am able to walk in both worlds (Bonner & Tolhurst 2002). I have no direct governance over the clinical nurses and am not part of the ward leadership team but have insight into both aspects of nursing practice. My clinical experience has given me the insight necessary to understand and acknowledge the difficulties nurses face when administering medications in a busy ward. My previous research experience and academic study has enabled me to look beyond the immediate and obvious difficulties, such as short staffing and a lack of resources and strive to recognise the underlying influences on our nursing practice. I am particularly interested in how routines and rituals continue to govern our medication practice and this has been a frequent and frustrating conversation with many colleagues and provided an impetus for this study.

The researcher in an action research study openly acknowledges their bias to the other participants (McIntyre 2008) to enable them to be an active participant in all aspects of the research and activities. I recognised the need to continually question my own assumptions and perceptions of medication safety. I was aware that what I thought was important may not be the same for frontline nurses. I needed to remain alert that I did

not use my experience to define the problem for potential participants, rather than facilitating the ward nurses to define the problems in their practice. It is the frontline nurses who are best able to look at their medication practice and decide what is relevant and feasible with regard to determining solutions. I used a critical companion (Titchen & McGinley 2003a) to enable my critical reflection during the action research study.

1.4 Structure of the Thesis

This thesis is presented in seven chapters. This first chapter has identified the aim and objectives of the action research study presented in this thesis. An introduction to the difficulties in improving medication safety has been presented and why a new approach to improving medication safety for hospitalised children is crucial. The literature on the complexity of improving medication safety is explored further in chapter two.

In the second chapter, I have examined the literature on the challenges to safe medication administration. I present the literature from two perspectives; an integrative review of what is known in relation to the challenges to safe medication administration and narrative appraisal of proposed evidence based interventions to improve medication safety.

The literature concerning implementation of evidence based practice change is presented in chapter three. The literature discussed was drawn from evidence-based practice, diffusion of innovation, behavioural change theory and practice development. The knowledge generated from this review was used to inform the conceptual framework and confirm the choice of action research method for the intended study.

I have provided an account of the conceptual framework underpinning the research and the study design and methods employed to meet the research aim and objectives in chapter four. Action research is examined as it pertains to this study and methods of data collection and analysis are described. An overview of the three action spirals of the study are presented. The chapter concludes with a discussion of the ethical issues that were considered for the study.

Chapter five reports the study findings, providing a rich description of the action research journey examining medication administration and capturing the transformation of context, culture and practice. The themes that emerged from the data synthesis and the picture of medication practice which emerged at the beginning and conclusion of the study are presented.

In chapter six, the findings from the action research programme are synthesised with current literature to develop an understanding of what happened during the action research process which resulted in improved medication safety. The chapter concludes with the presentation of a new model for improving the safety of medication administration which emerged from practice. Chapter seven provides a conclusion for the study. The reflections of the researcher in undertaking the study are presented. Consideration is given to the inherent limitations of the study and potential implications of the study findings for practice, education and research are identified.

1.5 Conclusion

In this first chapter, I presented the background to the study. While we can't accurately determine how big a problem medication error is, there is agreement that it is a significant problem with some evidence that medication error causes more harm in child

healthcare settings. Notwithstanding, it is critical to find ways of improving the safety of nurses medication administration practice. I offered the reader an insight into my values and beliefs on medication safety and working with practitioners to change practice and improve patient safety. Building on this introduction, the substantial body of literature concerned with the medication process is reviewed in the following chapter.

CHAPTER 2 LITERATURE REVIEW PART ONE: MEDICATION SAFETY

The previous chapter provided an introduction to the complex problem of improving the safety of nurses' medication practice. It highlighted a large variability in published reports which generally underestimate the actual rate of medication errors owing to inconsistency in defining, identifying and measuring them (Johnson & Young 2011). While a large proportion of professional literature has been concerned with documenting medication incidence rates, there is no acceptable rate of medication error and adverse patient outcomes associated with medication errors remains unacceptably high (WHO 2014). It is time to change the emphasis from quantifying the problem to focus on how to improve the healthcare system to prevent medication errors. For hospitalised patients, nurses' medication administration presents a final opportunity to identify and intercept errors. Interventions are needed that improve patient safety through safe medication administration practices which will reduce errors. The key to successful implementation of medication safety interventions is to understand how and why errors occur. In this chapter an integrative review of the extensive and diverse literature concerned with improving the safety of medication administration is presented.

2.1 Review Method

An integrative review, as described by Whittemore and Knafl (2005), allowed for the inclusion of a broad and diverse range of literature in order to fully understand the phenomenon of medication safety. The purpose of the review was to establish the latest evidence on the challenges faced by nurses in safely administering medications in hospital, and to identify and appraise the interventions that have been proposed to improve the safety of the medication delivery process. Specifically looking at whether

the interventions effectively reduced medication administration errors and improved medication safety for children in hospital. A systematic approach to searching the literature was undertaken.

2.1.1 Criteria for considering studies.

Types of studies

Systematic review, controlled and uncontrolled clinical trials, qualitative and descriptive studies that explored the medication delivery process were considered. Case reports of an individual medication error were excluded.

Types of participants

The review considered articles that involved medication administration in clinical areas of hospitals in which nurses are predominantly the professional who administers the medication. Therefore articles which mainly featured anaesthesia or pharmacy departments were excluded as were studies based in ambulatory, residential or community settings. Articles which included nurses, nursing students or captured nursing practice through a whole of system approach were included, whereas articles that focused on doctors or medical students were excluded. Due to the smaller number of articles exclusively focused on children, the search was not limited to children. Where possible, the review presented compares and contrasts adult and paediatric focused literature.

Types of interventions

All interventions used to increase medication safety by reducing medication administration errors in hospitals were considered. As nurses are the final safeguard in

the medication delivery process, all components of the medication process were included:

- computerised physician order entry
- bar coding
- electronic medication administration record
- SMART pump
- clinical pharmacist
- medication safety education programmes
- incident reporting
- standardised medication chart
- double checking

Types of outcomes

The main outcomes of interest were the number of medication errors and indicators of medication safety, such as interruptions during medication administration, were considered. Reports of specific adverse drug reactions and drug trials were excluded.

2.1.2 Search strategy.

Figure 2-1 provides details of the literature selection process. A three stage process was employed. A systematic search of MEDLINE and CINAHL Plus was undertaken for English language articles published since the landmark report "To Err is Human" (Kohn, Corrigan & Donaldson 2000) up to and including December 2016. The MeSH terms, *Medication System, Hospital* and *Medication Errors* and key words; *medication administration*, OR *medication administration safety* OR *medication administration error* were used. The second stage involved undertaking a search using the names of the specific medication safety interventions. Tables of all included studies for each of the interventions in this part of the review are provided in Appendix A. In the third stage,

reference lists of retrieved articles were searched to identify additional publications. Consistent with action research, the literature search was continued throughout the research journey to respond to the "reflexive and unpredictable nature of a problem solving approach" (Morton-Cooper 2000, p. 37).

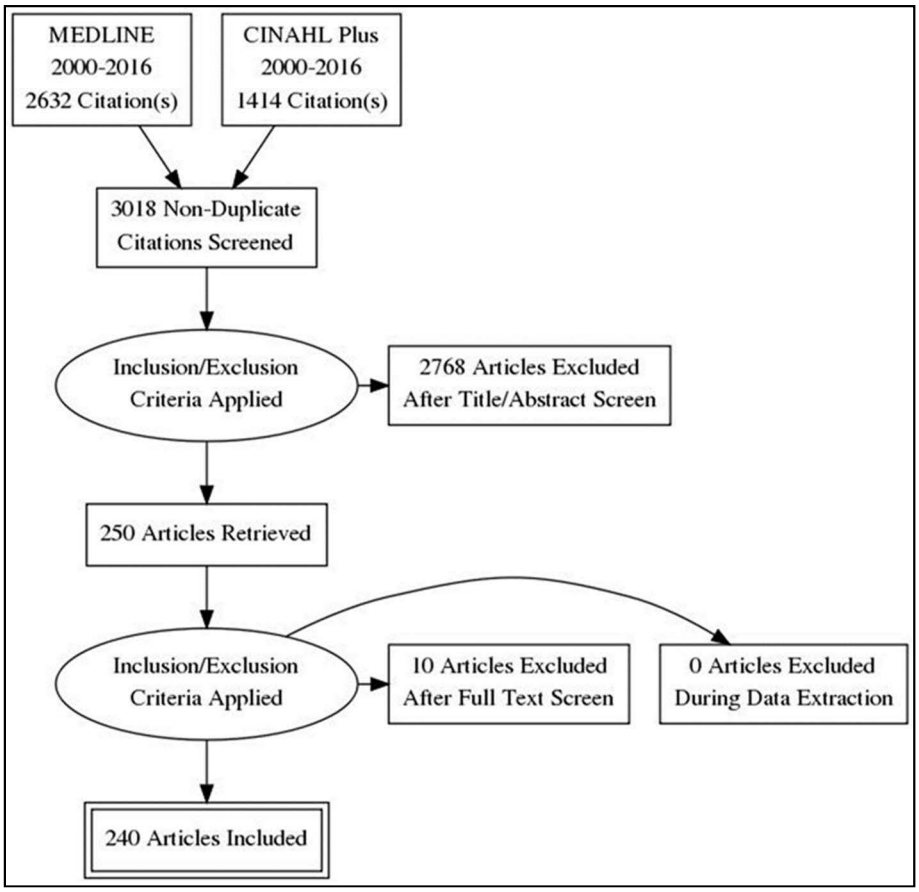

Figure 2-1 Flow diagram of article selection process

The search resulted in 240 articles, from different levels of the evidence pyramid (Figure 2-2), included in the review. The articles ranged from systematic reviews of clinical effectiveness of proposed medication safety interventions to nurses self-reported perceptions of contributory factors to medication error. The majority of literature was focused on adult patients with approximately a third including both adults and children and ten percent focused solely on children. The majority of literature originated in the

United States, followed by Europe, Australia and New Zealand. There were three dominant themes identified from the literature; quantification of medication error rates (presented in chapter one), challenges for nursing practice, and interventions proposed to improve medication safety. The initial analysis presented in this chapter assimilates qualitative findings regarding the challenges to safe medication nursing practice. This is followed by a synthesis of medication safety intervention literature which integrates both quantitative studies of effectiveness and qualitative studies that explore nurses' views and perceptions of these interventions.

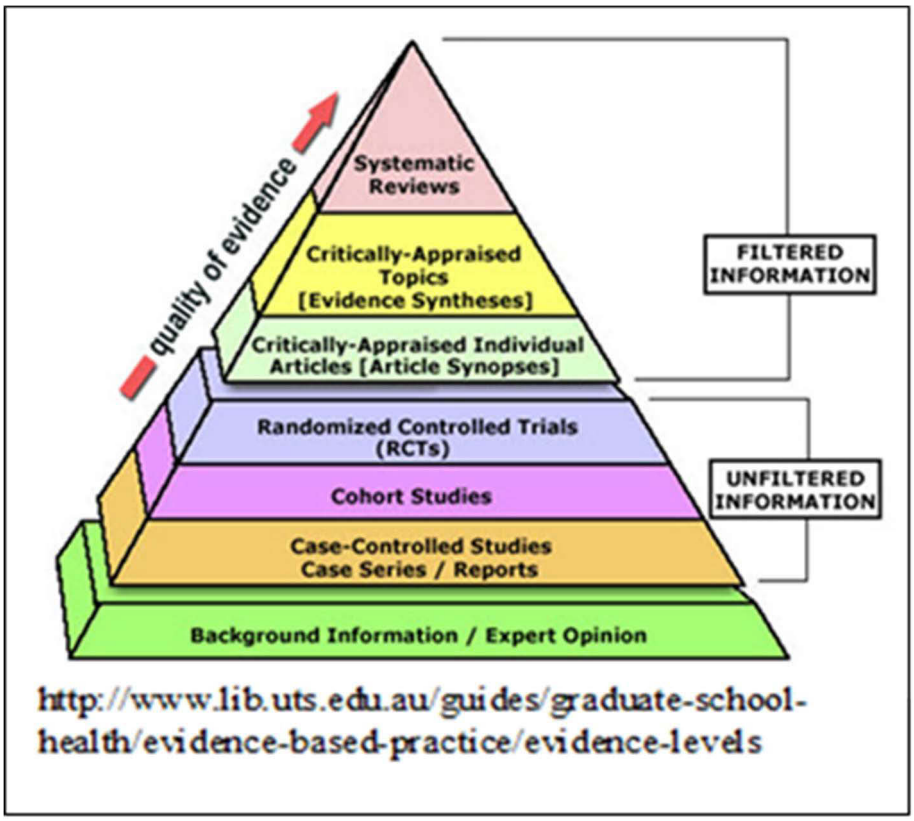

Figure 2-2 Level of evidence pyramid

2.2 Medication Safety: Challenges for Nursing Practice

Medication administration is an important part of delivering quality nursing care. Nurses work hard to maintain safe medication administration practices as medication delivery becomes increasingly more complex. Not only has there been a large increase in the number of available medications, there are different formulations of the same medication, increasingly similar sounding medications and a greater variety of ways of administering medications. Today, the process of medication delivery to inpatients is highly complex, involving many interdependent processes and healthcare professionals with a resultant increase in the risk of something going wrong during medication delivery. The British Nursing and Midwifery Council note that medication administration is "an important aspect of the professional practice" of nurses and "is not solely a mechanistic task to be performed in strict compliance with the written prescription of a medical practitioner… It requires thought and the exercise of professional judgement..." (NMC 2010, p. 3). Nurses are indeed the final safeguard in the medication delivery process to hospitalised patients. Their central role in medication administration puts them in an ideal position to identify and manage errors made in earlier parts of the process (Cullen, Bates & Leape 2000; Rothschild, Landrigan, et al. 2005).

Challenges to medication safety are multifactorial in nature. A number of literature reviews (Armitage & Knapman 2003; Brady, Malone & Fleming 2009; Fry & Dacey 2007a; Gonzales 2010; McBride-Henry & Foureur 2006) and individual studies on the causes of medication error (Manias et al. 2014; Mayo & Duncan 2004; Ozkan et al. 2011; Sears et al. 2013, 2016; Ulanimo, O'Leary-Kelley & Connolly 2007) have identified factors related to patients, nursing, and system. Patient factors relate to the

characteristics or attributes of patients that place them at increased risk of experiencing a medication error. Nursing and system factors, respectively, relate to the characteristics of nurses and nursing practice and organisational characteristics that contribute to the relative risk of medication errors. While it is helpful to use this framework for thinking about the contributing factors to medication administration error it is important to remember that it is the interplay of many factors that result in a medication error reaching a patient.

2.2.1 Patient factors.

While all patients are at risk of a medication error (Wolf et al. 2000), there are patient populations considered at increased risk of medication error; such as patients on multiple medications (Benner et al. 2002), those who cannot communicate, for example patients in intensive care or peri-operative setting (Hicks et al. 2007; Kane-Gill, Jacobi & Rothschild 2010; Kopp et al. 2006) and children (Ghaleb et al. 2006; Manias et al. 2014; Miller et al. 2007). Safe medication administration for children is inherently more complex providing more challenges and opportunities for error when compared with adult inpatients. Children are at particular risk of certain errors, such as 10-fold dosing errors facilitated by mistakes in dose calculation, poor documentation of decimal points and confusion with the use of zeros (Doherty & McDonnell 2012). Moreover, adult medications typically have one standard dose with one type of preparation (tablet or capsule). In contrast, medications for children involve weight-based dosing requiring several calculations and often multiple preparations (infant drops, solutions, chewable tablets, and capsules) or preparations which have been made for adults (Levine & Cohen 2007). Nurses have to work out the correct proportion of medication to be administered. To illustrate the challenge; an infant is prescribed 100mg of cefuroxime to be

administered intravenously every 8 hours. The nurse has to establish if the amount prescribed is appropriate for the infant's weight. In this case, the infant's weight is 5kg, meaning that the prescribed dose is 20mg/kg and the total daily dose is 60mg/kg both of which are appropriate (NZFC 2017). The available preparation of Cefuroxime is either 750mg or 1.5gm powder for injection. The nurse selects the 750mg vial and adds 6mL of water as per the medicines data sheet. The nurse notes that the final reconstituted solution equals 750mg in 6.3mL due to powder displacement. The nurse has to calculate the correct volume of solution to administer (100 ÷ 750 x 6.3 = 0.84mL) and accurately measure this in an appropriate sized syringe. Children are reliant on nurses to administer their medications appropriately. The National Reporting and Learning Service for England and Wales, demonstrated that medication errors were the most commonly reported incident type in the child population (Cass 2016). Ferranti et al. (2008) found medication errors to be three times higher in paediatric patients than adult patients. High quality systematic reviews suggest that medication errors occur in up to one in four (5% to 27%) of all medications prescribed for children (Ghaleb et al. 2006; Kaushal et al. 2004; Keers et al. 2013b; Miller et al. 2007; Rinke et al. 2014). Interpretation of the review findings is difficult due to the large variation in definitions, identification methods and outcome measures (as previously discussed) used in the included studies.

More importantly, the pattern of medication error seen in child healthcare is different from that in adult healthcare. For adults the majority of errors are shared evenly between prescription and administration. A seminal study carried out by the Adverse Drug Event (ADE) study group, identified that within adult healthcare, 38% of medication errors were prescribing errors and administration errors accounted for a further 39% (Bates et al. 1995; Leape et al. 1995). Importantly, the ADE study also identified that nurses

intercepted 86% of medication errors that were made during prescribing and/or dispensing in contrast with only 2% of medication administration errors (Leape et al. 1995). While the authors acknowledged that the majority of prescribing errors were intercepted, this did not appear to influence their subsequent medication safety work, which focused on the merits of Computerised Physician Order Entry (CPOE) to reduce prescribing errors. This may be because the majority of early medication safety researchers were doctors and thus it seemed natural to focus on prescribing errors. In addition, doctors' illegible handwriting was a recognised contributory factor to medication safety problems (Mayo & Duncan 2004). In child healthcare, the highest rate of error is during administration (Miller et al. 2007). The systematic review of peer reviewed studies on preventable paediatric medication errors undertaken by Miller at al. (2007) identified that 72-75% of medication errors occurred during administration. While CPOE is aimed at the prescribing end of the medication delivery process, most of the challenges to medication safety for children occur at the administration end of the process (Miller et al. 2007). Children in hospital are at risk from a larger proportion of errors being made at the point in the medication delivery process which is most vulnerable to error; medication administration. It would seem reasonable to argue that a focus on improving medication safety at the point-of-delivery may have advanced medication safety for children further within the same timeframe.

2.2.2 Nursing factors.

There are several individual nurse characteristics proposed to increase the risk of medication administration errors; fatigue, lack of knowledge, mathematical skill, nursing experience, and variation from procedure, (Brady, Malone & Fleming 2009; Deans 2005; Hand & Barber 2000; Mayo & Duncan 2004; Tang et al. 2007; Ulanimo,

O'Leary-Kelley & Connolly 2007; Williams & Davis 2016). Fatigue and tiredness has featured as contributing to medication administration errors in several studies (Deans 2005; Hand & Barber 2000; Jones & Treiber 2010; Tang et al. 2007). In the survey conducted by Jones and Treiber (2010), responses from nurses who had been involved in a medication error, indicated that they made errors when they worked overtime and particularly on night shifts. Nurses also reported that not taking adequate breaks contributed to fatigue and medication errors. Several studies have used a survey instrument originally developed by Gladstone (1995). The Gladstone Instrument requires nurses to rank a list of 10 items according to how much they perceive each item contributes to medication errors. Nurses consistently ranked fatigue within the top three (Deans 2005; Mayo & Duncan 2004; Ulanimo, O'Leary-Kelley & Connolly 2007; Unver, Tastan & Akbayrak 2012). Care is required in interpreting these findings as data generated through self-report surveys could be based on general nursing opinion rather than experience of specific errors (Mayo & Duncan 2004; Ulanimo, O'Leary-Kelley & Connolly 2007). In addition, using a predetermined list may inadvertently lead nurses to choose an item they would not otherwise have reported.

To administer medication effectively and safely requires several skills (Sulosaari, Suhonen & Leino-Kilpi 2011), not least the ability to calculate medication dosages accurately (Pentin, Green & Smith 2016). The ability to calculate medication dosages accurately can be influenced by mathematical anxiety (Williams & Davis 2016). Maths anxiety can be reduced by a supportive environment and tailored learning opportunities to practise medication dosage calculations. Poor mathematical skills has long been argued as an important factor leading to medication error (Armitage & Knapman 2003)

with calls to reconsider how nurses are taught medication calculations (Wright 2008) as a way of improving medication safety.

The research which emphasises nurses' poor calculation skills has been generated using written tests in a classroom setting. Thus it is unclear if nurses' calculation skills are a concern in clinical practice. In large studies of medication errors in adult healthcare settings, incorrect calculation during medication preparation is not clearly identified as a cause of errors (Barker et al. 2002; Winterstein et al. 2004). The closest reported category is wrong dose, but this is not necessarily indicative of wrong calculation. Barker et al. (2002) undertook a prospective observational study of adult inpatient units across 36 U.S hospitals. The study defined wrong dose, but did not include miscalculation within this definition. Winterstein et al. (2004) sought voluntary reports of medication error in one U.S. hospital. While incorrect dose was identified as a cause of error, the authors reported a lack of knowledge of correct dosage as the only contributing factor and miscalculation was not mentioned. These findings signal, perhaps, the infrequent need for calculations within adult healthcare settings and thus miscalculation is reasonably less likely to be highlighted as a cause for error.

In contrast, several large retrospective reviews of paediatric medication errors suggest miscalculation is a cause of medication errors (Cowley, Williams & Cousins 2001; Hicks, Becker & Cousins 2006; Manias et al. 2014; Ross, Wallace & Paton 2000). Hicks, Becker and Cousins (2006) reviewed 5 years of paediatric medication error data from the United States Pharmacopeia (USP) MEDMARX Reporting System and found that wrong dose was associated with miscalculation, incorrect patient weight, confusion between units such as milligrams and micrograms, and confusion between weight and

volume, e.g. where 0.4mg was prescribed and 0.4mL was administered. Similarly, in a previous review of MEDMAX paediatric data, Cowley, Williams and Cousins (2001) found 4% of errors reported were caused by miscalculation. Ross, Wallace and Paton (2000) identified 5/195 (2.5%) of medication errors were ten-fold dose errors as a result of miscalculation in one U.K. hospital over 5 years. In a retrospective review of medication errors reported to an online incident facility at an Australian children's hospital over a 4-year period, Manias et al. (2014) identified that miscalculation of dose or infusion rate was responsible for 521 (8.6%) of medication errors. As these paediatric studies relied on voluntary error reports, the number of errors are likely to be substantially underreported and the actual number of errors due to miscalculation may be a bigger problem than the evidence suggests. Hence, there is some low quality evidence supporting miscalculation as a cause of medication errors within child healthcare. However, perceived higher level evidence, in the form of a systematic review, examining whether nurses' calculation skills led to medication errors in clinical practice, concluded that there was insufficient evidence to support nurses' mathematical skill as a major contributory factor in medication error (Wright 2010). A potentially important message is lost when paediatric data is combined with adult data.

Despite the apparent lack of supporting evidence, researchers and educators have invested time and effort into developing alternative ways of strengthening nurses ability to undertake medication calculations from workshops to computer based education programmes (Grugnetti et al. 2014; Harne-Britner et al. 2006; McMullan, Jones & Lea 2011; Sherriff, Burston & Wallis 2012). Interestingly, none of these programmes were specifically aimed at paediatric nurses or were set in clinical practice. In other words, potential interventions to improve medication safety did not reflect current evidence.

There is some evidence that specific education on medication calculations in the clinical practice setting, should be provided for nurses in child healthcare settings to improve medication safety.

Looking at the role experience plays in medication error, nurses with limited experience may be more likely to make errors because of insufficient knowledge and skills. Smith and Crawford (2003) found that half of the newly qualified nurses in their study had been involved in medication errors, suggesting there may be a relationship between a lack of experience and medication errors. The risk of making a medication error should decrease as nurses develop medication safety related knowledge and skills through experience as a registered nurse. The evidence suggests that reality is not that straightforward. Experienced nurses are less likely to make severe medication errors but more likely to make less severe errors (Chang & Mark 2009; Sears et al. 2016). Chang and Mark (2009) used self-reported surveys and compared the findings with a retrospective review of medication incident reports from 279 nursing units in U.S. hospitals, to investigate the predictors of medication error. They found that the greater the level of nursing expertise, as determined by the average length of time nurses had worked on the ward, the fewer medication errors which caused harm and the more errors which did not cause harm were reported for the ward. The study setting was adult healthcare and the cost effectiveness of self-reported survey was evidenced in the large data set (1671) produced. There are limitations to self-reported surveys as they rely on participants understanding the questionnaire and being honest in their responses.

Sears et al. (2016) also used a self-reported survey to explore the influence of nursing experience on medication error in 3 children's hospitals in Canada. Their study design

was prospective and nurses were asked to voluntarily complete the survey at the time of a medication error, resulting in 370 completed questionnaires. Similarly to Chang and Mark's (2009) study, nursing experience was aggregated at ward level. Multiple regression analysis demonstrated that significantly fewer severe medication errors occurred on wards where the nurses had worked longer. However, there were more total errors reported in these wards (Sears et al. 2016). What changed in the nurses' approach to medication administration as they gained experience? There is some evidence emerging from qualitative descriptive research using focus group interviews of nurses on the challenges of medication administration to children (Dickinson et al. 2010) and adults (McBride-Henry & Foureur 2006) in hospital. The findings suggest that as nurses gain experience, they develop (misplaced) confidence in their medication knowledge and believe that they are less likely to make an error than their junior colleagues (Dickinson et al. 2010; McBride-Henry & Foureur 2006).

If wards with less experienced nursing staff have more severe medication errors, does the use of temporary nursing staff have a similar influence? Temporary nursing staff may present an increased risk of errors from insufficient orientation and less familiarity with the ward culture and practice. They may also not be up to date with the latest knowledge because they are usually not included in hospital continuing professional development opportunities (Manias et al. 2003). Nurses perceive that working with inexperienced or new staff leads to medication errors (Jones & Treiber 2010; Nichols et al. 2008). A cross sectional review of 5 years of MEDMARX data was undertaken by Pham et al. (2011) to evaluate whether there were differences in the outcome of medication errors made by either temporary or permanent nursing staff in the emergency department. The authors identified that medication errors made by temporary nursing

staff were more likely to cause harm or be life-threatening compared with medication errors made by permanent nursing staff.

Aside from nurses' personal experience influencing whether they make and report a medication error, experienced nurses shape less experienced nurses' practice (Davis et al. 2009). The studies by Chang and Mark (2009) and Sears et al. (2016) only explored nursing experience as it directly related to cause and reporting of medication errors. The inadequacies of nursing administration that result in medication error is a common feature of professional literature (Gibson 2001). Less apparent is the positive contribution nurses' experience can make to safe medication practice. There is an emerging body of research on understanding the role of nurses in safe medication administration (Davis et al. 2005; Davis et al. 2010; Dickinson et al. 2010; Dickson & Flynn 2012; Eisenhauer, Hurley & Dolan 2007; Manias, Aitken & Dunning 2004a, 2004b; McBride-Henry & Foureur 2007; Smeulers et al. 2014). In a study of graduate nurses, Manias, Aitken and Dunning (2004a; 2004b) used semi structured interviews and participant observation to explore nurses' perceptions of their medication management activities and decision making. The authors found two major themes: monitoring medications, which included assessing patients and interventions for patient care that included pro re nata (PRN) medications and timing of medications. While these studies explored medication management rather than medication safety specifically, similar ideas can be seen in medication safety focused studies.

Eisenhauer, Hurley and Dolan (2007) used semi structured interviews to investigate the thought processes nurses used during medication administration to prevent errors and harm. The authors identified ten categories related to nurses' thinking. Three of these,

assessment, evaluation and side effects are comparable to the notion of monitoring medications. Additionally, dose-time and drug administration are consistent with the theme of timing of medications identified by Manias, Aitken and Dunning (2004a; 2004b). Eisenhauer, Hurley and Dolan's (2007) study also found that teaching patients about medications and anticipatory problem solving were features of nurses' medication practice associated with safety. Nurses' practice of educating patients about the medications they are receiving as part of maintaining medication safety was identified as part of clinical reasoning, which Dickson and Flynn (2012) argued is the essence of nurses' medication safety.

Another practice that nurses in Dickson and Flynn's study highlighted was that of verifying with a colleague when they were unsure of a particular medication or situation. This is similar to the notion of double checking which is more readily apparent in the research on understanding the nurses' role in safe medication administration to children (Alsulami, Choonara & Conroy 2014; Dickinson et al. 2010; Gill et al. 2012). Double checking is discussed further in section 2.3.5 on page 55, as a specific medication safety improvement strategy. Dickson and Flynn's (2012) grounded theory study identified that nurses' medication safety work involved managing the work environment, through four categories of environmental safety practices. A greater understanding of nurses' experiences of medication administration can be used to develop strategies and practices to improve medication safety. The impact of the environment on nurses' ability to maintain best practice in medication safety was highlighted in a number of studies (Dickinson et al. 2010; Dickson & Flynn 2012; McBride-Henry & Foureur 2007; Smeulers et al. 2014) and is discussed further as a system factor in section 2.2.3 below.

2.2.3 System factors.

Nurses have identified workload, distraction, interruption, communication and access to resources as factors within the complex and unpredictable clinical environment which challenge safe medication administration (Brady, Malone & Fleming 2009; Dickinson et al. 2010; Manias, Aitken & Dunning 2005a; Parry, Barriball & While 2015; Prot et al. 2005; Sears et al. 2013; Stratton et al. 2004). Sears et al. (2013) asked nurses across 3 children's hospitals in Canada to prospectively complete and return a designated questionnaire whenever a medication error occurred. The questionnaire required the nurses to identify in order of priority the environmental factors which had influenced the medication error. The top three factors were noted as workload, distraction and communication respectively (Sears et al. 2013). Four studies using self-reports noted that a rise in workload is associated with an increase in medication error (McKeon, Fogarty & Hegney 2006; Nichols et al. 2008; Ulanimo, O'Leary-Kelley & Connolly 2007; Valentin et al. 2009). An observation study which found that medication administration error increased when nurses undertook several activities simultaneously (Taxis & Barber 2003) support the self-report findings.

Workload was found to combine with distractions and interruptions to increase the risk of medication error (Taxis & Barber 2003). Distraction and interruptions during the preparation and administration process have been proposed as contributing to the number and seriousness of medication errors (Bennett, Dawoud & Maben 2010). Biron, Loiselle and Lavoie-Tremblay (2009) conducted a systematic review of 14 observational studies and estimated a rate of 6.7 interruptions per hour to medication administration. The conclusion of the review is limited due to the inconsistent definition of interruption or distraction between included studies. Constant distractions and interruptions are

generally accepted as the norm in healthcare. While nurses cite interruptions as a contributory cause of medication errors (Pape et al. 2005; Stratton et al. 2004), it is unclear if interruptions do actually lead to medication error. Nevertheless, the argument that distractions and interruptions contribute to medication errors is persuasive.

Westbrook et al. (2010) observed nurses preparing and administering 4271 medications to 720 patients in 6 wards at 2 Australian hospitals. Interruptions were positively associated with clinical errors, such as incorrect medication dose. The risk of any medication error increased 12.7% with each interruption, and the risk of a harmful medication error was doubled when nurses were interrupted 4 times during a single medication administration and tripled when interrupted 6 times. Thus, distractions and interruptions have major consequences in healthcare. During clinical practice, nurses continually adapt their workflow to accomplish daily nursing activities in the hectic work environment. Nurses use a workflow management strategy called "stacking" to help manage their work day (Ebright et al. 2004). Using this strategy, nurses continually organise and reprioritise care delivery. However, the stacking process can be impaired by environmental conditions such as distractions and interruptions (Relihan et al. 2010). Attending to multiple activities increases the risk of an error with one or all of the activities being attended to because cognitive fatigue can lead to slips, lapses, or mistakes (Reason 1995).

Difficulty with written communication featured prominently in several studies of nurses' perceptions of what contributes to medication error. In two studies (Deans 2005; Hand & Barber 2000) nurses reported illegible prescriptions, and in three others (Balas, Scott & Rogers 2004; Tang et al. 2007; Taxis & Barber 2003) unclear/messy prescriptions,

contributed to medication administration error. Other studies highlighted that the failure to pass on information or passing on incorrect information between doctors and nurses contributed to medication administration errors (Dickson & Flynn 2012; Eisenhauer, Hurley & Dolan 2007; Manias, Aitken & Dunning 2005a; McBride-Henry & Foureur 2007). Interpreting doctors' orders, communicating and coordinating care with doctors were three activities nurses undertook to maintain medication safety in the study by Dickson and Flynn (2012). Manias, Aiken and Dunning (2005b) found that the structure of ward rounds influenced the effectiveness of communication between graduate nurses and doctors about how medications are managed. The nurses' discussion in McBride-Henry and Foureur's study (2007) recognised the importance of effective multi-disciplinary team communication in maintaining a safe environment for patients.

In summary, there is a growing body of literature on the factors which challenge nurses' medication safety. Much of the research sits on the lower levels of the evidence pyramid (Figure 2-2 on page 25) as it is largely self-report surveys or face to face interviews seeking nurses' perceptions of what contributes to medication error. Thus there is a small chance that the evidence reflects what nurses think they do rather than what they actually do. That said, frontline nurses are ideally placed to recognise the system weaknesses and make recommendations for improvement of medication safety practices. Another prominent study method was retrospective review of large reported incidence databases. As mentioned previously, a limitation of this evidence is the significant underreporting which may contribute to an inaccurate picture of medication error. The findings of the observational studies that have been undertaken generally support the findings as presented (Barker et al. 2002; Taxis & Barber 2003; Westbrook et al. 2010).

While some studies have focused on one aspect such as nursing experience (Sears et al. 2016), distractions (Biron, Lavoie-Tremblay & Loiselle 2009) or communication (Manias, Aitken & Dunning 2005a), the majority consider the multiple influences on medication safety (e.g.Lapkin et al. 2016; Mayo & Duncan 2004; Ozkan et al. 2011; Ulanimo, O'Leary-Kelley & Connolly 2007; Wimpenny & Kirkpatrick 2010) and suggest that medication error is an interaction of many factors. Nurses strive to maintain safe medication administration and are the final link in the medication delivery process but they do not practice in isolation. The evidence presented in this part of the literature review suggests that nurses can improve the safety of medication administration through understanding how the context they work within impacts safe medication practice. The discussion will now focus on the large number of innovative medication safety interventions that have been developed in attempts to improve medication safety.

2.3 Medication Safety: Evidence for Practice

Some medication safety interventions reflect a system approach to improving medication safety through the implementation of new technology. Medication safety technology includes; Computerised Physician Order Entry (CPOE) and Clinical Decision Support Software (CDSS), electronic Medication Administration Record (eMAR), Bar Code Medication Administration (BCMA) systems, and smart intravenous pump technology (Acheampong, Anto & Koffuor 2014; Keers et al. 2014; Miller et al. 2007). Other medication safety interventions reflect an individual approach to improving medication safety. These interventions typically encourage changes in individual behaviour and practice and are less technologically complex. Interventions include such things as double checking, distraction and interruption minimisation, education

programmes, incident reporting, standardised medication chart and having a clinical pharmacist in the ward (Lapkin et al. 2016; Wimpenny & Kirkpatrick 2010).

While many medication safety interventions have been developed, their implementation into clinical practice appears to be slow (ACSQHC 2011a; ACSQHC 2011b; Aspden et al. 2007; Bates 2007; Miller et al. 2007). For example, CPOE has been available since the early 1970's, however by 2008, less than 1% of healthcare organisations in the United States of America had more than 90% of orders entered using an electronic system (Ford et al. 2008). Ford et al. (2008) suggested that CPOE diffusion will take at least a further 20 years to reach a 50% level of adoption in the marketplace (Ford et al. 2008). In addition, not all the expected benefits of the medication safety interventions have been actualised in practice (Han et al. 2005; Kaushal, Shojania & Bates 2003; Pirnejad et al. 2008). These interventions are explored in more detail below. Tables of included studies for each of the interventions are provided in Appendix A.

2.3.1 Computerised Physician Order Entry.

Computerised Physician Order Entry (CPOE) technology is aimed at decreasing prescribing errors. CPOE systems require practitioners to prescribe medications straight into an electronic system, which then transmits the prescription directly to pharmacy. These systems have the potential to greatly reduce prescribing errors, since at a minimum they ensure standardised, legible and complete orders (Fortescue et al. 2003; Wang et al. 2007). There is some evidence that CPOE can reduce prescribing errors (Devine et al. 2010). In a before and after implementation study comparing handwritten prescriptions (n=5016) with electronic prescriptions (n=5153), Devine et al. (2010) demonstrated a 70% reduction in medication errors related to use of abbreviations,

missing information and prescription illegibility. Clinical Decision Support Systems (CDSS) are often integrated with CPOE, and aim to optimise the safety and quality of clinical decisions by providing practitioners with reminders or recommendations at the point of care. For example, CDSS may offer default values for doses, routes of administration and frequency for commonly used drugs (Doolan & Bates 2002). In more advanced forms, CDSS can also be programmed to check for drug allergies or drug–drug interactions, or provide reminders for appropriate laboratory monitoring.

Questions about the clinical effectiveness of CPOE and CDSS remain. One systematic review (Radley, Wasserman & Olsho 2013, p. 43) estimated that CPOE can reduce medication errors in hospitalised patients by 48% on average, but acknowledged that 'it is unclear whether this translates into reduced harm for patients'. Similarly other systematic reviews have suggested that CPOE can reduce medication error (Ammenwerth et al. 2008) particularly where the baseline medication error rate is high prior to CPOE implementation (Nuckols et al. 2014). As the definition of medication error varied between the studies in the reviews it is not clear what type of error (e.g. wrong route) or stage of the medication use process (e.g. prescribing or administration) was impacted. A recent evaluation of the potential benefit of CPOE in addition to clinical pharmacists demonstrated that CPOE could reduce prescribing errors but would have no effect on administration errors (Wang et al. 2007). Slight et al. (2015) tested 13 commercial and home-grown CPOE systems using a random sample of 63040 medication error reports from the US Pharmacopeia (USP) MEDMARX reporting system where CPOE systems were considered a "contributing factor". The study found that the CPOE systems often failed to detect and prevent important medication errors.

CPOE and CDSS have been shown to decrease certain types of medication errors (Doolan & Bates 2002) and is strongly recommended by the Institute of Medicine (Kohn, Corrigan & Donaldson 2000). Barriers to successful implementation are described in the literature. Georgiou et al. (2009) conducted individual interviews and focus groups with a mix of 50 healthcare staff from one hospital and identified shared concerns relating to work practices, communication, technology, education, and experience, with the implementation of CPOE. Beuscart-Zéphir et al. (2005) also used interviews and supplemented with observation of practice across 3 hospitals. The authors noted that additional time was required to enter prescriptions with CPOE as compared to written forms which caused delays in medication administration to patients. Pirnejad et al. (2008) used a combination of self-reported questionnaires and interviews and discovered that CPOE disrupted the usual way nursing and medical professionals discussed medication queries which resulted in the development of informal practices (workarounds). Healthcare professionals make decisions to override the CPOE and CDSS alerts, when they feel these are not specific for the given patient (Ammenwerth et al. 2011) which can increase the risk of medication error. In addition, evidence is now emerging that CPOE is responsible for a new type of error, coined a 'computer related error' due to keypad entry error or drop down menu selection error (Walsh et al. 2006). CPOE related medication errors may occur early in the implementation process as staff are learning the new system (Berger & Kichak 2004).

The evidence for CPOE and CDSS in paediatric populations is inconsistent (Westbrook et al. 2016). Han et al. (2005) observed an unexpected increase in mortality for hospitalised children coincident with implementation of a commercially available CPOE programme. The authors reported that CPOE was associated with over a threefold

increase in the odds of dying. Subsequent studies have shown no increase in mortality rates (Longhurst et al. 2010). A rapid implementation process with limited attention to workflow redesign were considered contributory factors in the study by Han and colleagues. Individual studies comparing reported incident data before and after CPOE implementation demonstrated a decrease in overall adverse drug events (Holdsworth et al. 2007) and harmful adverse drug events (Upperman et al. 2005) in hospitalised children However, following a meta-analysis of studies, van Rosse et al. (2009) concluded that while the introduction of CPOE clearly reduces medication prescribing errors, the ability of CPOE to reduce harm to children has not yet been demonstrated. CPOE systems designed for adults need to be modified for the complexities of medication prescriptions in children (Cordero et al. 2004; Holdsworth et al. 2007; Walsh et al. 2008). For instance, a CPOE system designed to prevent common adult medication errors, such as overdoses based on adult maximum dosages, needs to be modified to prevent common medication errors in children, such as using weight-based dosing calculation to prevent dosage errors.

CPOE and CDSS is promoted as an important component of medication safety. There are a very limited number of randomised controlled trials of CPOE. This paucity of high quality evidence is unsurprising, as randomising patients or individual wards to deliver medications through CPOE would be logistically challenging. Thus the majority of studies are nonrandomised designs, especially pre/post intervention studies comparing CPOE to pre-CPOE practice, but the conclusions from these studies are mixed. Interestingly, while numerous studies are published on CPOE, a process that involves nurses, Weir, Staggers and Phansalkar's (2009) systematic review found that nurses were not a common population of interest for studies published in refereed journals. In

practice, CPOE affects medication delivery in complex ways, with risks as well as benefits. CPOE and CDSS is just one aspect of potential technological solutions to improve medication safety.

2.3.2 Electronic Medication Administration Record.

An eMAR is an electronic record of the medications administered to an inpatient. This technology is largely thought to reduce incorrect time errors including omissions and supports appropriate or correct documentation. It is best used integrated with electronic prescribing (CPOE) and bar code technology (discussed in more detail later in this chapter) to improve workflow and increase the potential safety improvement (Keohane et al. 2005). The system will trigger an alert when medications are due. To administer a medication, the nurse logs onto the system, selects the medication to be given and confirms the administration or the nurse may select a reason for omitting the medication if necessary. When the administration is complete the nurse logs out of the system and an electronic signature and time stamp is inserted against the medication.

The evidence for the effectiveness of eMAR in improving medication safety has been obtained from before and after intervention study designs using prospective or retrospective medication chart audit or incident report review (Coleman et al. 2013; Munzner, Welch & Richardson 2012; Redley & Botti 2013; Warrick et al. 2011). In all these studies the eMAR was integrated with other technology such as an electronic prescribing system, thus it is unclear how much any improvement is directly associated with the eMAR. Munzner, Welch, and Richardson (2012) compared the rate of medication omissions before and after implementation of an eMAR system and although there was no difference in omission rates overall, eMAR supported the documentation

of rationale for the omission. In contrast Warrick et al. (2011) observed a reduction in omitted medications identified by medication chart audit before (8.4%) and after eMAR implementation (1.4%). In an interrupted time series analysis Coleman et al. (2013) reported a reduction in medication omission errors following eMAR. The change in omission error rate was the result of sharing audit data with health professionals, through the use of clinical dashboards generated by the eMAR system rather than the implementation of a visual display showing when a medication was overdue (Coleman et al. 2013). In other words making the local data explicit for staff resulted in ownership of the need for practice change. Redley and Botti (2013) carried out a retrospective review of medication-related voluntary incident reports at two Australian hospitals; one of which had implemented eMAR while the other was using a paper based medication administration record. The authors found a difference in the type of medication errors between the hospitals. In particular, medication omissions were reduced in the hospital using eMAR.

An eMAR must facilitate nurses' medication administration and not introduce difficulties associated with using the technology. Generally nurses appear to be satisfied with eMAR. Moreland et al. (2012) and Culler et al. (2011) conducted qualitative studies to explore nurses' perceptions of eMAR. Moreland et al. (2012) analysed a total of 719 surveys from nurses in one hospital across three time points; implementation, then three and six months following the introduction of an eMAR system. Surveys were returned from wards and intensive care units. The authors reported that the eMAR system was associated with perceptions of improvement in workload, teamwork, ease of documentation, drug information accuracy, and patient safety (Moreland et al. 2012). Culler et al (2011) interviewed a total of 14 nurses representing wards and intensive care

units at 2 paediatric hospitals at 6 and 18 months post eMAR implementation to understand the facilitators and barriers to using the eMAR system. The most significant barrier to adoption (identified by 72% of respondents) was excessive time for logging into the system. Nurses reported being more satisfied when modifications to the eMAR system which resulted in improved workflow and increased patient safety were realised (Culler et al. 2011). Guo et al. (2011) conducted a formal usability evaluation of an implemented eMAR system to determine the fit between systems, tasks, and users in the clinical environment, from a nursing perspective. This study revealed a high number of usability difficulties with potentially severe consequences for patient safety.

The current evidence that eMAR in hospitals may reduce medication errors is inconsistent and it is difficult to isolate the effectiveness of eMAR as it is usually implemented alongside other technology. There is some evidence that eMAR may reduce medication omissions and improve documentation related to medication administration. Consideration needs to be given to the impact of eMAR on workflow, existing systems and healthcare professional practice.

2.3.3 Bar Code Medication Administration system.

Bar Code Medication Administration (BCMA) is another technology which was shown to have the potential to significantly reduce medication dispensing errors when it was introduced nearly 20 years ago (Gebhart 1999). BCMA allows electronic verification of patient identity and medication orders. The nurse scans a bar code on their identification badge, the medication to be administered and the patient's identity band. This information is compared with the electronic medication administration record. If any mismatch is detected a visual or auditory warning is displayed on the computer screen.

BCMA is designed to verify the five rights of medication management and therefore prevent incorrect dose, medication, time, route and patient errors (Young, Slebodnik & Sands 2010).

Several before and after implementation studies of the impact of BCMA on medication administration errors have been undertaken with varying results. Helmons, Wargel and Daniels (2009) observed nursing staff administering medications in two medical-surgical wards and two intensive care units, one month before and three months after implementation of BCMA technology. There was no demonstrable change in overall administration error rates following BCMA implementation. This was most likely due to a large increase in incorrect time administration errors. In other words, while some categories of error had been reduced, the reduction in number was offset by the uncovering of another category of error. Similarly Morriss et al. (2009) reported more medication errors post implementation of BCMA in a neonatal intensive care unit due to a large increase in incorrect time errors. BCMA technology records the actual time a medication is administered and if it is out with the predetermined criteria, such as 30 minutes either side of scheduled time, the system will automatically assign this as a medication error. It was unlikely that these time errors were manually reported by nurses prior to the implementation of BCMA.

In contrast, DeYoung, Vanderkooi and Barletta (2009) demonstrated that BCMA significantly reduced the number of medication administration timing errors in a medical intensive care unit. DeYoung, Vanderkooi and Barletta (2009) observed 775 medication administrations pre-implementation and 690 post-implementation of BCMA, and noted a 56% reduction in wrong time medication errors. There was no change in other error

types (wrong dose, wrong medication, wrong route, wrong documentation, omission). By observing practice, the authors ameliorated the influence of nurses' non-reporting of timing errors. Poon et al.'s (2010) observational study demonstrated a reduction in timing and non-timing medication error rates in wards that were using BCMA compared with wards that did not have BCMA. This was a large study involving the observation of 14041 medication administrations and review of 3082 prescriptions. Medication administration timing errors were reduced from 16.7% to 12.2% and non-timing medication administration errors were reduced from 11.5% to 6.8% following the implementation of BCMA. Equivalent to a relative reduction of 27.3% and 41.4% in the rate of timing and non timing administration errors respectively. In another observational study, Paoletti et al. (2007) reported inconsistency in results with a 54% reduction in medication errors in one intervention ward but no change in another. The authors suggested a more homozygous patient population with standard order sets and the requirement for a double check already in place on the ward may have contributed to the finding of no change in errors with BCMA. The authors had excluded medication administration timing errors. When timing errors were included, both intervention wards demonstrated smaller reductions in medication errors. The 54% reduction in medication errors became 35% and the zero change became a 24% reduction in medication errors. There is variability in the evidence supporting BCMA to consistently decrease medication errors.

Unanticipated system problems have been identified with using BCMA. In one study, involving a retrospective audit of warning and error reports generated by the BCMA system from 6 hospitals, 70% of system warnings were not valid (Sakowski et al. 2005). This degree of unreliability encourages nurses to ignore and override system warnings,

which can lead to errors. Subsequent analysis of scenarios based on the generated error reports identified that the majority of medication administration errors identified by BCMA were expected to produce minimal or no clinical effects (Sakowski, Newman & Dozier 2008). Fewer than 1 in 10 (8%) of errors were judged to have the potential to produce moderate adverse effects, and only 1% of the errors reviewed were rated as having the potential to result in a severe or life-threatening adverse event. The perception that the vast majority of medication administration errors pose minimal safety risks can inadvertently support nurses' workarounds. One workaround evidenced by data collected via electronic medication administration records, identified that nurses verified the bar codes of only about half of medications administered to patients (van Onzenoort et al. 2008). In the study by van Onzenoort et al. (2008) difficulties in scanning bar codes on the medication labels, lack of awareness of bar codes on medication labels, delays in responses from the computerised system, and shortage of time, were the most common reasons given by nurses for not using the BCMA. Holden et al. (2013) investigated how the implementation of bar code technology affected nurses' operational problem-solving and identified that nurses often resort to potentially risky workarounds to be able to achieve their goals.

In studies designed to understand nurses' perceptions of BCMA technology, nurses believed that fewer errors were likely to occur when BCMA was available but they also felt that the process was more time consuming (Fowler, Sohler & Zarillo 2009; Hurley et al. 2007; Morriss et al. 2009; Topps et al. 2005). Fowler, Sohler and Zarillo (2009) surveyed nursing staff before and after implementation of BCMA technology using the Medication Administration System – Nurses Assessment of Satisfaction (MAS-NAS) scale. The MAS-NAS comprises 18-items within three-subscales, efficacy, safety, and

access. Each item has a 6-point Likert rating system anchored with descriptors ‘‘strongly agree’’ (score, 1) and ‘‘strongly disagree’’ (score, 6) with reverse scoring on selected items so that high scores indicate high satisfaction (Hurley et al. 2006). Fowler, Sohler and Zarillo (2009) reported an increase in nurses’ satisfaction scores related to improvement in patient safety but a decrease in satisfaction related to the increase in time required for administration of medications. Topps et al. (2005) conducted a self-developed ‘Bar-Coding Medication System’ survey of multidisciplinary healthcare staff. The survey included eight questions, with a 5-point Likert rating scale, seeking staff perceptions of the barcode system. The study found that staff felt that it took more time to administer medications using the barcode system. In addition, staff considered that medication errors had not decreased as much as they thought they would. On the other hand, Hurley et al. (2007) who surveyed nursing staff using the MAS-NAS, concluded that nurses were very satisfied with barcode technology. The authors did acknowledge that some interview participants believed that using BCMA was more time consuming.

While the participants in Hurley’s (2009) study accepted that the extra time required for BCMA was wisely spent to assure patient safety. Nurses have devised steps to avoid the increase in workload due to BCMA and thus circumvent the inbuilt safety features (Marini & Hasman 2009; Nelson et al. 2005) which may be one explanation for why BCMA has not been able to reliably decrease medication administration errors. It is worthy of noting that nurses’ perception of additional time required for medication administration when using BCMA was not borne out in a time and motion study (Poon et al. 2008). Poon et al. (2008) investigated the impact of BCMA on nursing workflow in medical and surgical wards of a tertiary level hospital. They found that nurses spent 27% of their time on medication administration before BCMA was implemented and

25% of their time when using BCMA. The authors also noted that the time spent providing direct patient care increased from 26 % to 30%, suggesting that a well designed BCMA system may streamline medication related activities allowing more time for other nursing activities.

2.3.4 Smart intravenous pump technology.

Technology has become available with the capability to safeguard the patient at the point of medication delivery for intravenous infusions. This is referred to as "smart pump technology" (Billman 2004). A smart pump is an infusion device that has an embedded computer with medication safety software that contains a medication library including safe dose ranges for each medication. Most medication libraries also include a generic mode (programme infusion as mL/hr) to deliver any medication not contained in the library. The computer programme is capable of calculating and checking the medication dose. When a nurse programmes the pump for a particular medication at a given dose, the computer verifies whether the dose has been calculated correctly and whether it is within the safe dose range. As part of a linked technological system, verification of the prescription and timing of administration as well as patient identification can also be achieved. If used properly the infusion pump can intercept an intravenous infusion administration error before it reaches the patient. However like many of the other technological safeguards it is not fool proof. Even when medication safety features are configured nurses often workaround the medication libraries by selecting the generic mode (McAlearney et al. 2007). Workarounds are usually employed when there are differences between clinical practice and the programmed pump settings, for example related to medication concentrations or limitations on administration rates (McAlearney et al. 2007).

There has been one systematic review undertaken with the aim of understanding the impact of smart pumps on medication error reduction. The authors concluded that based on the existing literature, smart pumps appear to be an asset in the improvement of medication safety and prevention of infusion errors, though the evidence continues to be mixed (Ohashi et al. 2014). While reports from sites that have implemented smart pumps suggest that they reduce medication errors (Fields & Peterman 2005; Keohane et al. 2005), studies suggest no benefit (Husch et al. 2005; Rothschild, Keohane, et al. 2005). Fields and Peterman (2005) described the implementation of smart pump technology in an inpatient hospital setting. Following a review of the smart pump software log, the authors concluded that the technology had a critical impact in preventing potentially serious infusion errors. In contrast, by using point prevalence methodology, Husch et al. (2005) found 70% of 426 medications observed infusing through a smart pump, had an error. The authors identified that only one of 37 wrong rate errors would have been prevented by smart pump technology and concluded that smart pump technology has little effect on medication safety in the absence of other technology, such as CPOE. Rothschild et al. (2005) conducted a prospective, randomised time-series trial, comparing serious medication errors with and without smart pump technology (safety software switched on or off). Investigators analysed pump software logs, chart review data and voluntary reported incident data and found no difference in the number of serious medication errors with the software on or off (93 vs 87 respectively).

The validity of the above studies is questionable due to a lack of compliance with the smart pump technology in practice. Nurses were able to work around using the programmed safety software thus the efficacy of smart pump technology in reducing medication error cannot be reliably determined (Hertzel & Sousa 2009).

McAlearney et al. (2007) used focus groups to conduct an exploratory study of nurses' perspectives on the clinical use of smart pump technology. Four themes emerged; general perceptions of use, challenges encountered, interventions to overcome challenges, and learning about use. Nurses viewed the safety aspects of dose and rate checking positively, however mechanical issues and inconsistency between pump medication library and medication preparation information provided challenges. Participants indicated that they used the generic mode to work around the challenges. The fourth theme related to the way nurses teach other nurses on how to use the pumps and the potential for any workarounds to be spread. For instance, if a nurse preferentially chooses to programme the pump without using the safety software, it is likely that this is what they will teach another nurse. Although smart pumps have great promise, broader contextual issues must be addressed if the pumps are to be used to achieve their potential for improving medication safety.

Complex technological solutions to improving medication safety; CPOE with CDSS, eMAR, BCMA and smart intravenous pumps have the potential to improve medication safety by improving adherence to the five rights of medication safety through prescription, dispensing and administration (Smaling & Holt 2005). Rigorous evidence demonstrating the effectiveness of medication technology is limited (Rinke et al. 2014). It is unclear whether this technology actually reduces the number of medication administration errors in everyday clinical practice as the results of studies are inconsistent. There are few studies examining the implementation of technological medication safety interventions specifically within the child heath setting (Westbrook et al. 2016). Inconsistency in effectiveness may in part be due to how the technology has been implemented. It is necessary to consider medication technology not simply as a

tool but as something which co-shapes the medication delivery process (Boonen, Vosman & Niemeijer 2016). An approach to implementation which takes into account the impact of the technology on healthcare professionals practice would better enable them to use the technology to its full potential for improving medication safety. Often nurses' perceptions of unreliability and increased workload have led to dissatisfaction with electronic systems and the creation of informal practices which bypass the inbuilt safety mechanisms (workarounds). Electronic medicines management is in its infancy in New Zealand. Therefore it is important to also explore non-technology based interventions aimed at mitigating the risks associated with manual medication management systems to improve medication safety.

2.3.5 Double checking medication administration.

Double checking is an initiative aimed at improving medication safety through decreasing the risk of medication administration error (Grissinger 2003; Kunac & Reith 2008; Merry & Webster 2008) and is advocated by safety organisations such as the Institute for Safe Medication Practice (ISMP 2003). Double checking is a redundant function based on the theory that human errors can be minimised by another individuals' compensatory behaviour (Schöbel & Manzey 2011). Redundancy means that a system component is duplicated to serve as a back-up in case of failure and is a design strategy for high reliability healthcare. Conducting a double check is where one person reviews and signs off on another's activity. Double checking has been successfully used in non-healthcare settings. In aviation, double checking or checklists have become a mandatory part of practice and have significantly decreased the risk of error and improved aviation safety outcomes (Hales & Pronovost 2006).

The strategy of double checking during medication administration is aimed at reducing errors based on the five rights (right dose, right medication, right route, right time, and right patient). Due to a lack of empirical evidence demonstrating the effectiveness of double checking in reducing medication errors, its usefulness is debateable. The authors of one systematic review on double checking concluded that there "is insufficient evidence to either support or refute the practice of double checking" (Alsulami, Conroy & Choonara 2012, p. 833). In contrast, the recommendation from another systematic review stated that nurses should double check medications as a strategy for reducing medication errors (Hodgkinson et al. 2006). Nurses have recognised double checking as necessary to safeguard patients and that it should direct decision-making when administering medications (Davis et al. 2010). Notably, the participants in Davis et al.'s (2010) study were responding to a number of hypothetical situations and their judgements may not be the same in actual clinical practice. Nurses also frequently report that a lack of a double checking process contributes to medication administration error (Stratton et al 2004; McBride-Henry & Foureur 2007; Tang et al 2007).

There are a small number of studies comparing the effectiveness and safety of single checking compared with double checking (Jarman, Jacobs & Zielinski 2002; Kruse et al. 1992; Ross, Wallace & Paton 2000) and each produced a different result. Kruse et al. (1992) compared double checking versus single checking in a crossover trial in 3 wards using medication chart audit. The medication error rate was significantly lower with double checking compared with single checking. There were 2.12 errors per 1000 medications administered with double checking compared to 2.98 errors per 1000 medications administered with single checking (Kruse et al. 1992). Although a descriptive study rather than a controlled trial, Jarman, Jacobs and Zielinski (2002)

found no significant difference in error rates after a single checking process compared with a double checking process. A confounding factor may have been that errors required self-reporting. When single checking, nurses may not be aware of their error or may be less willing to highlight them. In addition, there were only four single checking errors notified during the study period compared with five when double checking was the standard. The overall error rates make these conclusions less reliable, and the results have not been confirmed by larger studies. It is also important to note that this study included only nurses who had been assessed as competent for single checking, and the findings therefore should not be generalised to all nurses. The findings of a five year retrospective review of all medication errors reported in a large children's hospital identified that most errors occurred despite the double checking process (Ross, Wallace & Paton 2000). As Ross Wallace and Paton's study was undertaken in a children's hospital, double checking is almost certainly going to have been the expected standard of practice for nurses. Nurses are also the healthcare professional most likely to submit incident notifications, therefore it is unsurprising that most medication administration errors were reported after a double check process. However it does raise questions as to the standard of the double check process, rather than providing evidence that double checks are ineffective.

The variability of findings may be due to inconsistency in carrying out the double checking procedure. Alsulami, Choonara and Conroy (2014) observed 2000 medication administrations and found variation between nurses' adherence with double checking during medication administration. Remarkably, medication dose calculations were only independently double checked 30% of the time. Dickinson et al (2010) identified 60% compliance with double checking even though it was recommended best practice in their

paediatric setting. Other research observed 45% compliance (Smetzer et al. 2003) and 80% compliance (Manias, Aitken & Dunning 2005b)with double-checking policies.

Several qualitative studies have sought nurses' views on the benefits, limitations and barriers to double checking (Armitage 2008; Davis et al. 2009; Dickinson et al. 2010; Gill et al. 2012; Manias, Aitken & Dunning 2005b; Schwappach, Pfeiffer & Taxis 2016). As Armitage (2008, p. 516) pointed out "double checking is a common but inconsistent process". Nurses have described various ways of undertaking a double check at the calculation, preparation and administration phase of the medication process (Dickinson et al. 2010). Schwappach, Pfeiffer and Taxis (2016) found that nurses perceived the value of double checking as the joint action of checking rather than the independence of checks. Double checking can be subject to system weakness; such as when double checking is sacrificed because time is short or there are not enough qualified staff available (Dickinson et al. 2010; Manias, Aitken & Dunning 2005b). The increased nursing workload involved in double checking has been used to argue against its use (Jarman, Jacobs & Zielinski 2002). Jarman, Jacob and Zielinski (2002) suggested that single checking saved an average of 20 minutes on each medication round.

Double checking also has inherent weaknesses such as deference to authority, reduction of responsibility and automatic processing (Armitage 2009; Dickinson et al. 2010). Armitage (2008) explored the process of double checking through structured interviews with health professionals in the United Kingdom. Dickinson et al. (2010) sought to understand paediatric nurses' understanding and practice regarding double-checking of medication administration through focus groups with nurses in New Zealand. The results were congruent, in that, when a junior nurse is double checking a senior nurse's

medication preparation and has a concern, they may not feel able to question the senior nurse and an opportunity to prevent an error reaching the patient is lost. Participants in both studies identified the possibility that by having two people involved in the administration process, this may reduce individual responsibility and thus the vigilance of both. While Armitage (2008) used the term automatic processing and Dickinson et al. (2010) referred to automaticity, both expressed the same idea that double checking can become inappropriately routine whereby those undertaking the double check go through the process but without actively paying attention. As Toft and Mascie-Taylor (2005, p. 212) explain "checklist items begin to take the form of litany where eventually the literal meaning of the message is ignored". The notion of automaticity is recognised as a potential hazard to safety within the aeronautical industry (Tolleson 2007).

A common way of trying to reduce the variability of practice is the implementation of policies and guidelines for practitioners. Nurses have said that policies and guidelines help promote safe practice (Dickinson et al 2010) and enable them to practise autonomously (Manias et al 2005b). However, guidelines on double checking can themselves be unclear. It has been suggested that the role of the second checker needs to be clarified as nurses tend to interpret the second check differently. For example, the second nurse may not check that the dose prescribed is appropriate for the weight of the patient, relying on the first nurse to have completed this step (Sanghera, Franklin & Dhillon 2007). In addition, guidelines may also not be clear on what medications should be double checked (Dickinson et al. 2010).

Another suggestion to minimise the weaknesses associated with the process of double checking, is that it should be carried out independently (Grissinger 2003). An

independent double check is a process in which the second person conducts a separate verification and the first person does not communicate what they expect the second person to hear or see (Gosbee 2004; Grissinger 2003). Grissinger (2003) suggests that to preserve the effectiveness of the independent double check process, it should be limited to situations involving high risk medications, complex processes such as calculating doses, or high risk patient populations such as infants and children. For many nurses caring for children all three conditions are met each time they administer a medication and therefore independent double checking would therefore be deemed appropriate in paediatric clinical settings.

In summary, double checking is a strategy being advocated by healthcare organisations (Conroy, Davar & Jones 2012) and employed by many nurses (Kellett & Gottwald 2015) in an effort to prevent medication error despite little compelling evidence of its effectiveness (Alsulami, Conroy & Choonara 2012). Although there may not be strong evidence for double checks in the medication administration process, it has been reported that people checking the work of others will find about 95% of all mistakes (Grissinger 2003). It is important to also take account of the evidence on double checking safety measures which have been shown to decrease errors outside the healthcare environment (Pape 2003). For example, double checking has become a mandatory part of aviation practice and has significantly decreased the risk of error and improved aviation safety outcomes (Hales & Pronovost 2006). The notion of 'independence' in the double checking process needs to be transferred more actively into clinical practice.

2.3.6 Reducing interruptions during medication administration.

Interventions to reduce interruptions during medication administration are based on an underlying assumption that interruptions are significantly associated with medication administration errors. Qualitative studies of nurses' perceptions and retrospective reviews of medication incident reports are increasingly suggesting that interruptions to nurses during preparation and administration of medication impacts medication safety (Biron, Loiselle & Lavoie-Tremblay 2009). Supporting this, an observational study in two Australian hospitals which involved 98 nurses preparing and administering 4271 medications found that interruptions were significantly associated with more medication errors and more severe errors. Each interruption resulted in a 12.7% increased risk of a medication error and the error rate tripled when a nurse was interrupted six times (Westbrook et al. 2010). An integrative literature review examining interruptions to nurses work in acute care settings found the large variability in quality and methodology of studies suggest that "beliefs about the ill effects of interruptions remain more conjecture than evidence-based" (Hopkinson & Jennings 2013, p. 38).

There is variability in the pattern of interruptions reported. Kreckler et al. (2008) observed 38 drug rounds in one UK hospital ward and found that nurses are frequently distracted, with an average of 11% of each drug round observed spent dealing with interruptions. In the study, the most common distractions were from patients. This is in contrast to previous studies (Fry & Dacey 2007b; Tang et al. 2007) where the perception of staff is that dealing with telephone calls and patient's relatives are the main cause of interruptions. A systematic review of the literature undertaken by Biron, Loiselle and Lavoie-Tremblay (2009) concluded that interruptions were mostly initiated by nurses themselves. An observational study conducted by the review authors established the

same finding (Biron, Lavoie-Tremblay & Loiselle 2009). Conversations are a common source of interruptions and can arise either when the nurse administering the medication initiates a conversation or when they are disrupted by a nursing colleague starting a conversation with them (Relihan et al. 2010).

A concept taken from the aviation industry to remove non-essential conversations during safety critical tasks known as "sterile cockpit" (Fore et al. 2013; Pape 2003) has been tried in several healthcare settings in the form of 'no interruption zones' and 'do not disturb' vests for the preparation and administration of medications (Conrad et al. 2010; Pape 2003; Relihan et al. 2010). Pape (2003) observed a convenience sample (N=24) of medication administrations split between a control group, Focused protocol (checklist and staff asked not to interrupt) intervention group and Medsafe protocol (Focused protocol plus special vest) intervention group. Nurses' distractions were counted using the validated Medication Administration Distraction Observation Sheet (MADOS). The number of distractions in the control group was 484, which decreased to 180 when the focused protocol was used to guide medication administration, and 64 when the Medsafe protocol was used. While there were fewer distractions in the intervention groups, one of the interventions was to directly ask the other ward nursing staff not to interrupt the nurse administering medications and to divert telephone calls. Only 8 medication administrations were observed in each group. It is unclear if nurses will have a similar high level of adherence with a request not to interrupt over a longer period of time or outside of a study setting. Relihan et al. (2010) observed a total of 30 hours of medication rounds in a before and after intervention study. Following implementation of a bundle of interventions, including staff education, checklist, red vest, signage, and patient information leaflets, the rate of interruptions more than halved. It is unknown to what

extent the observer may have influenced the behaviour of staff. Freeman et al. (2013) reported a decrease in medication errors by a total of 28 over a 3 month period following implementation of a bundle of safety interventions aimed at reducing interruptions during medication administration.

A systematic review of studies that assessed the impact of different interventions to reduce interruptions concluded that there is limited evidence of their effectiveness (Raban & Westbrook 2014). The review highlighted the limitations due to the small size of the original studies, inconsistency in definition of the key terms, interruptions and distractions and reporting of outcomes. There is even less evidence that reducing interruptions effectively reduces medication error (Raban & Westbrook 2014). However, as previously indicated, only 2% of medication administration errors in child healthcare are intercepted before reaching the patient. Any improvement to the medication administration process could have a large impact on medication safety within healthcare organisations.

2.3.7 Medication safety education programmes.

Based on the studies that indicate gaps in medication safety knowledge contributes to medication errors (Brady, Malone & Fleming 2009; Kane-Gill, Jacobi & Rothschild 2010; Kopp et al. 2006), another strategy to improve medication safety is to affect the knowledge and skills of healthcare professionals (Keers et al. 2014). Medication safety education is promoted as an initiative to reduce medication error particularly as it is perceived to require minimal financial investment. However, the effectiveness of medication safety programmes to reduce medication errors is undetermined. One systematic review found little evidence of the efficacy of nursing educational

interventions in reducing medication administration errors (Hodgkinson et al. 2006). While a systematic review by Härkänen et al. (2016) found that all educational interventions, including traditional classroom training, simulation, e-learning, and the use of posters and pamphlets had a positive effect albeit that the effect varied greatly between the different interventions. Notably less than half of the included studies achieved a moderate or high quality assessment rating.

Education programmes based on the 5 rights of medication administration or independent double checking have been reported to have limited success on improving medication safety as they focus on individual performance. Dennison (2007) used a pre-test-post-test study design involving 20 nurses in one ward. The nurses completed a medication safety education programme consisting of two computer modules; Medication Error Reduction Training and Intravenous Infusion of High-Alert Medications. Nurses' knowledge was measured using a self-developed Medication Safety Knowledge Assessment Tool. Nurses' behaviour was measured by their compliance with four recommended infusion practices. The number of medication errors was determined by reviewing medication incident reports. Dennison (2007) found that while there was a statistically significant change in nurses' knowledge there was no change in nurses behaviour or number of reported medication errors. In a randomised controlled trial in two hospitals, Greengold et al. (2003) found that the use of dedicated medication nurses who had undergone specific training in safe medication use, did not reduce medication administration errors compared with the control group. Conversely, Niemann et al. (2015) demonstrated that the combination of an information handout, training course and reference book, reduced medication administration errors from 527/581 (91%) to 116/441 (26%). The successful reduction in errors may be because a

combination of interventions is able to address the diversity of causes of medication errors.

2.3.8 Voluntary incident reporting.

Incident reporting is an organisational system to detect patient safety events, including medication errors. As mentioned previously, incident reporting is less reliable than chart review or direct observation for detecting medication errors. Indeed it is more accurate to say that voluntary incident reporting produces a measure of rate of reporting rather than a rate of error per se. More importantly, voluntary incident reports provide an opportunity to learn about the contributing factors and potential system changes to improve medication safety. Globally, medication errors are significantly under reported within voluntary reporting systems (Yung et al. 2016).

Several authors have sought to find out why staff are reluctant to report errors (Bayazidi et al. 2012; Evans et al. 2006; Hand & Barber 2000; Yung et al. 2016). Common reasons identified include, previous responses to reported medication errors, fear, and lack of agreement over whether an error occurred. The perception that 'nothing is done' with the information provided when reporting a medication error may discourage nurses from reporting errors. A lack of system change following the review of medication incident reports is highlighted in the nursing literature. Anderson et al. (2006) identified that the review of medication incident reports most often resulted in recommendations for an individual's performance improvement rather than system improvements. The recommendation for individual improvement supports the fear of punitive repercussions for self or another which nurses have identified as a reason for not reporting medication errors. This fear of reprisal can result in as much as up to half of all medication incidents

not being reported (Mayo & Duncan 2004). Yung et al. (2016) conducted a survey using a self-developed questionnaire among hospital nurses in Taiwan. The authors found that the major barrier to incident reporting was a fear of individual consequences. Bayazidi et al. (2012) used a self-developed questionnaire with a large cohort of Iranian nurses who similarly, perceived that the most important barrier to reporting medication errors was the resultant blaming of individuals.

Another reason for not reporting medication errors is not knowing what incidents to report. Baker (1997) discovered that nursing teams developed their own shared set of tacit rules about what constituted a medication error. Where the irregularity was; (a) clerical, (b) not directly attributable to one individual, (c) subsequently put right, or (d) prevented a worse patient outcome. Then the nurses in Baker's study perceived that a 'real error' had not been made. It is only when an irregularity cannot be assigned to one of these categories that it is reported as a medication error (Baker 1997). Nearly twenty years later, inconsistency in what is considered a medication administration error continues (Keers et al. 2013b; McLeod, Barber & Franklin 2013; Shawahna et al. 2016). That educational initiatives have been shown to increase reporting is encouraging (Silver & Antonow 2000).

2.4 Limitations of the Methodological Approach to Medication Safety

While a number of medication safety interventions have been shown to be effective at reducing some medication errors, there appears to be a large gap between the knowledge generated from research and its translation into clinical practice. This may be due to several reasons, e.g. there may be differences in context between where the research was undertaken and the clinical environment in which the intervention is subsequently

implemented. For example, when a BCMA system was introduced into clinical practice, this new practice resulted in disruption to workflow and healthcare professionals developed interventions to work around the new technology, bypassing the built-in alerts and warnings which had been put in place to reduce errors (Koppel et al. 2008; Nelson et al. 2005).

Additionally, knowledge generated from positivist research 'may perpetuate technically oriented practice' (Weaver & Olson 2006, p. 462), by reducing a multidimensional activity such as medication administration to a simple task and inadvertently decrease the professional vigilance required for such a complex activity. Thus, limitations of research can be related to the methodological approach taken.

A positivist approach to medication safety, such as determining the effectiveness of an intervention, will emphasise the importance of objective evidence as the sole criterion of truth (Crotty 1998) and seek knowledge through systematic and detailed observation, experimentation and verification (Denzin & Lincoln 2011). Thus, the aim of inquiry based on this approach is to seek explanations to predict and control events. For example, Bates et al. (1998) conducted a random stratified before and after study to examine a pharmacist team-based intervention. The authors demonstrated an increase in the number of serious medication errors that were intercepted. Undeniably, the knowledge gained from the medication safety studies conducted within the positivist paradigm has the potential to improve patient outcomes. However, it is not enough to demonstrate that a particular intervention is effective. A better understanding of how the intervention is applied in practice is needed. Knowledge on how to successfully implement new interventions in practice are not generated from research based on a positivist world

view as this view does not account for the context within which the research is being undertaken (Denzin & Lincoln 2011). Indeed a positivist approach to research tightly controls the intervention to ensure there are no external influences which may impact on the outcome of the study.

On the other hand, the constructivist paradigm of inquiry is based on the belief of relativism. Namely, researchers acknowledge that there are multiple realities grounded in the subjective experience of individuals which are constructed through socially developed understanding (Crotty 1998). In other words, multiple ways of knowing are valued and used to generate knowledge; study participants are encouraged to share their views. The researcher also seeks to understand the context within which the inquiry is taking place. A goal of inquiry based on this ontology and epistemology is the search for human experience to help people understand and make sense of their experiences (Appleton & King 2002).

Medication safety research conducted from a constructivist approach has explored a range of issues. Researchers have used a constructivist inquiry approach into medication safety to understand clinician's perceptions of medication administration, medication error reporting, and how individual nurses and local context and culture can impact medication safety practice (e.g. Antonow, Smith & Silver 2000; Baker 1997; Brady, Malone & Fleming 2009; Chevalier et al. 2006; Davis et al. 2005; Dickinson et al. 2010; Manias, Aitken & Dunning 2004b). For example, Davis et al. (2005) explored nurses' understanding of medication practice in a series of focus groups and similarly, Dickinson et al.'s study (2010) used focus groups to elicit nurses understanding of double checking process and practice. These medication safety studies conducted within the

constructivist paradigm enabled personal subjective descriptions of nurses' experience of medication practice and error. This research has value for nursing as it offers an insight into practice and the findings from such studies may be useful when developing interventions to improve medication safety. However, the abundant literature on implementation of research to practice serves as a reminder that knowledge in itself does not lead to improvements in clinical practice (e.g. Balfour & Clarke 2001; Dopson, Fitzgerald & Ferlie 2008; Greenhalgh et al. 2004; McCormack et al. 2002; Rycroft-Malone 2004; van Achterberg, Schoonhoven & Grol 2008).

The medication safety research reviewed in this chapter demonstrate that it is possible to attain answers to medication safety questions within a positivist or constructivist paradigm. However the particular ontological, epistemological and methodological orientation has resulted in gaps in knowledge. Furthermore, the new knowledge generated from research using these approaches has not necessarily been translated to clinical practice. Neither the positivist nor constructivist approaches to inquiry informs us on how best to apply the new knowledge in practice. A third research paradigm is critical social theory. This approach orientates research to examine practice and context while providing the means for taking action. The critical social theory approach to inquiry is not readily apparent in the medication safety literature to date. This is the approach taken within the action research study presented in this thesis and is discussed in detail in chapter four.

2.5 Conclusion

In summary, there are a multitude of factors related to patient, staff and workplace which impact on nurses' ability to safely administer medications. The complexity in

medication administration has not been mirrored in the approach to medication safety. Medication safety interventions have generally targeted single parts of the process, e.g. prescribing. Potentiating a view that medication practice is a simple linear process. The evidence supporting the efficacy of medication safety strategies for preventing medication administration errors to children is limited by the relatively small number of studies. The majority of evidence is drawn from self-reports, review of large databases or observational study. Where undertaken, controlled studies have generally been small involving a single centre. Only a handful of medication safety strategies in children have been studied in robust study designs (Maaskant et al. 2015).

Study findings are somewhat variable, ranging from suggesting no effect to a limited effect at reducing some types of medication errors. There is some evidence that medication safety, related to illegibility of prescriptions and distractions during medication preparation and administration, can be addressed using Computerised Physician Order Entry (CPOE) and creating 'no interruption zones'. The contradictory or inconclusive findings on safe medication practices have limited the translation of quality evidence into practice with potentially negative consequences for patients (Grimshaw et al. 2012). There is also support for professionals' non-adherence to new technology or redesigned work processes because of perceived and real impact on how work is performed (Halbesleben et al. 2010) as healthcare organisations' generally implement practice change without the collaboration and participation of frontline practitioners (Rothschild 2004). Improving medication safety may rely more on how to successfully implement practice change, rather than the innovation itself. Many authors have noted that changing practice can be complex and challenging (e.g. Badger 2000; Flodgren et al. 2011; Greenhalgh et al. 2004; MacPhee 2007). In the following chapter,

the literature on implementing evidence based practice is explored to better understand how successful practice change can be achieved.

CHAPTER 3 LITERATURE REVIEW PART TWO: IMPLEMENTING EVIDENCED BASED PRACTICE CHANGE

Despite intense organisational focus, increased professional awareness and the proliferation of medication safety initiatives, improving practice related to medication safety has proved difficult to realise. The slow uptake of new knowledge into clinical practice is a consistent theme in health care (Grimshaw et al. 2004). Implementing practice change is more challenging than it is sometimes perceived. Szabla (2007), for example, estimated that two thirds of change projects fail. There are difficulties relating to almost every aspect of implementing evidence based practice change, such as the nature of evidence itself (Rycroft-Malone et al. 2004), the ways in which evidence is implemented into practice (van Achterberg, Schoonhoven & Grol 2008) and the impact of the context (Retsas 2000). van Achterberg, Schoonhoven and Grol (2008) suggested that implementation can be optimised by linking implementation strategies with theory. In this chapter a review of the literature relating to evidence based practice implementation is discussed. The literature is informed by and arises from various bodies of knowledge including, evidence based practice, diffusion of innovation, change theory and practice development.

3.1 Review Method and Search Strategy

A narrative review of the literature on implementing evidence based practice change was undertaken starting with a search of CINAHL Plus and MEDLINE databases for English language studies published since 2000. The MeSH term, *evidence based practice*, and key words; *nursing practice* OR *practice improvement* OR *change implementation* were used. The purpose of the review was to provide a broad overview and discussion of the current debates relating to evidence based practice implementation correlated to

improving medication safety. Literature which focused on the nature of evidence, implementation of evidence into practice, and contextual barriers to implementation of practice change were selected for inclusion. Initially a brief background to the development of evidence based practice as a means of highlighting its central role in contemporary health care is provided. This is followed by a review of, what constitutes evidence, models to support implementation and the impact of context on practice change.

3.2 Evidence Based Practice

3.2.1 Development.

During the 1990s, there was an increasing focus on evidence-based practice within nursing as an essential component of clinical effectiveness (Currie & Loftus-Hills 2002). Evidence based practice centred on the belief that it was no longer acceptable to practise according to routine and ritual (Walsh & Ford 1989) or because 'sister says' (Tod, Palfreyman & Burke 2004, p. 211) as had been the basis of much nursing care in the past. The focus was on the use of evidence to underpin practice that would be most likely to improve patient outcomes (Pearson 2005). Evidence-based practice was (and is) defined as the use of the best available evidence along with one's own clinical expertise and the patients values and preferences to improve outcomes (Melnyk & Fineout-Overholt 2011). In general, nurses did not contest the notion that care should be based on evidence. Indeed, the application of the findings of nursing research was viewed as the basis for quality care provision (van Achterberg, Schoonhoven & Grol 2008).

However, nurses were concerned about the origins of evidence based practice and its implications for nursing, nurses and patients (Holmes, Perron & O'Byrne 2006). Critics viewed evidence based practice as "a pervasive approach to directing and regulating nursing care" (O'Halloran, Porter & Blackwood 2010, p. 91). O'Halloran, Porter and Blackwood (2010) argued that evidence based practice stifled nurses' critical thinking and professional accountability; a notion that is in direct contrast with the stated aim that evidence based practice supports nursing clinical effectiveness. While Holmes, Perron and O'Byrne (2006) argued that evidence based practice over simplified the complexities of clinical nursing care. Many of the concerns for nurses stemmed from their belief that evidence based practice was a medical imposition, as the term that originally appeared in the literature was evidence-based medicine (Ingersoll 2000), and was an attempt to de-professionalise nursing and further medicalise health care (McCormack 2006).

Evidence based medicine was dominated by a dependence on randomised controlled trial research and by implication devalued other research (Loughlin 2008). As a result, many nurses were suspicious of what it had to offer to nursing, where other types of research and other types of evidence might be more valuable, as discussed later in section 3.3 on page 76. The specific difficulty lay with the incongruence between the type of knowledge needed for nursing practice and its suitability to be generated from randomised controlled trials (Nelson 2008). Nursing practice requires pluralism; the acceptance of multiple points of view (Rycroft-Malone et al. 2004) and different sources of knowledge (Benner 1984; Carper 1978; Titchen & McGinley 2003a).

3.2.2 Evidence based models.

There have been a number of models developed to conceptualise the evidence into practice process. While models have something to add to understanding the process, many do not adequately capture the entirety or complexity of the process. Some models focus on a discrete aspect of the process. The Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) (Newhouse et al. 2007) and the Advancing Research and Clinical Practice through Close Collaboration (ARCC) (Ciliska et al. 2011) models focused particularly on the use of high quality research evidence. Other models are linear and don't acknowledge that there is more likely to be an iterative progression through the stages from knowledge or awareness of evidence, to implementation of evidence in practice (Nutley, Walter & Davies 2003). Some models fail to take into account the barriers to implementation and present an overly optimistic account of the process.

The JHNEBP and Stetler (Stetler 2001) models concentrate on the individual nurse level with an emphasis on critical thinking and decision-making process. The individual is responsible for accessing, appraising and implementing research into their own practice, with the outcome being increased clinical effectiveness of individual nurses. The underlying belief appears to be that if nurses understood that they should be using research or evidence in practice, then they would do so. A commonly identified barrier within this viewpoint is the individual nurses' lack of knowledge or skill, in particular, their ability to critically apply research findings in practice (Koh et al. 2008). Estabrooks et al. (2003) undertook a meta-analysis of studies of individual determinants of evidence based practice. The authors concluded that the only statistically significant factor was a positive attitude to research. However positive attitude as a factor was not clearly defined and could have varied considerably between the individual included studies.

The Promoting Action on Research Implementation in Health Services (PARIHS) (Rycroft-Malone 2004), ARCC, and Iowa (Titler et al. 2001) models are helpful at an organisational level. These models are built around integrating research and evidence into the foundation of policies, standards and procedures and underpinning quality initiatives to maintain and improve organisational excellence. Hence, they stress the contextual application of evidence. The PARIHS model better reflects the complexity of implementation and considers that an understanding of evidence, facilitation and context is necessary for successful practice change (Rycroft-Malone 2004) and is discussed further in section 3.5 on page 91.

3.3 Nature of Evidence

What constitutes evidence is complex and contested (Leach 2006; Thurston & King 2004) and this has led to nurses holding differing views about its nature (Holmes, Perron & O'Byrne 2006). There appears to be two schools of thought. Evidence is considered to be synonymous with research (Grol & Wensing 2004; Ingersoll 2000) and the quality of the evidence is based on the hierarchy of research evidence (refer to Figure 2-2 on page 25). While randomised controlled trials are viewed as best evidence within medicine, other types of research were argued as valid and more useful for nurses (Titler et al. 2001). For instance, observational studies allow a first-hand account of behaviours and interactions in nursing practice. For others, evidence is more than research alone (Penz & Bassendowski 2006; Rycroft-Malone et al. 2004). A wide range of knowledge informed by clinical experience is accepted as evidence (Pearson 2005; Scott & McSherry 2008). Practice based evidence, such as clinical expertise which can take account of patient values or preferences, local quality improvement and audit data, and reflection on practice are all viewed as types of evidence on which practice decisions

can be based (Harvey 2005; Rycroft-Malone et al. 2004) The essence of this more inclusive approach to evidence still requires the caveat noted by Stetler (2004), that evidence, whatever it encompasses, must be able to act as 'proof' for making clinical decisions. For the purposes of this action research programme, I have taken a pragmatic and broad view of evidence as a concept and one that included quantitative and qualitative research, guidelines, local best practice statements, local data, such as medication incident reports and clinical expertise. The aim was to be inclusive rather than exclude any types of evidence.

Notwithstanding different types of evidence, quality remains an important consideration and can range from high to low. For example, in relation to clinical experience, professional consensus may be widely divided (low quality evidence) or high levels of consensus may exist (high quality evidence) (Kitson, Harvey & McCormack 1998). High quality evidence has been identified as a critical component of effective evidence based practice implementation (Rycroft-Malone et al. 2004; van Achterberg, Schoonhoven & Grol 2008). However, the quality of evidence alone does not fully explain whether a new practice change is successfully adopted. Within medication safety, there is evidence to support the use of a bar code medication administration (BCMA) system. Yet this has not necessarily resulted in widespread adoption and implementation. Individuals do not automatically adopt new practice. They make a conscious and deliberate decision of whether to use the new knowledge or innovation (Sanson-Fisher 2004). Rogers (2003), the most notable researcher in the field of diffusion, suggested that other characteristics of the proposed change impacts on the likelihood of successful adoption. According to Rogers (2003) and supported by a systematic review by Greenhalgh et al. (2004) there are five elements of a new practice

that will determine the ease of adoption: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability. This chapter will now focus on highlighting how these elements can inform evidence based medication safety improvement.

3.3.1 Relative advantage.

Relative advantage is the degree to which a practice is perceived as better than the current practice. Objective research data may be less important than the nurses' perception of whether the change will have disadvantages for patients or their nursing practice. While CPOE has demonstrated effectiveness in reducing medication error in controlled trials (Doolan & Bates 2002), it requires changes to clinicians' workflow. Two barriers to its adoption are the additional time required to enter prescriptions when compared to written forms and the interruption to usual communication pathways of medical and nursing staff. These barriers can delay medication administration to patients (Beuscart-Zéphir et al. 2005). Thus, some health professionals perceived that CPOE did not provide an advantage over current practice, and they have published reports questioning CPOE's clinical efficacy (Pirnejad et al. 2008). Ford et al. (2008) suggested that this literature slowed the rate of CPOE adoption. Another perspective, is that in this instance, health professionals are using their clinical experience and professional practice knowledge as an important source of evidence. From nursing's conception as a profession, the literature has asserted that nurses use various types of knowledge; such as practical knowledge, personal knowledge, aesthetic knowledge, experiential knowledge and scientific knowledge (Benner 1984; Carper 1978). Exploring nurses' knowledge of medication practice, particularly what aspects are working well, can support evidence based medication safety improvement.

3.3.2 Compatibility.

New practices which are perceived as being compatible with existing values, past experiences, and the needs of potential adopters are more readily accepted (Rogers 2003). This is seen within nursing where implementation of practice change is more successful when the evidence matches professional consensus (Rycroft-Malone 2004). An important aspect of implementing new practice therefore is to explore individual values and beliefs regarding the proposed change, and develop a clear vision for change (MacPhee 2007). The new practice has an increased chance of being adopted if it is consistent with the team's values and addresses an issue that practitioners believe is problematic. The role of nursing in relation to medication practice has been largely framed in the literature on the inadequacies of nursing administration that result in medication error (Gibson 2001). Nurses may not willingly engage with practice change if they believe that the approach is one of punishment and blame. In addition, serious medication errors are infrequent in practice and not openly discussed in the clinical areas. It is difficult for staff to perceive the need to change their practice when the rationale is to lower the probability of some future event happening (Greenhalgh et al. 2004). A potential strategy to increase nurses' compatibility with medication safety practice change would be to share a patient story or collecting and sharing local medication incident data. This can help establish the relevance and urgency for practice change.

3.3.3 Complexity.

Complexity refers to the extent an innovative practice is perceived as difficult to understand and use (Rogers 2003). A clinical procedure is more likely to be adopted if it is simple and well defined. Medication technology which enables verification of

pharmacy dispensed individual doses of medication was shown to significantly reduce medication dosing errors when it was introduced nearly 20 years ago (Kohn, Corrigan & Donaldson 2000). However, nurses have developed many workarounds (Koppel et al. 2008) which circumvented the inbuilt safety feature (Nelson et al. 2005) as they perceived that medication administration using bar coding technology is more complex and takes more time (O'Malley 2008). If a medication safety intervention is too complex leading to practice workarounds, it increases the risk of error and the intent and outcome of the innovation is lost. Collaborating with frontline nurses when developing changes to practice aimed at improving medication safety can identify potential barriers associated with added workflow complexity. This experiential knowledge can inform the implementation plan, improving the likelihood of success.

3.3.4 Trialability.

Rogers (2003) defined trialability as the degree to which the practice may be tried and modified. The ability to test a potential intervention on a limited basis allows the practitioner to explore the safety and effectiveness of the procedure and its acceptability to patients. Piloting a change in practice is essential to determine the fit between the information/innovation and the local context. There is no one way to implement change and what works in one area may need modification to fit the culture of another (O'Malley 2008). Implementing practice change in selected clinical areas that are receptive to change can demonstrate success and provide evidence for the change being implemented successfully in other areas. For instance, an inpatient medication chart was originally evaluated in 5 hospitals in one state of Australia and was shown to reduce prescribing errors. The chart was modified based on feedback and piloted in 31 hospitals nationally and a reduction in prescribing errors was again demonstrated (Coombes et al. 2011). The

authors reported that following the national pilot study the chart was endorsed by health ministers as a standardised National Inpatient Medication Chart and recommended for implementation in all public hospitals in Australia (Coombes et al. 2011). Using the notion of trialability, implementation of practice change to improve medication safety may start in one ward and then spread ward by ward throughout an organisation.

3.3.5 Observability.

An innovation is more likely to be adopted when the advantages are readily visible to potential adopters (Rogers 2003). The notion of observability is most readily seen in the use of change champions. If an influential practitioner changes their practice, it is likely to have a positive impact upon adoption rates. Thus role modelling behaviour of colleagues in adopting a new practice is beneficial in getting the innovation spread throughout a clinical area. As an example, the introduction of a coloured tabard alone, is not enough to minimise distractions. Nurses need to role model the expected behaviour, which is not interrupting a colleague when they are wearing the red tabard. Similar to piloting (refer to trialability above) a phased approach to implementation, where areas go live on an incremental basis over a number of months, offers opportunity for individuals to observe the successes of other areas.

In summary, the characteristics of the evidence can support its use in practice. Changes to improve medication safety which are perceived by nurses to be; based on quality evidence, an improvement on what is currently being done, compatible with their own values, able to be evaluated (even if on a limited basis), visible and not overly complex will be more likely to be adopted. Yet, even when a new idea has obvious advantages, it is still difficult to get it adopted (Rogers 2003). Using evidence in practice is not

straightforward (Hancock & Easen 2004) requiring multiple strategies to tackle the complex process (Pearson 2004). Focussing attention on the process of how to implement change increases the likelihood of success (Grimshaw et al. 2004; Mitchell 2013).

3.4 Models to Support Implementation of Evidence into Practice

Implementation of evidence into practice is a process of change. Changing practice is a complex and demanding endeavour (e.g. Badger 2000; Davis et al. 2003; Kanter 2004; MacPhee 2007), and has been described in the literature as the process of adoption, diffusion, dissemination and implementation (Gale & Schaffer 2009; Mitchell 2013). For the purpose of this discussion, adoption refers to an individual's decision to change practice, and diffusion, dissemination and implementation relate to the spread of the practice change to the nursing team. Rogers' model of diffusion (2003) has been widely used to support change in health care (Greenhalgh et al. 2004). Rogers model describes the steps an individual takes when deciding to adopt a new practice. The Transtheoretical Model of Change (Prochaska, Prochaska & Levesque 2001), was developed to motivate behavioural change, and thus may provide a more useful framework for implementing and sustaining change. In the following section these 2 models are explored as a means of implementing evidence in practice.

3.4.1 Adoption

Rogers (2003) identified 5 steps in the adoption process while Prochaska, Prochaska and Levesque (2001) proposed that there are 5 stages and 10 processes of change involved. There are similarities and differences between the models (Table 3-1). The first 3 steps in the diffusion model correlate to the pre-contemplation stage in the stages of change

model. Individuals have not yet fully acknowledged that there is a problem that needs to be changed and tend to defend current practice.

Table 3-1 Comparison of Diffusion and Stages of Change Model

Rogers (2003)		Prochaska, Prochaska and Levesque (2001)	
Step	*Description*	*Stage of change*	*Process of change*
Awareness	Exposure to new practice but lack complete information	Precontemplation	Consciousness raising (increasing awareness of the problem and potential solutions)
Interest	Seek out additional information		Dramatic relief (evoking emotions to inspire people to change)
Evaluation	Think about current practice and whether the new practice will work		Environmental re-evaluation (appreciating the positive impact of the change on the context)
		Contemplation	Self-re-evaluation (appreciating that change is beneficial for self)
		Preparation	Self-liberation (believing change is possible and making commitment to change)
Trial	Try out the new practice	Action	Reinforcement management (finding intrinsic and extrinsic rewards for new way of working)
Adoption	Decide to continue to use the new practice	Maintenance	Counter conditioning (requires the learning of new practice that can substitute for problem practice)
			Helping relationship (seeking and using social support to facilitate change)
			Stimulus control (removes cues for old practice and adds prompts for new practice)
			Stimulus control (removes cues for old practice and adds prompts for new practice)
		Termination	

During the initial steps in both models, individuals become aware of the new practice, which may occur when participating in a journal club or attending a professional conference. The individual decides whether to seek out more information about the practice. When they have additional information, they consider the nature of the evidence as discussed previously in section 3.3 on page 76. Although individuals are able to consider the possibility of changing their practice, they tend to remain ambivalent about it. Prochaska, Prochaska and Levesque (2001) referred to this weighing up of pros and cons of changing practice within each stage of change as decisional balance. In the contemplation stage, individuals acknowledge that there is a problem but are not yet ready or sure of wanting to make the change. The preparation stage comprises individuals getting ready to change. These stages relate to how the change will impact on the individual, an important component missing from Rogers's model. The trial stage of Rogers' adoption process is when the initial behaviour change is made and can be considered similar to the transtheoretical model's action stage. Rogers' adoption stage and the maintenance stage of the transtheoretical model is when the new behaviour is sustained over time. The stages of change model by Prochaska, Prochaska and Levesque (2001) provides a lot more detail for this vital stage of implementation. Prochaska and colleagues included a termination stage which describes when there is no longer any temptation for the individual to return to previous behaviour and abandon the new practice.

Rogers distinguished five categories of adopters: innovators, early adopters, early majority, late majority, and laggards (Rogers 2003). Innovators and early adopters are characterised as active seekers of new developments in practice and are perceived to accept change without resistance. Innovators and early adopters are valuable change

agents who influence their peers through peer to peer communication, role modelling and networking (Rogers 2003). Late majority are often sceptical of change but respond to peer pressure. Laggards maintain a point of interest in the past 'the way we have always done things' (Rogers 2003). From a transtheoretical model of change perspective, individuals move through the process to adopt practice change at different rates. Thus, improving medication safety can be supported using interventions targeted at the stage of the change journey an individual (or team) has reached and is discussed later on page 87. The end result is sustained behavioural change (Chilvers et al. 2002).

3.4.2 Diffusion and dissemination.

Sustainable practice change within a health care organisation needs more than one nurse to change, it needs the nursing team to have a greater understanding of the changes that are required and to share the responsibility for improving patient outcome (Ramanujam, Abrahamson & Anderson 2008). For a practice change to be spread throughout a team, it must be communicated from one individual to another. Rogers conceptualised the gradual change by which an innovation is communicated from one individual to another within a social structure through certain channels over time as the diffusion process (2003, p. 11). Greenhalgh et al. (2004) identified three different processes; diffusion, dissemination, and implementation. Greenhalgh et al. (2004) defined diffusion as an unplanned spread of information, dissemination as a directed process with the intention of convincing people to adopt the change and implementation as a planned and managed process to make the innovation part of everyday practice.

In reality, diffusion and dissemination of research has largely revolved around presenting research findings at education meetings and circulating the findings within

organisations, without any additional attempts to encourage the actual use of the research findings to inform practice change (Nutley, Walter & Davies 2003). Educational meetings including, courses, conferences, lectures, workshops, seminars, and symposia, are commonly used for continuing medical education with the aim of improving professional practice. There is some evidence that educational meetings alone or combined with other interventions can improve professional practice (Forsetlund et al. 2009). In a study specifically examining medication safety education, the authors noted that while there was a statistically significant change in nurses' knowledge, this did not translate to a change in behaviour (Dennison 2007). According to Rogers (2003) and Prochaska, Prochaska and Levesque (2001), one explanation maybe that the nurses were in the preparation stage and had not yet committed to taking action to change.

Some authors have suggested that the most effective communication strategy is face-to-face exchange (Thompson et al. 2007), this may depend on the individual and the nature of the intervention. Medication delivery within hospitals is a highly complex, dynamic, social intervention which occurs within many different contexts, involves many interdependent processes, healthcare professionals, and avenues of communication. Implementation of evidence based practice related to medication safety is therefore a challenging and complex process. One of the underlying beliefs of Rogers' (2003) theory is that change is promoted through ideas or information introduced by people with whom you can identify, therefore change implementation may be more effective if focused on a designated aspect of medication practice and targeted within a single discipline.

Thompson et al. (2007) conducted a systematic review of interventions aimed at increasing research use in nursing. The methodological quality of included studies was generally low, however there was some evidence that diffusion and dissemination of information are generally ineffective at changing practice (Thompson et al. 2007) and are inadequate to support knowledge use in clinical decision-making (Straus & Haynes 2009). Yet, these remain commonly used strategies within nursing. The assumption being that once nurses have the information they will change their practice. Perhaps in part due to the perceived low cost nature of this approach. A well-developed and designed implementation plan (Thompson et al. 2007) which focuses on participants' motivation, attitudes and intentions could result in more effectively achieving action and practice change (Buckley et al. 2003).

The transtheoretical model provides guidance for selecting appropriate strategies to support practice change at both individual and healthcare team and as such is a useful framework for implementing practice change. At the pre-contemplation stage a useful strategy may be to use local opinion leaders. Local opinion leaders are clinicians within the team who are identified by team members as being influential (Bero et al. 1998). However, the evidence supporting the success of opinion leaders in effecting change is equivocal (Flodgren et al. 2011; Grimshaw et al. 2001; Robertson & Jochelson 2006). The use of multiple sources of evidence, or ways of knowing, can assist nurses to make sense of the new knowledge and enable them to think about adopting the proposed changes. Acknowledging the intersection of research findings, clinical experience and patient experience has been demonstrated to be more effective in the readiness to accept suggestions in practice (Rycroft-Malone 2004).

A strategy to assist nurses to move to the contemplation stage is to share findings from research, such as providing current journal articles on different aspects of medication safety for the health care team to read. However, nurses have reported that they did not consider implementing research into practice to be relevant to them and described a lack of confidence in their ability to understand and evaluate research reports (Hutchinson & Johnston 2006; Nagy, McKinley & Macfarlane 2001). Increasing nurses' knowledge of how to use evidence is an important area that requires specific targeting with strategies to increase their critical appraisal knowledge and skills and attitude to evidence based practice. This will support the individual or nursing team's move through the pre-contemplation to contemplation stage as their knowledge and attitude changes.

Successful sustainable change requires engagement of healthcare professionals in the design and implementation of change (Jarrett 2003). Engaging frontline nurses in designing potential implementation strategies to improve medication safety is an effective strategy in enabling clinicians to take ownership of change. This will assist nurses to move from the preparation stage into taking action. Once nurses have reached the action stage, the aim is to embed the change in to daily practice. It may be necessary to provide some form of intermittent reminder to maintain the behaviour change. Audit of medication practice and feedback of results can be used as a reminder to sustain practice change (Grol & Grimshaw 2003). There is evidence that multifaceted strategies (Grol & Grimshaw 2003) which are tailored to address the barriers to change (Baker et al. 2015) can be effective, but the effect is variable and tends to be small to moderate. A key factor considered necessary for effective implementation of evidence based nursing practice is the active facilitation of change (Harvey et al. 2002; Rycroft-Malone 2004) and this is the focus of the discussion in the next section.

3.4.3 Facilitation of change implementation

Various authors have advocated for a bottom up facilitative approach (Eve 2004; Thompson et al. 2008) to changing practice. The characteristics of facilitation are described as being on a continuum from 'doing' to 'enabling' (Harvey et al. 2002, p. 582). The facilitator assists others so that they have an opportunity to acquire new knowledge and experience. For facilitation to be effective, facilitators need to have insight and a range of skills to be able to move along the continuum as needed (Harvey et al. 2002). Skilled facilitation enables expert practitioners to surface, articulate and then reflect on their practical knowledge and its melding with other forms of evidence (Harvey et al. 2002). McCormack (2006) has suggested that nurses need to become critical about practice to discover and tell some unwelcome truths about how things are here and now, and how they have come to be. Facilitated change interventions have been shown to be very effective (Robertson & Jochelson 2006).

A facilitated approach is strengthened when key stakeholders that will be affected by the change are included in the development of the change plan to enable identification of the barriers and enablers (Wallin 2009). Wallin et al. (2006) measured staff perceptions of contextual factors related to use of research in practice. The authors reported that initiatives that involve staff in decision making at the unit level enhance the use of research in practice and evidence-based practice. Change is effective when a locally considered and planned multi-faceted approach is used (Currie & Watterson 2007). Successful practice change requires nurses to engage in experiential learning and reflection, creating a culture of innovation and continuous improvement (Kitson 2009a; McCormack, McCance, et al. 2009). Balfour and Clarke (2001) argued that individuals will only become innovators of practice improvement through ownership of change. One

method of promoting nursing involvement in practice change and ensuring ownership is to use nurse-sensitive patient safety practice. This provides nurses with the accountability, responsibility and authority to lead and action the changes required to improve patient outcomes (Gallagher & Powell 2003). As medication administration to hospitalised patients is a part of everyday nursing practice it is essential that nurses are enabled to lead medication safety practice change.

Practice development is a facilitated approach to change that assists local nursing teams to review their practice and identify how it can be improved (McCormack, Dewing, et al. 2009). Change is focused on knowledge translation and empowerment of practitioners (Wilson 2005b). Practice development is a way of working collaboratively with nursing teams directly involved in patient care, enabling them to identify and address practice concerns themselves rather than imposing change on them. Sustainable practice improvement is through transformation of practice, and the context and culture within which it occurs (Garbett & McCormack 2002). Practice development describes a variety of methods for developing and changing healthcare practice within the context of clinical care (Manley, McCormack & Wilson 2008). Two general approaches have been identified; technical and emancipatory (Manley & McCormack 2004). Technical Practice Development is a 'top down' approach to implementing change; one that is concerned with traditional change management approaches in a contemporary healthcare setting (Manley & McCormack 2003). The previous medication safety improvement work that I had been involved with in the organisation might be considered technical practice development. It was systematically implemented and evaluated in terms of participation in and response to the education programme. However it relied on providing practitioners with information where I was perceived as an expert authority

figure; a ‘top down’ approach. There was no consideration of the workplace context or culture. Consequently there was no ownership of adopting changes to practice and initial improvement in practice was not sustained. Chin and Hamer (2006) proposed that emancipatory practice development is widely recognised as a mechanism to reflect upon everyday practice issues to implement a ‘bottom up’ change in healthcare organisations which is in direct contrast to a ‘top down’ approach. The emancipatory practice development interventions such as values clarification and developing a collective vision can support nurses as they progress through the stages of change as identified in the transtheoretical model discussed previously on page 82. The following section considers the influence of the context on practice change.

3.5 The Context of Change

Nursing practice change cannot be viewed in isolation from the context within which it is situated. Context has been described as the setting in which practice occurs (McCormack et al. 2002), but it is more than a mere back drop to practice, instead it is an influential factor in practice (Dopson, Fitzgerald & Ferlie 2008). A recent study of nurses’ use of research demonstrated that even nurses who were confident of their knowledge of research found organisational barriers to be a hindrance to using research in their practice (Wallin et al. 2006). Research to try and understand the contextual barriers to evidence based practice began with the Barriers Scale in the U.S.A. (Funk et al. 1991). This survey tool sought to measure four domains of research use activity; the characteristics of the individual nurse, the setting or context in which the nurse worked, the research itself and the way in which the research was communicated, with the intention to provide an overall view of the barriers to research use in practice. The majority of nursing research on contextual impact of evidence based practice are

descriptive. For example, some 45 studies have been completed using the Barriers Scale (Hutchinson & Johnston 2006) as well as other surveys (Hutchinson & Johnston 2004; Nagy, McKinley & Macfarlane 2001; Wallin et al. 2006). As with most surveys, the nurses who are more interested in research may have completed them and therefore the samples may not be representative of the wider nursing population. They are also self-reports, with no objective measures to support nurses' views. Nevertheless, the surveys have provided information relating to the barriers to evidence based practice. Overall, the studies have consistently identified the problems as being related to a lack of time and knowledge of how to find research and appraise it, research reports being too difficult to understand (Gerrish et al. 2007), and lack of a culture in which nursing research is valued or in which nurses had a positive attitude towards research (Windle 2006).

Meijers et al. (2006) undertook a systematic literature review to examine the impact of contextual factors on research use in nursing. Six contextual factors; education, support, time, access, climate and role were identified as impacting on nurses' research use. The 10 included studies were of generally low methodological quality and limited the authors' conclusions to suggesting that contextual factors may influence the development of environments that are conducive to implementing research in practice, and should be investigated further.

Kitson, Harvey and McCormack (1998) identified the contextual factors involved in managing change within nursing practice and used this information to develop the Promoting Action on Research Implementation in Health Services (PARIHS) model to promote implementation of evidence-based practice. The Model was subsequently

modified by Rycroft-Malone and colleagues and represents the interdependence of many factors that influence effective implementation of research findings into practice (Rycroft-Malone 2004; Rycroft-Malone et al. 2002). The authors argued that successful implementation is a function of the relation between the nature of evidence, organisational context and mechanisms for facilitating the process of change. They also argued that a competent change agent as facilitator is crucial to success. The PARIHS model can be used to determine where an organisation fits on a continuum between high and low for each of the three domains; evidence, context, and facilitation. This enables any problems to be addressed or countered prior to implementing practice change. Cummings et al. (2007) used structural equation modelling to test a theoretical model of contextual influences on nurses' research use. Their findings highlighted the combined importance of culture, evaluation and leadership, thus supporting the PARIHS framework.

Implementation of practice change is more likely to be successful when there is strong leadership that is committed to effecting change (Kitson 2009a) and a culture of creativity which allows local autonomy (Kent & McCormack 2010; Kitson 2009a). That is, a nursing team which shares a sense of pride, commitment, collaboration and teamwork and is supported to use new knowledge in creative and innovative ways to improve practice (McLean 2005). There are six characteristics of nursing teams associated with successful implementation of change; clarity of purpose, trust and confidence, leadership, roles and responsibilities and communication (Holleman et al. 2009). A clear team vision is favourable to implementation of change. A team which ensures psychological safety thus supporting its members to challenge practice, propose new ideas and participate in decision-making will enable the implementation of

innovation (Holleman et al. 2009). Leadership support must be visible (Sandström et al. 2011). The role of nursing leadership is to present, empower and facilitate change in a manner that is perceived as challenging (resulting in increased job satisfaction), as opposed to threatening, which has the potential to result in increased distress in the work place and absenteeism (Kuokkanen et al. 2009). Clear understanding of own and other team member's roles can maintain team members' sense of autonomy and professionalism (Clark 2009), positively affecting the implementation process. Implementation strategies employing a participatory approach, such as face to face communication with teams have shown some evidence of effectiveness (Chilvers et al. 2002; Greenhalgh et al. 2004; Thompson et al. 2007). This may depend on the size of the team; communication is better in smaller teams (Edmonson 2003) and the nature of the practice change. Personal communication provides an opportunity to tailor information to the team, allows sharing of information and an opportunity to check understanding. Not all factors will be relevant in all settings, rather each practice environment will have its own factors which either hinder or enhance the implementation of evidence based practice change.

3.6 Conclusion

The literature reviewed in this chapter has identified the critical components of effective evidence based practice implementation as; high quality evidence which is perceived to be needed, active facilitation of change, enabling practitioners to identify and address practice concerns themselves rather than imposing change on them and understanding the contextual barriers and enhancers (Dopson, Fitzgerald & Ferlie 2008; McCormack et al. 2002; Rycroft-Malone et al. 2004; van Achterberg, Schoonhoven & Grol 2008). The complexity of implementing evidence based practice change cannot be met by any

one strategy. It is critical that nurses not only understand research evidence, they need to change their behaviour to incorporate the new knowledge in their practice and work in an environment that enables the change. Changing medication administration practice requires frontline nurses to be supported to take the lead in transforming their clinical environment, culture and practice. In the following chapter, key concepts from emancipatory practice development, the transtheoretical model of change and critical social theory are combined in a conceptual model which underpins the action research study on improving medication administration reported in this thesis.

CHAPTER 4 METHODOLOGY AND METHOD

In the previous chapters, two significant bodies of knowledge have been explored; medication safety and professional practice change. As previously discussed, medication administration safety can be improved through practice change informed by an understanding of the impact of the context associated with patient, nursing and system characteristics, in conjunction with implementation of evidence based medication safety strategies. Implementation of practice change is a learning process engaging attitudes, beliefs, knowledge and behaviours (Matthew-Maich et al. 2010). A review of the key constructs of evidence-based practice, practice development, diffusion of innovation and behavioural change theory suggests that to effectively tackle the problem of sustainable practice change, a collaborative, inclusive and participatory approach is needed. In this chapter, the conceptual framework for the study is presented. This is an important first step in methodological design, as Grant and Giddings (2002, p. 11) reminds us, 'the paradigm serves to focus our attention in certain ways'. Action research method was chosen for the study as it aligned with the key elements of the conceptual framework and provided a systematic approach to support a robust research study (Appleton & King 2002; Cresswell 2009). The chapter concludes with the study data collection and analysis procedures, participant details, and ethical considerations.

4.1 Conceptual Framework

A key assumption underlying this doctoral work is that it is desirable to have empowered nurses as this leads to safe, high quality nursing care (McCarthy & Freeman 2008). Hence a research approach which is consistent with empowerment was required. The view that practice change requires a change of attitude, beliefs, knowledge and behaviour and that sustainability is increased when collaboration, inclusion and

participation in the change process is enabled was also embraced. The conceptual framework (Figure 4-1) draws on the critical theories of Fay and Habermas (Fay 1987; Habermas 1972; 1984), practice development (Manley, McCormack & Wilson 2008), and the transtheoretical model of change (Prochaska, Prochaska & Levesque 2001; Prochaska & DiClemente 1983). Critical social theory, practice development and the transtheoretical model of change are all concerned as much with the process of change as they are with what change is achieved. Therefore, collaboration and participation with those who will be affected by the change is deemed essential, enabling the fundamental requirement of the research methodology, which was to create the conditions for nurses in the real world of practice to be actively involved and have a voice in all aspects of the research process. The framework itself and the key constructs within it will now be discussed in detail.

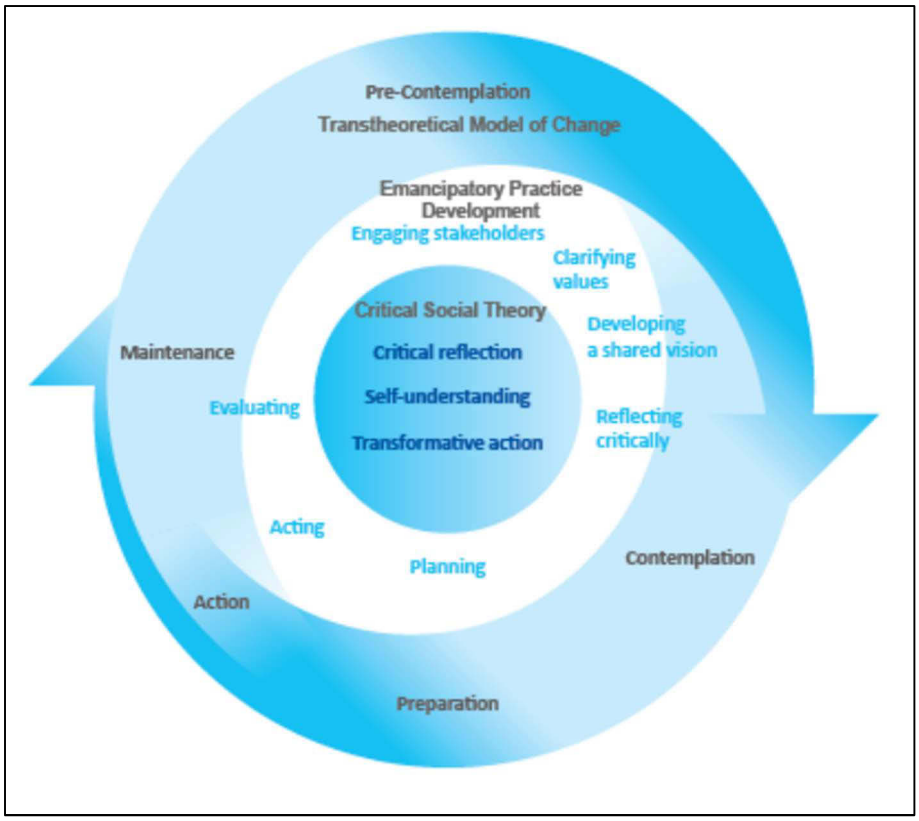

Figure 4-1 Conceptual Framework

4.1.1 Critical social theory.

The initial perspective considered in developing the conceptual framework was the philosophy of critical social theory. Critical social theory underpins the study as this approach promotes consideration of the workplace context and culture, enables participants to develop a self-critical understanding of practice, and supports participants to create as well as translate knowledge into practice (Kemmis 2001). Critical social theory aims to explore and critique the social world in such a way that understanding or enlightenment becomes the catalyst for empowerment which results in the transformation of the social order through emancipation (Fay 1987). The theory holds that there is a fundamental conflict that causes dissatisfaction in the social world resulting in a crisis. Those who are dissatisfied have an unawareness or 'false consciousness' of one's self in the social world (Fay 1987, p. 23). Fay asserts that the social group is only able to overcome their dissatisfaction by coming to a different understanding of one's self in the social world. This 'consciousness raising' empowers the social group to change. Through education, the dissatisfied group learn about their situation (in this case medication administration) and their potential capacity to change it (enlightenment) and become motivated into 'transformative action' to change their situation (empowerment) resulting in collective autonomy to 'freely determine the nature of their collective existence' (emancipation) (Fay 1987, p. 205).

Nurses have been viewed as a group that are dissatisfied in the social world of healthcare, in terms of their role in the healthcare system (Kuokkanen et al. 2009; Matheson & Bobay 2007). The conflict may be attributed to the medical dominance in decision-making related to patient care in healthcare organisations (Luzio 2008). Nursing practice is often conditional on medical directions, coercing nurses into task oriented ways of

working. The value of nursing care is poorly recognised by medical staff and nurses are seldom included in decision-making processes (Daiski 2004). As well as the inter-disciplinary hierarchy between nurses and doctors, there is also intra-disciplinary hierarchies, exhibited by, for example, a lack of support for the nursing team from the nurse manager (Daiski 2004). This leads to nurses' feelings of lack of autonomy and control over their practice and a perception of not being able to change practice. Professional literature is a part of the discursive ensemble of nursing, contributing to how nursing is constructed and viewed. In relation to medication practice in particular, the role of nursing has been largely framed on the inadequacies of nursing practice that result in medication error (Gibson 2001). Critical social theory is a theory of practice which recognises that nurses can understand and change their workplace context and culture through exploring the effects of values, knowledge and power (Manias & Street 2000).

While there were several concepts from critical social theory (as discussed in this chapter) that informed the research study there are three concepts; critical reflection, self-understanding and transformative action deemed central to the study's conceptual framework (Figure 4-1 on page 97). The following sections will discuss each of these three concepts more fully.

Critical reflection

It has been argued that critical reflection has the capacity to create emancipatory change. For example, Fook (2004, p. 16) argued that

> *"critical reflection, as a process which is partially based on, and integrates, elements of deconstructive thinking, can provide a means of reconstructing,*

and thus changing the ways in which individuals perceive and relate to their social worlds. In this sense critical reflection holds emancipatory possibilities"

Hence a key proposition embedded within the study conceptual framework is that critical reflection will enable study participants to envision possibilities for change. Specifically, the conceptual framework supported nurses to explore their experiences of medication practice within their practice environment, with the aim of enhancing their self-understanding of the safety of their own and the nursing team's medication administration practice. The insights gained from the critical reflection on and in practice enabled the transformation of participants' perspective of medication safety and inspired them to take action to change practice.

Critical reflection is congruent with the philosophical tradition of critical social theory that emerged in the 1920's and 1930's from the University of Frankfurt's Institute of Social Research and revised in the 1960's by the second generation of critical theorists Jürgen Habermas and Brian Fay (Crotty 1998). According to Habermas, knowledge is created on the basis of human interests and the contexts that shape them, which he labelled as technical, practical, and emancipatory. That is, an understanding of human reality is achieved from an orientation towards 'technical control', 'mutual understanding' or 'emancipation' (Habermas 1972, p. 311). Habermas proposed that these three domains of knowledge relate to analytic, hermeneutic and critical ways of thinking.

Habermas described technical knowledge as that generated by the empirical-analytic sciences. This knowledge seeks explanations to predict and control events and is congruent with the positivist science paradigm. However while technical knowledge is essential and important, it is not the only legitimate knowledge (Habermas 1972). Habermas' practical knowledge, derived from the historical-hermeneutic sciences, focuses on achieving shared agreement by understanding the meanings people make of their social reality. Habermas argued that this knowledge cannot be sought through a positivistic scientific orientation and thus practical knowledge fits with the constructivist or interpretive science paradigm. Constructivist science generates knowledge in the form of mutual understanding of subjective meanings that can inform and guide practical judgment.

Habermas argued that reducing the social sciences to subjective meanings fails to take into account the social and cultural constraints. Therefore Habermas' emancipatory interest focuses on emancipation from the social and cultural constraining forces through critical reflection (Habermas 1972; Terry 1997). Habermas' emancipatory knowledge unites the explanatory and understanding knowledge in critical reflection founded on emancipatory intent (Habermas 1972). Critical social theory aims to provide understanding of practice through explanations that are scientific, reflexive, critical and practical. Thus technical and practical knowledge can be used in an emancipatory approach embedded within the action research study. The intention here was to raise participants' awareness of technical and practical knowledge to enable informed decision-making. For example, the conceptual framework supported my sharing different illustrations from the medication safety literature with the participants to enable them to reflect critically on their own practice.

In his theory of communicative action Habermas considered that through critical reflection and dialectic discussion people purposefully seek to reach mutual understanding and unforced consensus about what to do in a particular practical situation rather than pursue their own individual goals (Habermas 1984, p. 86). This provides a theoretical basis for a view of practice that replaces the technical expert with one of the reflective practitioner (Argyris & Schön 1974; Schön 1983).

The intent of this action research study was to create emancipatory knowledge about how to change the context and culture of nurses' medication practice. Culture is expressed through values, beliefs, assumptions and norms. Part of my role in the action research process was to enable nurses to explore these aspects of their workplace culture. According to Habermas' (1984) theory of communicative action, people relate to each other through shared interpretation of their experiences, during which they come to understand them. In addition, communicative action is open, free communication that is not imposed on by those with power (Godin et al. 2007). Communicative spaces are conceptual and physical (Singhal 2003). Conceptually, communicative spaces provide a forum in which individuals' voices can be heard. They develop as issues are opened up for discussion through discourse and debate aimed at reaching mutual understanding and consensus (Kemmis 2001). Physically, a space and time is provided to enable people to come together to engage in discourse. This space needs to be mutually accessible and in a safe environment with open channels for communication where none previously existed (Singhal 2003). In this study, the medication action group meetings were held away from the ward. However, due to restrictions on room availability, the meetings occurred in various rooms. The rooms where meetings took place invariably had a large table in the middle of the room which could have inhibited open communication.

However, the table was used to complete activities such as data theming and collection of field notes. It appeared to provide an anchor for participants to lean against. So, although initially I had attempted to find a room that could have chairs arranged in an open circle, it soon became evident that this would have been a mistake.

Dewey (1933; cited in Leitch & Day 2000) defined reflection as a conscious cognitive process necessary for knowledge production through experience. However, Schön (1983) viewed reflection as both an unconscious and a conscious cognitive process. Schön distinguished between reflection-in-action and reflection-on-action linking the different forms of reflection to informal and formal knowledge. In other words, informal knowledge is gained from doing (reflection-in-action) and formal knowledge is gained from a retrospective intellectual activity (reflection on action). Within this study, reflection on action occurred during the action group meetings focused upon the critical and supportive examination of medication practice problems, and reflection in action was undertaken by the nurses in their daily practice.

Similar to Habermas, more recent authors have classified reflection as descriptive, analytical or critical (Brookfield 1990; Mezirow 1990). Descriptive reflection refers to uncovering the situation and general reaction with little attempt to discover personal beliefs or assumptions about the situation. Analytical reflection integrates meaningful reaction to the situation based on assumptions, beliefs, feelings, and alternative points of view. Critical reflection is a systematic process of questioning beliefs, values, assumptions and behaviours regarding the situation, thus discovering new meaning and suggestions on how this experience can inform future practice. Various authors have described critical reflection as a process of developing conscious awareness of practice

situations to create deeper understanding and linking theory, research, and practice (Mantzoukas 2008; Nielsen, Stragnell & Jester 2007; Perry 2000). Thus critical reflection enhances thinking about complex, difficult to resolve practice issues and guides decision-making as practice developments progress.

Self-understanding

The process of increasing self-understanding necessitates going beyond technical understanding or subjective meanings and is congruent with emancipatory knowledge. However, self-understanding is itself shaped by culture and context (Carr & Kemmis 1986). While based on realism, it is also important to acknowledge that the universal truth may not be accessible to everyone (Weaver & Olson 2006). People co-create their reality through; participation, experience, thinking and action (Heron & Reason 1997). People influence each other and are in turn influenced by each other (Appleton & King 2002). Interpretation of meaning and truth are further influenced by past experience, context and culture and are social in nature (Campbell & Bunting 1991).

The concepts of co-creation of reality and the importance of context are applicable to this current study. Medication administration in the study setting is mostly a two person procedure. However, a previous study undertaken in the same organisation demonstrated that individual nurses have different perspectives of what constitutes safe medication practice (Dickinson et al. 2010). In addition, many contextual factors which interfered with the nurses' ability to prepare and administer drugs according to best practice were highlighted (Dickinson et al. 2010). Variation in practice between nurses has been identified as contributing to medication error (Davis et al. 2005), especially when members of the nursing team shared a set of tacit rules which allowed less than optimal

practice to exist. Therefore it was important in designing the current study that the theoretical approach enabled participants to take a step back and critically evaluate everyday practice.

Some individual learning is achieved through information acquisition from others, however it is largely by experiencing the learning in person that valuable knowledge is generated. Knowledge is subjectively knowable, generated through shared awareness and understanding (Weaver & Olson 2006). In action research, knowledge is co-constructed through the relationships between the participants and also between the participants and the researcher (Campbell & Bunting 1991) and attained through a dialogical and dialectical approach (Denzin & Lincoln 2011). My role of practitioner/researcher was essential in facilitating a climate which enabled critical self-reflection, supported dialectic dialogue and learning (Wilson 2005b). This harnessed the collective knowledge of the nurses involved in direct patient care and promoting collaboration between nursing team members and between nursing team members and myself.

Fay (1987) cautioned that a collaborative approach can also lead to 'false consciousness', where the shared understanding of a group of people fails to account for the situation. It is important to remain alert to the influence of false consciousness as that is how a group can become stuck in a particular situation (Fay 1987). Incorrect illusions of practice can contribute to supporting habitual practice. Facilitated discussion about perceived dissonance between desired practice and current practice can raise the groups awareness and critical consciousness (Freire 1998). In other words, an increase in self-understanding can enable a team to reveal their distorted perception of current

practice reality (false consciousness) therefore helping the group become enlightened. Facilitated group discussion can help overcome the team's perceived inability to change practice (e.g. challenging the notion that 'there is no time' to critically reflect or implement changes).

Transformative action

Transformative action (Fay 1987) is the third central tenet of the conceptual framework and describes how individuals and teams are enabled to change their way of being and how they work. This is achieved through engaging nurses in dialectic discussion about what needs to change and how to develop action plans to achieve it. This aspect of the conceptual framework promotes sharing values and creating a vision that enables the nursing team to move forward in a strategic and practical way. Transformative action is inspirational and innovative thinking that allows individuals and teams to uncover the realities of hidden practice and see new possibilities in place of habitual practice. It is the process for understanding how to turn obstacles into opportunities. The focus is on solving the problem through consensus building and finding new ways of working together based on respect (Heron & Reason 2006). Building on the work of Friere (1998) and Habermas (1972), Mezirow developed the theory of transformative learning (Mezirow 1990). In describing transformative learning, Mezirow suggested individuals acquire the ability to move beyond preconceptions toward a "frame of reference that is more inclusive, discriminating, self-reflective, and integrative of experience" (1997, p. 5). The goal of transformative learning is for individuals to fully understand their actions through exploring the values and knowledge on which they are based. Consequently, attitudes and beliefs developed through transformative learning are open to processing the emotions involved, and are better able to guide subsequent action (Mezirow 1997).

Transformative learning enables the understanding of why experiences are perceived as they are by individuals and groups and how that perception leads to certain actions. This in turn enables individuals and groups to make thoughtful, informed, enlightened, and intentional choices about related actions (Mezirow 1997).

In summary, the central tenets of the conceptual framework supported the research aim to explore how the safety of nurses' medication administration practice is improved through working with frontline nurses enabling them to gain insight into their own and ward medication practice, supporting them to use their insights, clinical expertise and best available evidence to challenge and change practice. Critical reflection was used as a means of linking knowledge to emancipatory change. Having established that critical reflection, self-understanding and transformative action were the 3 central tenets of the conceptual framework, another component was needed to guide how the participants in the study would navigate these processes.

4.1.2 Emancipatory practice development processes.

Emancipatory practice development with its foundational links to critical social theory provided a congruent solution and thus was embedded within the conceptual framework. Emancipatory practice development provides a social means of working with nurses to question how the effectiveness of clinical practice can be improved (Garbett & McCormack 2004). It is a facilitated approach to change which focuses on the workplace context and culture and emphasises emancipatory change (McCormack, Manley & Titchen 2013). A critical attribute of emancipatory practice development is the development of new ways of working which lead to improved effectiveness of nursing care and patient outcome (Unsworth 2000). The processes of emancipatory

practice development are depicted in the middle ring of the framework; (a) engaging stakeholders, (b) clarifying values, (c) developing a shared vision, (d) reflecting critically, (e) planning, (f) acting and (g) evaluating (McCormack, Garbett & Manley 2004, p. 322). These processes formed the foundation for this study and are examined more fully below, building on the introduction to emancipatory practice development provided in chapter three.

Emancipatory practice development is about enlightening and enabling nurses to transform the practice environment in which they work, through a facilitated process of critical reflection and emancipatory change (Harvey et al. 2002; Kitson, Harvey & McCormack 1998; Rycroft-Malone 2004). Early explanations of the underpinning philosophy of emancipatory practice development aligned with Habermas' critical theory (Manley & McCormack 2003). As previously discussed, Habermas asserted that there are three kinds of knowledge; technical, practical and emancipatory (Habermas 1972). Manley and McCormack (2004) contend that Habermas' critical theory was extended by adding the elements of false consciousness which causes and perpetuates crisis and emancipatory action (Fay 1987). Meaning it is not sufficient to just be aware of the situation more so it is necessary to take action.

Including emancipatory practice development within the conceptual framework supported the development of a research design which values working with nurses within the complexity of practice, and the inclusion of local knowledge and ideas for change developed from practice (Manley & McCormack 2004). The approach to action is through participation in facilitated reflective learning in and on practice integrated with collaborative decision-making. Following the processes of an emancipatory

practice development approach, an important early activity in the research journey was to explore the values and beliefs associated with medication practice to develop a common vision. This embedded values and beliefs into everyday practice enabling the nurses to support and challenge each other in the implementation of the agreed values and vision. Critical reflection on the dissonance between the nursing team's stated values and shared vision, and the reality of practice was particularly useful in raising staff consciousness of practice problems. Building on the agreed vision, plans for learning and action were made and carried out. While implementing the action plans, the nursing team continuously evaluated the changes being made and refined the plans as required.

Emancipatory practice development processes are aimed at promoting the empowerment of nursing staff. They utilise nurses' knowledge and clinical expertise to raise awareness of practice that needs to be changed. Nurses are supported to motivate and challenge themselves and each other to take action to achieve the desired change. In other words the process of enlightenment, empowerment and emancipation (Fay 1987). Within this study, the practice development processes guided the research programme activities. This enabled the nurses to gain insight into their own and the ward nursing team's medication safety practice, and led them to develop and implement change initiatives. Nurses were empowered to reflect on how the culture and context of care was helping or hindering the changes they wanted to implement. This created the potential for improving patient care through a culture of effectiveness that promoted learning, ownership of change, and personal responsibility for quality of practice. In choosing emancipatory practice development, insights into constraints within existing medication administration practice was fostered to enable nurses to gain self-knowledge that was applied to change practice.

4.1.3 Transtheoretical Model of Change.

The final component of the conceptual framework provides a structure for combining the underpinning philosophical concepts and emancipatory practice development processes to guide practice change. Numerous theories explain behaviour change. However, researchers have not been able to establish one unified theory of change, applicable in all circumstances. The transtheoretical model of change supported the assessment of the nurses' readiness for change before action plans were designed to enable interventions to be tailored to specific needs. Accordingly, the stages of change were included in the outer ring of the conceptual framework.

In the adoption and implementation of innovative practice change in nursing, individual behaviour change is viewed as a dynamic process with movement from stage to stage. The stages of change guided the study participants' progression through the action research journey. The stages provided guidance for the selection and timing of appropriate interventions to support practice change with the effect designed to produce a permanent behavioural change (Berwick 2003). Moving through pre-contemplation to contemplation stage involved changing beliefs, attitudes and knowledge. As will be described in chapter five, a values clarification exercise was planned as a way of raising awareness of the need to improve medication safety on the ward whilst nurses were in the pre-contemplation stage.

Moving from contemplation to preparation and action involved changes in emotional processes. Group discussions enabled nurses to develop self-belief in their ability to challenge and change workplace context, culture and practice and supported them to move from contemplation to the preparation stage. The taking action stage provided a

foundation for the nurses' active participation in designing and implementing change interventions. The maintenance stage provided a basis for the nurses to observe changes, feedback and maintain ongoing contact (e.g. electronic reminders) to support sustainability of practice change. Using a range of interventions has been shown to be more successful than single interventions in the implementation of evidence into practice (Grimshaw et al. 2004).

The conceptual framework with its underpinnings in critical social theory holds that if nurses are enlightened to the features of the workplace context and culture that are causing dissatisfaction and crisis, and are empowered to challenge and change practice, they will be emancipated from old ways of doing (because that's how it is always done around here) and seeing themselves as passive participants (it's not for me to say…) in the healthcare organisation. Ownership and empowerment to change is located with the frontline nurses to ensure any changes implemented are meaningful and sustained (Kitson, Harvey & McCormack 1998).

Nurses have used critical social theory to examine the position of nursing as a profession existing in a hierarchical and authoritarian system (Kuokkanen & Leino-Kilpi 2000). The lack of empowerment of nurses as a group has promoted the use of critical social theory as a means by which nurses can examine nursing through investigating its controlling structures (Antrobus & Kitson 1999). Foucault (1980) sees power as something that results from the interactions between people, from the practices of institutions, and from the exercise of different forms of knowledge. The critical paradigm enables nurses to question the extent to which knowledge represents the interests of the dominant profession and serves to reinforce hierarchical positions in

healthcare (Habermas 1972). It affirms that experience can be a basis of knowing and that experiential learning can lead to a legitimate form of knowledge that influences practice (Kolb 1984). The conceptual framework for this study recognised the importance of enlightenment, empowerment and emancipation in enabling changes in nurses' behaviour. An approach which, at its heart is collective, self-reflective inquiry that the researcher and participants undertook to understand and improve medication safety practice within their own ward. The reflective process was directly linked to action achieved through iterative cycles whereby participants collected and analysed data and determined what action followed. As well as a critical alignment, the conceptual model is consistent with a participatory research style. There are numerous points of convergence between the conceptual foundations of critical and participatory research approaches and action research (Reason & Bradbury 2006) and is the focus of discussion in the following section.

4.2 Action Research Method

The characteristics identified as important for achieving planned change are inherent in action research (Bridges & Meyer 2007). Hence, it is described as an ideal method for studying change (Hart & Bond 1995; Reason & Bradbury 2006). Action research is particularly suited to studying a practical problem within a complex social situation. It takes into account the emerging nature of the inquiry and provides a way for taking action. Action research centres on people and their problems and has been described as

> *"a philosophical approach to the study of human problems which helps groups to share and refine their understanding of their situations in a mutually supportive environment"* (Morton-Cooper 2000, p. 14)

Collaborative participation is a fundamental feature of action research (Carr & Kemmis 1986; Hart & Bond 1995; Heron & Reason 1997; Kemmis & McTaggart 2000; Morton-Cooper 2000). An eclectic approach to data collection is taken, using whatever methods best address the problem being studied. Action research is not easily defined as there are many different models. It has been described as a family of research methods, which pursue action (e.g. improvement of practice) and research (creating valid knowledge about practice) through reflection (Altrichter et al. 2002). Reason and Bradbury (2006) argued that the 'family' are not different research methods, but approaches grounded in different traditions that express competing philosophical assumptions and worldviews.

In the context of the current study, the aim was that I would work with frontline nurses to enable them to determine what was required to improve the safety of nursing medication administration and how this would be achieved. The legacy of healthcare re-engineering and the hierarchical and authoritarian structure within the healthcare organisation had contributed to feelings of disempowerment among the ward nurses (Bamford-Wade & Moss 2010; Laschinger & Leiter 2006; McCloskey & Diers 2005). Therefore an action research approach was required which matched critique with action and emancipated participants from habit and customs which constrained their practice (Kemmis 2001). The primary means of knowledge generation was critical reflection on and in practice, enabling the nurses to develop a shared understanding of the desired practice change. There was an emphasis on the facilitation or enablement of the required change (Unsworth 2000). Thus, as well as seeking new understanding of practice and implementation of innovative practice change, this study was concerned with creating the conditions for empowerment and transformation of individuals, nursing team, workplace context and culture. The combination of critical inquiry and emancipatory

action within a participatory approach was fundamental to the research study reported within this thesis.

As a form of critical inquiry, action research encourages research that is 'with, for and by' people and communities (Reason & Bradbury 2006, p. xxi). It is an approach to inquiry which centres on people and their problems, taking into account all stakeholders and makes use of reflection. It is a cyclical process which begins with a group of participants examining a problem to find ways of solving or reducing that problem. Each participant is fully involved in articulating the problem and constructing possible solutions. The cyclical approach allows participants to reflect on findings as they are generated, and these reflections are used to inform further action and data collection. Initial action research cycles then lead on to further action research cycles.

Action research has much to offer healthcare practice (Hart and Bond 1995) and is particularly suitable where the aim is to engage practitioners to make changes to practice in a purposeful way while contributing to knowledge development (Kemmis & McTaggart 2000). That is, clinical effectiveness is developed whilst simultaneously generating new knowledge for and about practice through reflection (Hart & Bond 1995; Meyer 2000). Action research allows the development of knowledge relevant to local practice which can be used to inform future practice change (Chenoweth & Kilstoff 1998). It has been suggested that action research could help nurses better articulate the nature of their practice to address the invisibility of nursing work and to illuminate the significance of their contributions to healthcare and society (Canam 2008). Action research can bridge the gap between theory, research and practice (Morton-Cooper 2000) and is a promising approach to the implementation of evidence based practice

(Munten et al. 2010) knowledge transfer (Kitson 2009b) and organisational change in healthcare (Bamford-Wade & Moss 2010; Bridges & Meyer 2007; Pope 2007).

Healthcare action research is both patient centred and practice based with the aim of improving clinical practice. A recent systematic review by Munn-Giddings, McVicar and Smith (2008) found that action research has a strong presence within nursing research. Action research has been used to improve such things as pain management practices with older people (Brown & McCormack 2011), dementia management (Chenoweth & Kilstoff 1998), palliative care practice (Hockley & Froggatt 2006) and nursing handover and communication (Wilson, Ho & Walsh 2007). However, Munn-Giddings, McVicar and Smith (2008) found that the majority of action research undertaken by nurses was focused on organisational or professional development.

Lewin is credited for the origins of action research as a method of inquiry (Adelman 1993). Lewin identified that in solving practical problems, people are more likely to act upon decisions made democratically in a group rather than decisions in which they have had no involvement (Waterman et al. 2001). Lewin also promoted the cyclical nature of action research (Kemmis & McTaggart 1988). However, Lewin's work on action research has been criticised on the basis that the involvement of participants in the process was principally about facilitating the implementation of desired change (Cassell & Johnson 2006). In other words, action research when conducted within a positivist paradigm may be used to promote technical knowledge. Other origins of action research are located in psychotherapy, education and organisational development (Reason & Bradbury 2006). It is not surprising therefore that a variety of approaches have emerged since Lewin's original work manifested differently across disciplines and fields of study.

Several authors have described typologies of action research (Hart & Bond 1995; Holter & Schwartz-Barcott 1993; Waterman et al. 2001). These models can be expressed as a) technical b) organisational/workplace/professional and c) emancipatory/critical/ participatory with the variation identified in the project design and in decision making responsibility (Hughes 2008). Technical action research is largely controlled by the researcher and is most similar to Lewin's original approach (Holter & Schwartz-Barcott 1993). Action research within an organisation or workplace involves collaboration amongst a group of professionals with the dual aim of improving practice and contributing to knowledge development (Hart & Bond 1995, p. 38). Emancipatory or critical action research involves all key stakeholders in decision-making in all phases of the research project (Hart & Bond 1995). Action research typology is not static and may change as the research evolves (Hart & Bond 1995). I worked collaboratively with the MAG to come to a shared understanding of the specific problem (medication administration) and identify potential solutions. According to Hart and Bond (1995), the study was participative by its focus on the behaviour of participants and empowering by enhancing the individual's understanding and ability to challenge their workplace culture and context. The study became emancipatory as participants became more involved (Hart & Bond 1995). In this case, as the collaboration between the nurses and myself, as researcher, strengthened and became more equal, they took more ownership of the research and the changes to practice.

Irrespective of how action research is categorised, all action research includes four key characteristics. First, action research is concerned with practical issues (Holter & Schwartz-Barcott 1993); its primary aim being to produce 'knowledge that is useful to

people in the everyday conduct of their lives' (Reason & Bradbury 2006, p. 2). Second, action research aims for new knowledge, recognising that 'action without reflection and understanding is blind' (Reason & Bradbury 2006, p. 2). Third, action research is participative and democratic; all participants, researchers, practitioners or managers work collaboratively as equals (Hart & Anthrop 1996). Finally, action research is emergent, a process through which individuals and groups develop skills of inquiry and new understandings over time (Waterman et al. 2001). These four characteristics are all present within this study. The aim of this study was to achieve local improvements in medication administration safety (practical issue) co-created by the nursing team responsible for care delivery (participative). This was achieved through the facilitation of emancipatory practice development processes enabling the team to make contextually appropriate changes to their culture and practice (emergent process). At the same time, the knowledge generated has contributed to the discourse on medication safety, the means of achieving sustained best practice, and the use of emancipatory practice development as an approach for generating effective workplace culture (new knowledge).

Waterman et al. (2001) conducted a systematic review of healthcare action research studies and identified additional characteristics to the 4 discussed above. These features were; resources, project process and management, action researcher–participant relationship, key persons, and research methods. The resources which were identified as critical to action research were time, staff, money and material (Waterman et al. 2001). The flexibility and emergent nature of the cyclical process of planning, action, reflection and evaluation (Kemmis & McTaggart 1988) was identified as a key strength of action research projects. Waterman et al. (2001) noted that while project management

details, such as resources, process, and outcome are provided in written reports, details of the remaining components, level of participation, action researcher–participant relationship, key persons, and real-world focus were often limited.

While Waterman et al. (2001) found participation was the most common reason for choosing action research, the extent of participation can vary. Participation can lead to motivation and willingness to change and can help overcome potential barriers to change. However, participation can also change team dynamics which may need to be managed (Waterman et al. 2001). In this study, a medication action group (MAG) was established. Kemmis (2001) notes that participation in action research is influenced by Schön's work on reflection. In reflecting in action, the MAG looked at their experiences, connected with their feelings and built new understandings that informed their action. I facilitated the MAG meetings to assist reflection on action, enabling the group to explore the reasons for their actions and interactions. It is this reflective aspect of action research which enables attitudinal and behavioural change (Hart & Bond 1995), this change would be less likely if a positivist or interpretive research approach was chosen. Action research provides a focus and framework for participants to demonstrate and account for how they act as researchers, strengthening the practitioner researcher movement and the utilisation of research to underpin practice.

4.2.1 The action researcher.

The chosen approach to action research will influence the collaborative relationship between the researcher and participant (Unsworth 2000). If a positivist or technical approach is chosen, the researcher is a powerful outsider; objective, detached and controlling. Within the other action research approaches, the collaboration between the

researcher and participant is based on the principle of shared power (Meyer 2000). In the beginning stages, consistent with the professionalising approach to action research, a more directive leadership is required than the transformative style of leadership required in the emancipatory approach (Hart & Bond 1995). This research required that I be fully aware of the implications of power in my relationship and leadership style. I was assisted by my critical companion and supervisors to develop my own self-awareness and leadership style as the research progressed.

An action researcher can be either an 'insider' (sharing the characteristic, role, or experience under study with the participants), or an 'outsider' to the commonality shared by the participants (Dwyer & Buckle 2009). An insider will have knowledge of the research setting, its culture, norms and key contacts as well as practice-based knowledge. Insider researchers are often more readily accepted by the participants and participants are typically more open with insider researchers so that there may be a greater depth to the data gathered (Dwyer & Buckle 2009). However, insider researchers may be less able to consider alternatives or new ways of viewing practice (Waterman et al. 2001). Furthermore Asselin (2003) has pointed out that the dual role of practitioner researcher can also result in role confusion when the researcher responds to the participants or analyses the data from a perspective other than that of researcher. An outsider researcher can bring a fresh view to the situation and have a greater ability to raise sensitive issues and encourage honest feedback through assurances of anonymity. Although, an outsider may require additional time to develop links and learn how practice operates in the research setting (Dwyer & Buckle 2009). As a paediatric nurse who administers medication to children, literature would suggest that I was an insider. However I did not work on the particular ward in which the action research took place. My role as Clinical

Nurse Consultant, previously engaged in medication safety within the organisation, had the potential to influence the researcher-participant relationship. My role as facilitator of the MAG did not exclude my active participation within the group activities. At times I took the role of having subject expertise or being experienced with practice development techniques. The MAG members were experts in the structure and processes of the ward. Collaboration between the researcher, MAG and ward nursing team overcame any limitations of being an insider or outsider researcher. Importantly, it was not the researcher's status that determined the quality of the researcher. Rather it was "the ability to be open, authentic, honest, deeply interested in the experience of the participants, and committed to accurately and adequately representing their experience" (Dwyer & Buckle 2009).

In addition to the importance of participation and the research-participant relationship, Waterman and her colleagues (2001) noted that both practitioners who hold a formal position of influence and those in less formal positions can influence the research in either a positive or negative manner. This highlights the importance of stakeholder consultation and engagement at the beginning and throughout the research process. In this study, one of the action research cycles focused on identifying and defining the specific problem. The actions taken by the MAG ensured that the perspectives of all key stakeholders were identified and taken into consideration. This resulted in narrowing the focus of attention to the safety of medication administration in particular.

4.2.2 Action research cycles.

Action research occurs in a series of cycles where thinking, doing and watching are interwoven and repeated throughout the research activity. Each action cycle consists of

a series of steps (Kemmis & McTaggart 1988). Utilising a cyclical approach in the current study (Figure 4-2), the medication action group reflected on findings as they were generated, and these reflections were then used to inform their further action and data collection (Hart & Bond 1995). The initial action research cycle led to 2 further action research cycles. The overall number of cycles depends on the project goals, progress and timeframes and was not possible to predict in advance (Bridges & Meyer 2007). The first step in any action cycle is for the researchers to define the specific problem to be worked on. The second step is to start collecting evidence on the identified problem. Many sources of evidence, such as context, current practice and literature were explored and critiqued. The critique was fundamental to developing an understanding of the issues and enabling effective action plans to be developed (step 3) and implemented (step 4). Steps 5 and 6 involve repeated data collection and critical reflection on the implemented practice changes with the aim of determining further action cycles.

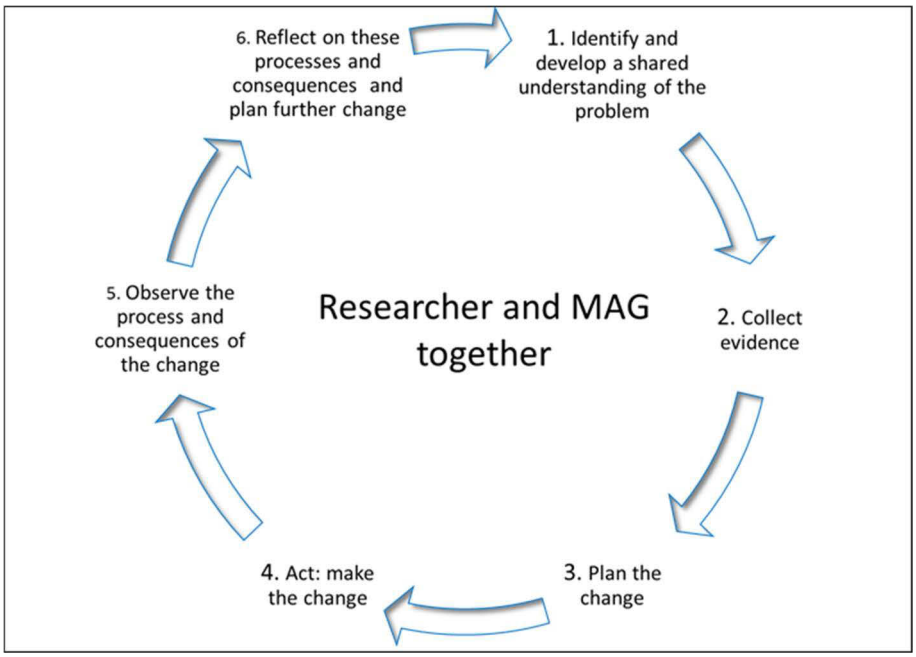

Figure 4-2 Schematic of action research cycle

4.3 Research Study Design

This study was based on the following premise: engaging nurses within participatory processes to explore their experiences of medication practice within their workplace will enhance their understanding of the safety of their own and the nursing team's medication administration practice. Informed by critical social theory, emancipatory practice development and the transtheoretical model of change, the insights gained from critical reflection on and in practice will empower and inspire the nurses to take action to transform context, culture and practice. The aim of the research study therefore was to evaluate what effect a programme of action research has on improving the safety of nurses' medication administration practice.

4.3.1 Study setting.

It was imperative to find a clinical setting with nurses who were willing to collaborate in developing practice related to medication safety. Before this could be achieved, agreement had to be obtained from senior managers of the hospital and consent obtained from the relevant ward charge nurse, the 'professional gatekeepers' as noted by Morton-Cooper (2000). This process proved to be unexpectedly lengthy and challenging. The study was discussed with the senior management team of the hospital and agreement reached to proceed with the study (Locality Assessment Form, 31/5/2011). In reality, there were many changes to the senior management team during the research journey and each time, it was necessary to ensure that those newly appointed to the positions were kept informed of the project. The personnel changes in the nurse leader position had greatest impact on the study due to the newly appointed person instigating a wave of changes to the hospital. This impacted on both the timing of the commencement of the study and my ability to successfully negotiate access to a clinical area.

An invitation to participate in the study was sent to all in-patient ward charge nurses (refer to Appendix B). There were three charge nurses who expressed interest in the study. Ward A was selected based on the following criteria; (1) it had the least amount of staff turnover or 'churn' as described by Duffield (2011, p. 96), (2) the ward staff had demonstrated previous commitment to effect change, (3) the ward had a low number of projects in progress and (4) the ward had the greatest continuity of ward nursing leadership. Ward B's acting charge nurse was just about to leave as the ward's charge nurse was due to return from maternity leave and Ward C's charge nurse was just about to go on maternity leave, with the potential for disruption due to the change of ward manager (Acree 2006). Prior to beginning participant recruitment, Ward A was chosen by the newly appointed nurse leader for a major renovation programme. Consequently, the charge nurse withdrew consent for the ward to be involved in the study. I had to amend my research plan and timeline and wait until the charge nurses of Ward B and C were established in their roles. I considered it important to have a consistent charge nurse during the action research study as nursing leadership in action enables nursing teams to embrace continuous learning and sustainable change processes on the ward (Bamford-Wade & Moss 2010). Leadership is one of the more important factors in influencing the process of implementing evidence based practice change (Sandström et al. 2011). A lack of support from the ward nurse leader can have a negative impact on evidence based practice implementation (Hutchinson & Johnston 2006). Subsequently I was able to negotiate access to Ward B.

Some 2 years after initial discussions held with the senior management team, the study was carried out in one ward of a tertiary level paediatric hospital in New Zealand during

2013-2014. The ward multidisciplinary team included nursing and specialist medical staff supported by a ward clerk and junior medical staff who rotated on a 3-6 monthly basis. Designated physiotherapy, occupational therapy, speech language staff, social worker, dietician and clinical pharmacist were available as required. Further details of the study setting as it related to nursing and medication practice are provided in section 5.2 on page 157.

4.3.2 Study participants.

Recruitment

A study information pack, explaining the study objectives and action research design, was sent electronically to all nurses on the ward inviting them to voluntarily participate in the study (refer to Appendix C). This information was reinforced by daily project presentation sessions held over a fortnight on the ward (covering both morning and afternoon shifts), at which a total of 25 nurses and the pharmacist attended. When recruiting participants, Morton-Cooper advises that the researcher should be realistic and clear about their expectations and if possible, offer something back to the participants for their efforts (Morton-Cooper, 2000). During the ward presentations I explained the purpose of action research and practice development and answered any questions which were raised. I particularly focused on the potential benefits for nurses participating in the research; gaining insight into and developing their own practice, and the ability to directly influence nursing practice on the ward which could then be used in their professional development portfolio. During these meetings I discussed that together, we would identify what was working well in regard to medication safety to enable us to build on this and what barriers to safe medication practice we could address to improve medication safety on the ward. The majority of nurses acknowledged the

need to improve medication practice on the ward. By the end of the fortnight, I had agreement from all the ward nurses that had attended the meetings that they would be open to trying out new ideas generated by the research and six nurses completed consent forms (refer to Appendix D) to participate in the medication action group (MAG).

Medication action group

The six members of the MAG were all female with a median age of 40. They had an average of 15 years nursing experience and 9 years working on the current ward. The group members included an enrolled nurse (EN), a registered nurse in her first year of practice (RN1), a registered nurse working at competent level (RN2), 2 registered nurses working at proficient level of practice (RN3) and a registered nurse working at expert level (RN4). The demographics of the MAG is provided in Table 4-1. In addition, I was also a participant in the MAG. I contributed within the group in exchanging information, participating in planning, observing, acting, and reflecting. A key part of my role in the research was as facilitator of the MAG's critical reflection.

Table 4-1 Medication action group demographics

Participant	**Gender**	**Ethnicity**	**Qualification**	**Level of Practice**	**Length of time in nursing (Years)**	**Length of time on current ward (Years)**
1	F	NZ European	Diploma	RN 3	18	15
2	F	NZ European	Certificate	EN 4	42	20
3	F	Indian	BSc (Hons)	RN 3	18	7
4	F	NZ European	Diploma	RN 2	6	6
5	F	NZ	BSc	RN 1	1	1
6	F	NZ	BN	RN4	12.5	11

Congruent with an action research method based on a critical theory approach, all ward nurses were considered participants. The ward had a compliment of 34 (23.6 full time equivalent) registered nurses and 2 (1.3 full time equivalent) enrolled nurses. The majority of nurses were female (92%) with only a third of the nursing team working on a full time basis. The nursing team skill mix comprised 5% EN, 5% RN1, 50% RN2, 35% RN3, and 5% who were practising at expert level (RN4) on the organisation's Professional Development and Recognition Programme.

Preparing the medication action group

I facilitated an initial preparatory day for the MAG to establish relationships with and between the MAG members. The nurses had all worked together on the ward for a relatively long time except for the nurse who was within one year of commencing practice as a registered nurse. All members of the group were aware of my role as a Nurse Consultant within the hospital. However, this was the first time we had come together as a group to specifically discuss and define what is important in our practice of medication administration. I believed that it was essential therefore to attend to group processes as part of this reconnaissance phase as it was the foundation for the future action and practice development. Our first undertaking on the preparatory day was the development of ground rules or 'ways of working', aimed at promoting a sense of cohesion and safety within the group. According to Wilkinson (2012), ground rules are used to set an agreed standard of behaviour that guide how the group will interact and behave towards one another. I commenced the activity by asking the group to think about what they, as individuals, needed to ensure a safe environment to discuss difficult issues. I had also planned the development of ground rules as an activity to start opening a communicative space (Kemmis 2001; Wicks & Reason 2009). In this regard, the group's

ground rules outlined; the boundaries regarding confidentiality, the expectation that everyone participated equally, that they would respect everyone's opinions and experiences and would remain focused. The latter two ideas were modelled during the activity. I did not assume agreement between group members. For each statement, I prompted the contributor to explain carefully what they meant and checked in with the other group members that we had consensus before statements were accepted and approved by the group. The statements were recorded on a flip chart which allowed us to revisit them at the beginning of each meeting.

I was aware that there was the potential for power imbalance within the group due to the differing levels of practice, particularly the registered nurse relatively new to practice and the enrolled nurse. However this was not manifested. Indeed as one participant noted *"we all have something to share"(M4)* and another member of the group acknowledged the contribution of the enrolled nurse *"sure there may be restrictions on your practice regarding medications but you are just as able to see what goes on in the medication room"(M1)*. All group members shared concerns regarding the ward medication practice, although at this point we did not delve into particular details as the intent of this preparatory day was to establish the group and expectations, and provide some education on the principles of practice development and action research.

4.3.3 Study design.

The research journey (Figure 4-3) unfolded as three action spirals (or phases); (1) establishing the practice context, (2) revealing current medication practice, and (3) improving practice, each with corresponding iterative cycles of 'planning, acting, observing and reflecting' (Carr & Kemmis 1986). The iterative cycles in the journey

were not necessarily discrete or linear. For the phases of the research, the term spiral was chosen as it better reflects that once started, the journey did not necessarily come back to the same point before moving on to the next phase.

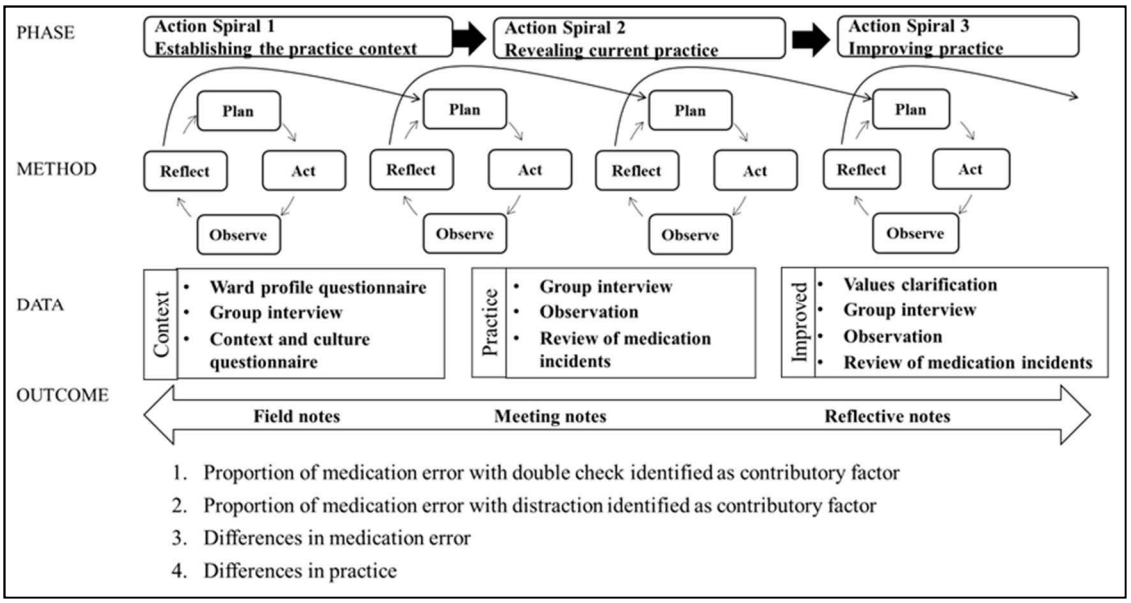

Figure 4-3 Action research journey

The initial spiral involved establishing the practice context and included negotiation of clinical area, and recruitment and preparation of the medication action group (MAG). Data collection in this spiral was aimed at understanding the context of practice and readiness for change and is discussed further in section 4.3.5 on page 131. This spiral took 8 months, which was longer than originally anticipated due to the delay in ward selection previously discussed. The second action spiral involved the exploration of current practice and took 6 months. The MAG observed practice, reflected on individual and team practice, and reviewed ward medication incident data. These two action spirals; establishing the practice context and revealing current practice corresponded with the pre-contemplation and contemplation phases of the transtheoretical model of change (Prochaska, Prochaska & Levesque 2001). Initially the ward nurses did not recognise

the need for change but through discussion and participation in the activities they started to become aware that medication safety on the ward could be improved. These early stages of an action research journey described as the assessment or diagnostic phase (Meyer 1993) or reconnaissance (Kemmis & McTaggart 1988) signal the pre beginning and beginning stages of action research.

The third action spiral included undertaking a values clarification exercise (Warfield & Manley 1990) and developing a common vision for medication safety. A critique of the consistency between practice and values was stimulated by reflective questioning. This allowed the MAG to further refine practice problems. The problems identified by the group related to concerns with how the chaos of workplace context and individual practice impacted the safety of medication preparation and administration. The MAG developed interventions to support individual practice change and to engage and enable colleagues to change their practice. This spiral took the longest time and occurred over 10 months.

4.3.4 Study data collection and analysis procedures.

Consistent with valuing the importance of different types of knowledge in obtaining a comprehensive understanding of complex nursing phenomena such as medication safety, a multi-method approach to data collection was taken. All members of the MAG were involved in data collection and analysis which enabled them to come to see how they worked in practice (Morton-Cooper 2000). To ensure the research was not considered as “mix and match research” (Morse, 2003, p. 191), each data collection method supplemented each other and were congruent with a critical approach (Morse, 2003). Rigour and trustworthiness of the research was aided by data triangulation using

multiple data collection methods, multiple data collectors and multiple individuals analysing the data (Groenkjaer 2002). An overview of the data plan is provided in Table 4-2.

Table 4-2 Study data plan

Action Spiral	Data collection method	Data source	Data analysis	Study objective (Page 2)
1	Ward profile questionnaire	Ward nursing demographics, nursing skill mix, clinical complexity, ward routines and rostering practices	Descriptive	2
1	Nursing staff context and culture questionnaire	CAI CWEQ II Medication Safety Culture Questionnaire	Numerical score	2
1,2,3	Group Interview	Reflective insights from MAG on ward environment and medication practice before and after practice changes	Thematic analysis	1, 2,3,4
1,2,3	Meeting notes	Written notes from the MAG meetings	Thematic analysis	1,2,3,4
1,2,3	Field notes	Written description of particular events from the researcher's perspective based on observation during the research journey	Thematic analysis	2,3,4
1,2,3	Reflective notes	Reflective notes documenting ideas, issues raised and reflections on medication practice from researcher and the MAG.	Thematic analysis	1,2,3,4
2,3	Observation	Ward environment Medication practice before and after practice changes	Thematic analysis	1,2,3,4
2,3	Database review	Reported medication incidents	Thematic analysis	1,2,3,
3	Values clarification exercise	Ward staff stated values and beliefs underpinning medication practice	Thematic analysis	1,4
1,2,3	Researcher journey reflection	Digital recording of reflective conversations with critical companion	Thematic analysis	4

4.3.5 Data collection.

Due to the participatory and iterative nature of action research, the majority of data collection methods crossed several action spirals. Each data collection method will be addressed within the action spiral it was first employed.

Action Spiral One

In spiral one, the aim of data collection was to develop an understanding of the local context. Several workforce related factors have been linked to nurses' medication errors; nursing experience, shift work and distractions (Armitage & Knapman 2003; Biron, Loiselle & Lavoie-Tremblay 2009). Therefore local data such as, nursing demographics, nursing skill mix, clinical complexity, and rostering practices were explored using a ward profile questionnaire (refer to Appendix E) which was completed by the ward nurse leader.

A context and culture questionnaire (refer to Appendix F) was developed which included the validated tools; Context Assessment Index (CAI) (McCormack et al. 2002), Conditions for Workplace Effectiveness Questionnaire II (CWEQ II) (Laschinger et al. 2001) and a Medication Safety Culture Questionnaire. Approval to use the CAI and CWEQ II was sought and obtained. The context and culture questionnaire was sent electronically and in hard copy to all nurses on the ward. The details of each component of the questionnaire is presented below.

Context Assessment Index:

Kitson, Harvey and McCormack (1998) and Rycroft-Malone et al. (2004; 2002) have identified that successful implementation of evidence in practice is dependent on the strength of the evidence, the quality of the context, and facilitation. In this study, the

CAI was used to evaluate the context's readiness for change and to raise consciousness of the strengths and weaknesses of the context with the MAG. The CAI measures three constructs; culture, leadership, and evaluation. Culture refers to 'the way things are done around here'. As Manley (2000) noted, each clinical practice setting (i.e. context) has its own cultural characteristics which may or may not support innovative practice. Clinical practice settings, in which the nursing leadership optimises everyone's skills and abilities and where data is used to evaluate nursing practice, will be more successful in developing and implementing evidence informed practice change (Kent & McCormack 2010).

The measures of homogeneity for each of the five factors, which make up the three constructs, to measure internal reliability have been reported. The Cronbach's alpha score for the complete questionnaire was estimated at 0.93. All five factors achieved a satisfactory estimated level of internal consistency in scoring, ranging from 0.78 to 0.91 (McCormack, McCarthy, et al. 2009).

The CAI consists of 37 questions which are rated according to a 4 point Likert scale from 'strongly agree' to 'strongly disagree'. Individual responses were numerically scored: 4 for 'strongly agree'; 3 for 'agree'; 2 'disagree' and 1 for 'strongly disagree'. Data were entered into a Microsoft Excel spreadsheet and collated to calculate a nursing team score for each construct and a total nursing team context score as recommended by McCormack, McCarthy et al. (2009). The scores were plotted on a continuum from weak to strong. In addition, individual questions that the team had consistently scored low highlighted contextual areas that the team agreed were weak. The findings were shared

with the MAG and ward nursing team. An example of how the scoring was undertaken can be found in Appendix G.

Conditions for Workplace Effectiveness Questionnaire II:

Laschinger et al. (2001) developed the CWEQ II to measure the concept of structural empowerment as identified by the extent to which employees felt they had the ability to access opportunities, resources, information and support in their work settings. The CWEQ II also measures power in the workplace as derived from specific job characteristics (formal) or social connections (informal). The validity of the questionnaire has been tested. Cronbach's alpha score for the total CWEQ II was estimated as 0.89. All six constructs achieved a satisfactory Cronbach's alpha score, ranging from 0.67-0.89 (Laschinger et al. 2000).

The CWEQ II instrument consists of 19 questions related to the six constructs; (1) access to opportunity, (2) access to resources, (3) access to information, (4) access to support, (5) formal power, and (6) informal power. Two of the nineteen questions related to a global measure of empowerment. The construct questions are answered on a 5 point Likert scale from 'none' to 'a lot' and the global empowerment questions ranged from 'strongly disagree' to 'strongly agree'. Individual responses were numerically scored (1-5), and entered onto an Excel spreadsheet. An average score was calculated for each of the six constructs (score range: 1-5). The six construct scores were then added to create a total empowerment score (score range: 6-30) as recommended by Laschinger et al. (2001). The higher the score, the higher the perception of empowerment.

Medication Safety Culture:

The third instrument contained in the nursing staff culture and context questionnaire provided a measure of the ward's medication safety culture. The PeaceHealth Ambulatory Medication Safety Culture Survey has good internal reliability, with a Cronbach alpha of 0.94 reported (Stock & Mahoney 2008). The survey was modified with some wording changes to reflect an inpatient context. The instrument consists of 16 questions which are answered on a 4 point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Individual responses were numerically scored and collated on an Excel spreadsheet. An average nursing team score out of a possible 4 was obtained. Individual questions which scored below the average were used to facilitate some MAG reflections on strengths and weaknesses of current practice.

The culture and context questionnaire was distributed to all ward nursing staff with the intent that the CAI enabled an assessment of the context within which care was provided. The CWEQ II was used to measure the concept of structural empowerment defined as the extent to which employees feel they have access to opportunities, resources, information and support in their work settings. The medication safety culture component was used to measure the degree to which a culture of medication safety existed within the study ward.

The remaining data collection methods used in action spiral one included group interview, meeting notes and reflective notes, and were common to all 3 action spirals. The action research meetings acted as group interviews. The focus of the interview was dependent on the spiral. In action spiral one, the focus was largely on developing our understanding of the context and culture in the ward. In spiral two the attention was on

uncovering current practice including understanding the impact of the context and culture on practice. In spiral three the focus was on developing, implementing and evaluating practice changes. MAG meeting notes, field notes and reflective notes were recorded and considered as study data and included in the thematic analysis. A critical inquiry approach meant that group interviews were semi-structured, that is, a few broad open-ended questions were used to guide the discussion and allowed for spontaneous and in-depth responses (Ryan, Coughlan & Cronin 2009). An increased depth of inquiry resulted from the discussion among the MAG participants (e.g. questioning one another, commenting on each other's experiences). The discussions unveiled aspects of medication safety that may not have been otherwise accessible.

The MAG critically reflected on both the ward medication practice in general and their individual medication practice. An early question asked was "Tell me about medication practice on the ward? Any concerns that I had prior to our meetings that the quality of discussion might be hindered by power imbalances within the group were quickly dismissed. *All group members contributed equally to the discussion and spoke frankly about practice concerns* (FN). The discussion followed the direction of the participants' responses (Corbin & Morse 2003). This allowed the MAG nurses to tell their own stories of medication delivery. A follow up question 'Tell me about the last time you administered a medication?' was not needed as the group members were sharing their own stories as much as sharing stories of team practice. The MAG were encouraged to summarise the common experiences that they had shared and this was captured on a flipchart. The group then undertook theme identification which involved looking at the data for common ideas and reflecting on what it meant to them.

Data also included the researcher's observations of group dynamics. A sense of trust was apparent in the group. When one MAG member talked about '*taking shortcuts when administering medication'* (M1)*,* the other group members agreed and shared their own similar experience (FN). While the group meeting dialogue is useful data, it reflects how people 'see' things rather than how people 'do' things therefore participant observation was used to supplement this data, Observation was one of two key data collection methods in spiral two and three.

Action spiral two

The aim of data collection in action spiral two was to reveal current medication practice. This was achieved through observation of nurses' medication administration practice and a retrospective review of ward medication incident reports.

Observation:

Observation is a strategy to collect data to create a picture of what is happening in practice at one point in time. Observation is a widely used method in collecting evidence for emancipatory practice development and one which was useful in this study (McCormack, Henderson, et al. 2009). The MAG members took a period of time to observe medication practice. By observing medication practice first hand and in context, observation can provide the most significant clues to putting a puzzle together that are otherwise difficult to solve (Morse 2003). Observation can also enable a picture of how nurses work within and relate to their physical environment as it occurs (Mulhall 2003). The greatest advantage of observation is that the evidence comes from seeing what people actually do, rather than listening to what they report that they do (Mulhall 2003). Observation of medication practice provided rich data on the realities of current practice.

The information included examples of good practice and also examples of circumstances in which nurses experienced difficulty in maintaining best practice. The aim of the observation was to:

- Identify what worked really well to facilitate medication safety
- Identify the barriers to medication safety
- Identify what processes and systems could be reviewed so that improvements can be made to medication safety.

Preparation for observation

Prior to commencing the observations of practice, it was necessary to prepare the MAG to be able to undertake the observations and to prepare the ward staff for the observation periods. The preparation of MAG members included a short presentation supplemented with written information and an observation practice exercise followed by reflection and feedback discussion. Observation was unstructured and recorded using an observation tool that I had been introduced to at Practice Development School (refer to Appendix H). Observation of medication administration practice has the potential to create a professional dilemma. When should the observer intervene or record data that will then be used to change future practice? The MAG agreed that non-intervention would, in the long term, be in the patients' best interests. However, we decided that intervention would occur when patient safety was compromised. To prepare the ward nursing team, daily information sessions were provided to outline the reasons for the observation of medication practice and to address any concerns about being observed. Nurses were also provided with written information (Refer to Appendix I) and reassured that they would not be observed if they did not want to be. A verbal check in with nurses was carried out immediately prior to any period of observation.

Observation of practice process

The initial plan for the observation was for the MAG members to spend a 30 minute period of time to stand discretely in the ward and observe medication practice, including individual's behaviour, interactions with others and the medication preparation and administration event. Observations are often done in pairs made up of an internal and external observer to provide different perspectives (Harrison 2010). I had planned to be a second observer with the group members. However, it became clear that due to the unpredictability of both timing of medication administration and clinical workload this plan was not feasible. Within the hospital, set medication administration times are not used, rather the schedule is based on the time the medication is first administered. In other words, if an antibiotic is prescribed to be administered every 6 hours and it is first given at 1100 then the next dose is given at 1700. In some hospitals the timing of subsequent doses would be altered to fit in with regular 'medication round' times such as 0600, 1200, 1800, and 2400. In reality the observation period had to be flexible rather than a fixed 30 minute period.

The literature often assumes that the observer will take a certain role and maintain it throughout the period of observation. Many authors make a clear distinction between participant or non-participant observation (Bonner & Tolhurst 2002). In participant observation, the researcher participates in the activities of those who are being observed, while in non-participant observation the researcher remains detached from those being observed (Turnock & Gibson 2001). During the observation of medication practice on the study ward, all members of the MAG were participant observers while, I was a non-participant observer. The MAG members made note of the practices that were occurring as opportunities arose. One advantage of the participant approach was that there was less

risk of the Hawthorne effect leading to bias in the study. The Hawthorne effect refers to when research participants who are being observed change their behaviour due to the observer's presence (McCambridge, Witton & Elbourne 2014). It is possible that if the nurses were consciously aware that their medication practice was being observed, they would change their usual behaviour to demonstrate what they perceived the observer wanted to see. For example, the Hawthorne effect was found to inflate hand hygiene compliance rates as measured by direct observation (Srigley et al. 2014). There was an increased risk of a Hawthorne effect during my non-participant observation periods. However, my observation records were not substantially different from the other MAG members' records suggesting that any Hawthorne effect was minimal. A disadvantage of the MAG participant observation was the loss of opportunity for 2 observers to discuss and reflect on what was seen and recorded at the conclusion of the observation period.

Retrospective review of ward medication incident reports:

The second source of data that the MAG explored in the second and third action spirals was the ward reported medication incidents. This was undertaken as a measure of the impact of current medication practice and to support or refute the emerging themes. The organisation has a voluntary electronic incident reporting system and I was able to access the reported incidents for the ward. The previous 5 years of reported incidents were explored to help understand the impact of current medication practice. The incident data were entered onto an Excel spreadsheet and converted to numerical counts to be able to display and better understand the key themes arising from the reported medication incidents.

Action Spiral Three

Data collection in spiral three was concerned with evaluating the impact of the changes on reported medication incidents and medication practice. Medication incident data for the 2 year period before (January 2011 – December 2012) and during the two year study period (January 2013-December 2014) were compared and further periods of observation of practice were completed. The specific outcome measures examined were:

1. Proportion of medication incidents with an incomplete double check as a contributory factor
2. Proportion of medication incidents with distraction as a contributory factor
3. Differences in the pattern of medication errors
4. Differences in the pattern of medication practice

Action research process data

At each stage of the research journey, data were collected to capture the learning that occurred during the action research process. The data sources were the meeting notes, field notes, and reflective notes documented by the researcher and MAG. From a synthesis of all the data the MAG came to an understanding of the context and practice in regard to medication administration, what was being done well, what required development and improvement and what were the barriers and enablers of medication safety. From this understanding, action plans were developed and implemented and data re-collected to evaluate the changes. Reflection on and synthesis of the study data with literature enabled an understanding of what happened during the programme of action research and the development of a model for improving the safety of nurses medication administration.

4.3.6 Data analysis.

Sixteen ward nursing staff context and culture questionnaires were completed giving a response rate of 47%. This quantitative data were entered into an excel spreadsheet and analysed as per the instrument instructions. The medication action group met for a total of 50 hours over the 2 year study period. They conducted and analysed a total of 12 periods of observation of nurses' medication practice (30 min each) and analysed the previous 5 years of reported medication incident data. A further 2 years of medication incident data (the study time period) was analysed in spiral 3 to allow a comparison of before and after change.

The qualitative data generated were subjected to thematic analysis. Thematic analysis is a qualitative analytic method (Braun & Clarke 2006) which is particularly appropriate for applied research in nursing (Bellman, Bywood & Dale 2003). Thematic analysis can be used with a range of theoretical frameworks and has the potential to provide a rich and complex account of the data. This is a method for identifying, analysing and reporting patterns (themes) in the data. An inductive approach, searching across the data set for common ideas that have similar meaning, which were then grouped into themes was conducted (Morse & Field 1995). Coding and identification of the themes evolved from the data, rather than driven by a theoretical framework. The thematic analysis was conducted in 6 phases, as described by Braun and Clarke (2006).

1. Becoming familiar with the data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

Observation data

To become familiar with the data (phase 1); each member of the MAG was provided with a copy of all observation of practice records which they read prior to a designated MAG meeting. The process to generate codes and themes from the observation of practice data was facilitated with the use of memo pads and flip charts (Figure 4-4). During the meeting, each member of the MAG reviewed each observation sheet again and noted on a piece of memo paper what they perceived as any common observations and any particular observation that they felt should be included, even if not common across the observation sheets. Once this was completed, everyone took it in turn to read out the text that they had noted and stick the memo paper on the flip chart, continuing until all the memo paper was stuck on the flip chart. As the process unfolded the text was grouped according to similar meaning.

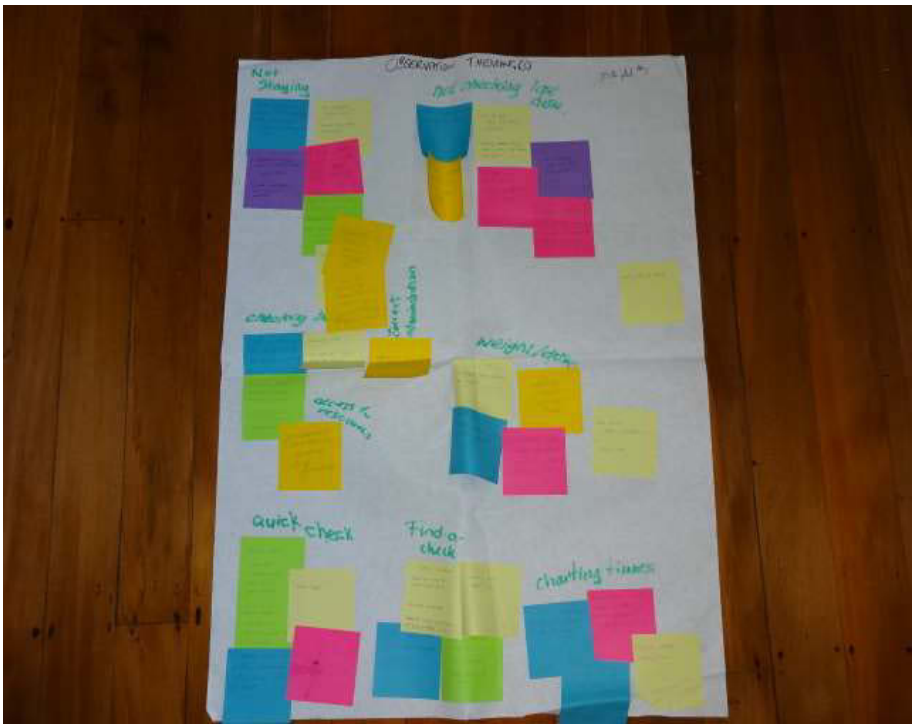

Figure 4-4 Photograph of flip chart data code and theme generation

The groups of text were then analysed to generate initial codes (phase 2). Similar codes were grouped together to facilitate the search for emerging themes. Reading the statements aloud enabled the group to ask questions of the data as the code and theme generation process proceeded (phase 3). Over the course of several weeks, the MAG reflected on what the codes and themes meant enabling them to become aware of what was actually happening in practice and increasing their awareness about what they may have been taking for granted in the business of everyday practice. This allowed for further refinement of codes and themes (phase 4).

The themes were presented back to the ward nursing staff. Ward nursing team feedback on the themes indicated a sense of recognition and support for the relevance of the themes to their practice, which enabled the MAG to finalise the naming and defining the themes and sub themes (phase 5). An example of codes, sub-themes and themes are shown in Table 4-3. On each observation record there was at least one statement, and often many, noting other activity that was occurring in the medication room while nurses were preparing medications. Initially several statements were identified by the code 'multiple interruptions'. In discussion it was noted that the interruptions were due to different reasons. Some were conversations related to the activity going on, that is preparing medication, or another aspect of patient care. At other times, conversations were social. The 'multiple interruptions' code was changed to four separate codes; 'social conversations', 'competing attention', 'noisy environment' and 'comings and goings' to better describe the purpose of the interruption. The 'social conversations' and 'competing attention' codes were subsequently combined into a theme identified as 'distracted' which described a behaviour associated with the impact of the activities in the medication room. This was later identified as a sub-theme of 'Way of Working', one

of the key themes of the study. The other two codes, 'noisy environment' and 'comings and goings' were deemed to better describe the 'disruptions' in the medication room within which the nurses worked as opposed to a way of working. Disruptions became a sub theme of 'workplace context', another of the study's key themes.

Table 4-3 Example of observation data code and theme generation

Text recorded on observation sheets	**Code**	**Sub-theme**	**Theme**
Several nurses involved in group discussion on non- medication related topic Staff were discussing personal matters while preparing medications Several nurses were chatting about weekend while drawing up medication	**Social conversations**	**Distracted**	**Way of working**
Nurse enters the medication room to ask colleague's advice Doctor entered medication room to talk with nurse about a patient Physiotherapist entered medication room to update nurse on patient's treatment	**Competing attention**		
Persistent telephone ringing in the background – nurse left to answer the phone Cleaner 'vacuuming' the work station area	**Noisy environment**	**Disruptive**	**Workplace Context**
Nurse enters the medication room to collect observation equipment HCA entered the room and started restocking cupboards … nurses preparing medications were asked to move to a different area of the room Cleaner entered the room to refill the hand towels	**Coming and goings**		

Reported medication incident data

An initial overview of the reported medication incident data identified that medication delivery was the number one cause of reported incidents for this ward over the set time period. Each member of the MAG reviewed each incident report and used their experience from code and theme generation of the observation data to look for commonalities in the incident data to identify contributing factors. An inadequate double check was found to be the most frequently identified contributory factor in the ward reported medication incidents (see Table 4-4).

Table 4-4 Identification of contributory factors to reported medication incident

Text from incident report	**Contributory factor**
Patient was post-op from surgery and I noticed he was charted three new IV antibiotics. I gave IV amoxicillin 1g at 1245 which had been given at 1025 in OT, IV Metronidazole 50mg which had been given 500mg in OT at 1025 and oral diclofenac 50mg at 1030 which had been given 100mg PR at 1108. When I realised the incident happened, I informed the other staff nurses, the shift coordinator and the surgical house officer. The house officer suggested to delay the time of next doses of drugs and I handed this over to the next shift.	An independent double check was not completed which may have alerted nurse to look at OT records
Given antibiotic IV Flucloxacillin charted 350mg Q6hrly. 1/2 way through administration another nurse noted that the dose was over maximum dose of 50mg/kg/6hrs. Stopped remainder of antibiotic and informed registrar. Advised to notify OCHS to re-chart dose to 250mg.	A more complete independent double check may have picked up the error sooner
While reading drug chart, noticed that the patient's Epilim has not been given as charted. It was charted QID but has only been given three times a day. Contacted on-call house surgeon. She stated that the therapeutic level is adequate for this patient.	a more complete double check may have picked up error sooner

The synthesis of the findings from all data collection methods allowed a picture of medication administration practice on the ward to emerge at the start of the study, directed the development and implementation of action plans and enabled a new picture of ward medication administration at the conclusion of the study.

4.4 Ethical considerations

This study was approved by the hospital management team and the District Health Board Research Office and received ethical approval from the Upper South B Regional Ethics Committee; reference number URB/11/07/023 in New Zealand (Appendix L) and was ratified by the University of Technology, Sydney Human Research Ethics Committee; reference number 2011-384R (Appendix M). Consideration of the ethical implications for the study extended beyond the formal ethical approval process. I could not predetermine the nature of the study, as it was dependent on the nurses with whom I would be collaborating. Thus I had to be flexible and responsive to deal with issues as they naturally occurred in practice. This included giving thought to how those involved in the research can be protected from harm. It was important that I negotiated a code of ethical practice with the MAG and the ward nursing team at the start of the study. In other words, how were we going to work together that enabled them control over what changes occurred, how would it be researched and how would the findings would be shared with others. The action research meetings enabled myself and participants to develop a mutual critical understanding of the socio-cultural realities of the ward (Wilson & Neville 2009).

In New Zealand it is required that all research conducted includes the principles of the Treaty of Waitangi and the values of partnership, participation, and protection (MOH 2006). These values are congruent with the emancipatory practice development principles of participation, inclusion and collaboration and the critical social theory approach underpinning this study. The study was supported by the Auckland District Health Board, Maori Research Review Committee. Maori healthcare professionals were equally eligible to participate in the research. The intent in this work was primarily

focused on working collaboratively with nurses to enable them to gain insight into medication safety within their context and enable them to transform their practice and culture and in so doing, to improve medication safety practice. The ultimate goal of this study was to protect children in hospital from harm by improving medication safety.

4.4.1 Informed consent.

The issue of informed consent is complex within action research as specific issues and action cycles develop as the research progresses. To address this, the participant information sheet and consent form (Appendix C and D) provided clear details of the study intent and asked that participants identify their level of participation in the study. The forms also included clear information about the participants' ability to withdraw from the research at any time without consequence. Participants were reminded of their ability to withdraw from the project and process consent obtained at the beginning of each action group meeting. Although the fact that the person was attending the meeting implied that they were consenting to be part of the group it was important to ensure participants were still comfortable to continue. Over the final 3 months of the research, three participants withdrew from the action research group due to changing employment. The group discussed and decided against seeking out other participants due to being in the later stages of the project. Individual consent was obtained for group interviews. All staff were potentially part of the observation and consent for this was established at a ward level with a process consent obtained at time of observation. Any staff member could decline to be observed, however no one did. Included in the negotiation of the ward participation, the majority of nursing staff had to be in agreement with the ward participating in the study, which included being open to practice being observed. Reassurance was provided that all data would be confidential and no names of

individuals would be recorded. It was reiterated that the MAG were concerned with the ward medication administration culture and practice rather than the behaviours of any given individual.

4.4.2 Confidentiality.

Maintaining confidentiality of information for group work is also complex. I, as the researcher, assured that I would keep the information that was shared with me confidential to my supervisors and me. It was also my expectation that all group members would keep the information shared in the group confidential which was more difficult to ensure. This expectation was addressed up front with the group, and group consensus achieved that no information was to be released or discussions held outside of the group without the group's prior approval. The group was reminded of this agreement at the start of each group meeting. Participants who felt that the group may not be able to sustain this level of confidentiality could choose not to participate any further. Nonetheless, it was likely that information would need to be shared to advance action plans and improve practice, however this information would not identify individual contributions.

Consensus was also sought about documenting and recording participation, for example, only the initials of individuals involved was recorded. Within a fairly defined context such as a paediatric ward, it was unlikely that anonymity would be achieved. Indeed, participants needed to be physically relieved from clinical work by another staff member to attend the group meetings. However individual contributions during MAG meetings were confidential within the group as discussed above.

As part of receiving institutional ethic's approval, I agreed that all raw study data will be kept in a secure place, including electronic data which will be password protected, and will be destroyed after ten years or five years after publication whichever is the greatest. No material which could personally identify an individual or the area in which they work will be used in any of the reports on this study.

4.4.3 Risks and benefits.

Within the MAG, there was the potential for actual/ implied criticism of clinical practice which could have caused some discomfort. However, it was not the intention of this study on improving medication practice to explore personally sensitive information therefore it was unlikely to be distressful. There were no episodes of staff discomfort or distress reported as a result of the study.

Observation of practice

The risk for nurses willing to have their practice observed is that possibly someone may try to guess which coded observation relates to a particular nurse. As the intent is to observe the practice and not the person, no potentially identifying data related to names, days and shift times were included. Consistent with guidelines for the ethical conduct of research (NHMRC 2007), the observers, as staff members, were obliged to report any errors observed, through the usual ward processes. If a mistake is observed during the study, which places a patient at risk of harm, the observer would only intervene to prevent medication administration taking place.

The potential benefit for participants of this study was through reflecting on and developing their own practice. In taking part, nurses were assisting with the extension

of knowledge regarding medication safety for hospitalised children and clinical practice improvement. The study could benefit patients by supporting practitioners to achieve best practice in medication safety and a reduction in medication error.

4.5 Conclusion

In summary, there is a gap between research evidence and current practice related to the safety of nurses' medication administration practice. Emancipatory change using action research and practice development procedures appeared to be a promising approach to engaging nurses in investigating and nursing medication safety practice. A research design involving an iterative data collection and analysis plan was developed that collected data from participants and the researcher throughout the research journey and using multiple methods including questionnaires, group interviews, observation of practice, review of reported medication incidents, meeting and reflective notes. Qualitative data were subjected to thematic analysis and quantitative data were analysed as per the specific instrument instructions. Thematic data analysis was undertaken by the MAG who reflected on the findings as they were generated. The reflections were used to inform further action and data collection. Synthesis of the study data with literature enabled an understanding of what happened during the programme of action research which resulted in improved medication safety. The findings of the research study are presented in the following chapter.

CHAPTER 5 FINDINGS: TRANSFORMING MEDICATION MAYHEM

In this chapter, I provide the findings of the action research study to improve medication administration safety. The key themes and sub-themes are depicted in Figure 5-1. Data synthesis from the first 2 action spirals enabled a picture of medication mayhem to emerge. The mayhem or dynamic complexity of medication administration was captured within the themes of 'Workplace Context', 'Workplace Culture' and 'Ways of Working'. Medication administration was a habitual, distracted and inconsistent process undertaken in a chaotic and disruptive environment. The culture did not support a safe process for individuals or teams to learn from mistakes. Following the implementation of practice changes in spiral 3, an improvement in medication safety was embodied in mindful medication practice. Nurses were empowered and accountable to be consciously present and focused during medication preparation and administration in a well organised and interruption free environment. A culture of medication safety started to emerge on the ward.

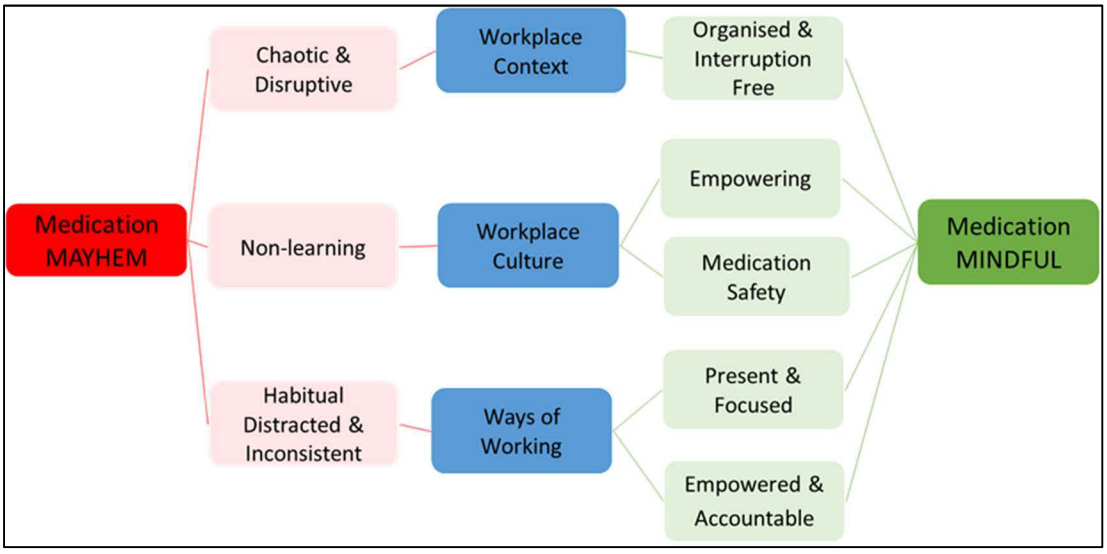

Figure 5-1 Transforming medication mayhem; themes and sub themes

The voices of participants are used to illustrate the study findings. Medication action group participants were identified by M and each given a number. Ward nurses were identified by RN and given a number. Descriptors from multiple data sources are provided to highlight the developing themes and sub-themes. The key in Figure 5-2 below was developed to assist the reader's understanding of the discussion in this and the following chapter.

'italics'	Speech of participants
-	Pause in the participant's speech
...	Material edited
M (1)	MAG participant
RN (1)	Ward RN participant
' ' OB	Observation note
' 'IR	Incident report
' ' FN	Field note

Figure 5-2 Key to data sources

Each of the themes and sub-themes will be addressed in turn, although one cannot be appreciated contextually without the others. For example, independent double checking emerged throughout the sub-themes as this was expected practice within the study context and something which the ward staff perceived as having an influence on improving medication safety. A picture of the mayhem of medication practice at the beginning of the study is initially provided. This is followed by a discussion of the key themes 'Workplace Context', Workplace Culture' and 'Ways of Working'. Within each

of the themes, the sub-themes from spiral one and two is initially presented, followed by the sub-themes which emerged from spiral three. The chapter concludes with an evaluation of the impact of the practice improvement on reported medication errors.

5.1 Medication Mayhem

At the beginning of the study, the nursing team did not appear to recognise any need for changes to practice. I noted following the third visit to the ward to explain the study, 'Again, the nurses' overwhelming response was that they don't have a problem with medication errors on this ward' (FN). However, as the action research progressed, the medication action group (MAG) and subsequently the ward nursing team became more aware of medication practice on the ward. They started to see the familiar, taken for granted, everyday practice differently. The vignette (Figure 5-3), drawn from the observations of practice data uses a narrative style to convey the 'story' describing a typical medication scenario on the ward at the beginning of the action research journey. Pseudonyms are used.

One Friday morning at 0800, the ward was very busy with a greater than usual number of children with high acuity. Sandra (nurse in charge of the shift) had attended the ward handover and was reviewing the clinical notes for the 4 children that she had been assigned. She noted that one child was prescribed intravenous flucloxacillin which had been due to be administered at 0730. Realising that she was already late with the administration Sandra went straight to the medication room to prepare the medication. Sandra had to move back and forth from one end of the medication room to the other to collect the flucloxacillin vial from the cupboard and sterile water diluent, syringe and needle from containers on the wall. Sandra drew up the diluent and diluted the vial of flucloxacillin. She calculated what volume of the prepared solution she required. However just as she was about to withdraw this volume of the solution into the syringe, Sandra remembered that flucloxacillin was further diluted in intravenous fluid and administered via a burette set, therefore she set the medication aside and left the medication room to go fetch an intravenous giving set and bag of intravenous fluid.

On her way to collect this equipment, Gloria, a nurse new to the ward, asked for Sandra's advice on one of the children she was looking after. Sandra went with Gloria to review the child and suggested that Gloria complete a set of vital signs and to let her know if any were outside acceptable limits. Sandra then continued to the store room and collected the required equipment. On the way back to the medication room with the equipment, Sandra was asked by the ward clerk to take a phone call from the mother of one of the other children Sandra was assigned, which Sandra attended to.

Sandra eventually returned to the medication preparation room where she had to recall how much diluent she had put into the flucloxacillin and recalculate how much flucloxacillin she needed. Sandra then proceeded to draw this up into the syringe. At this point, Sandra left the medication room and used the ward overhead pager to ask for another nurse to come for a 'quick medication check'.

After a couple of minutes, Sandra left the room and proceeded to the ward corridor where she met Beryl, a nurse who had worked on the ward for some time, who was looking for a pulse oximeter as she wanted to check a child's oxygen saturation. Sandra explained to Beryl that she was running late with some flucloxacillin that she needed to administer and just needed someone to run an eye over everything before she gave it. Beryl agreed to check Sandra's medication. Both nurses hurried back to the medication room. Beryl and Sandra had a brief conversation, Beryl glanced at the medication vial and syringe, nodded and signed the medication chart. Sandra put the medication into the burette and took this to the child's room and connected the intravenous administration set at 0840, one hour and 10 minutes late.

At 1430, Sandra and Gloria were both in the medication room and Sandra hesitated as she asked if Gloria would check her medication. Gloria reviewed the child's medication chart and took this out of the medication room to check the prescribed dose on a computer within the ward workstation. Gloria called Sandra to the workstation as she noted an error with the prescription. The prescribed dose of 350mg x 6 hourly exceeded the maximum 250mg allowed for the child's weight (50mg/kg/6hrs). Sandra informed the medical team who advised not to administer the dose. Sandra discussed the mistake with the child's parents. Later that afternoon, a member of the medical team came to the ward and re prescribed the correct amount of medication and ordered a blood test to check the serum level. Sandra completed a medication incident report before going off duty. Sandra left the ward saying that she felt upset and angry.

Figure 5-3 Vignette: the mayhem of medication administration

The nurse at the centre of this vignette is repeatedly interrupted to attend to other problems. Each interruption results in an activity which threatens the safety of the medication administration process. For example, while talking with Gloria, Sandra has to conduct a rapid clinical assessment of the child and assess Gloria's ability to respond to the child's changing condition. In reaching her decision to ask Gloria to repeat the child's vital signs, Sandra seeks to maintain that child's safety while supporting a less experienced staff member. While one aspect of patient safety has been supported, the added complexity of the interruption threatens the safety of Sandra's medication administration. Sandra now carries the knowledge that she may have to review both her own work plan and also the nursing team assignment and she starts anticipating potential changes. With the additional interruption due to the telephone call, by the time Sandra returns to the medication room she has multiple distracting thoughts and it is difficult to re-orientate to where she left off in the medication preparation process.

There was an initial delay in the time of the medication administration as medication was not routinely part of the nursing handover. Sandra only discovered that she had a medication due when she reviewed the charts for the children she had been assigned. The multiple distractions during preparation and then having to wait for someone to be available for a double check increased the delay. Hence there was some urgency taken with the double check of the medication. The double check did not follow the expectations of the organisation's medication administration policy. Current policy expectation is that both nurses are present throughout the preparation and a double check of the right medication, and right dose occurs at this stage. The ward culture had allowed a drift in practice so that Sandra prepared the medication ahead of asking for the double check. In checking the right medication, Beryl glanced at the vial and potentially 'saw

what she expected to see' as she expected that Sandra had correctly picked out a vial of flucloxacillin. Both nurses double checked that the prescribed dose had been prepared for administration based on Beryl accepting Sandra's word for how much diluent was used. Neither nurse checked that the prescribed dose was correct for the child's weight, resulting in too large a dose being administered.

When the medication was next due, Sandra appeared reluctant to double check the medication with a less experienced member of staff. However she did prepare the medication in the presence of Gloria and have each step verified at the time, something she had not done in the morning when checking with an experienced colleague. As Gloria was less familiar with flucloxacillin, she took the extra time to check that the dose was suitable for the child's weight and discovered the prescribing error and the earlier medication administration error. Due to the mayhem that was medication administration, there was a missed opportunity to detect and correct the prescribing error earlier, thus preventing the child being administered too large a dose of flucloxacillin and avoiding an additional blood test. The MAG confirmed that the scenario described commonplace practice on the ward.

This action research programme provided an opportunity for frontline nurses to 'step back' and explore their medication practice. During spiral one, the MAG reviewed the data from the nursing staff context and culture questionnaire. A description of the study instruments can be found in the Methodology and Method Chapter, section 4.3.5 on page 131. Preliminary findings from the questionnaires were followed up in group interviews during spiral two and combined with findings from the observation of practice and reported incident data theming, to enable themes and sub themes to emerge. The MAG

began to see how the ward context, culture and behaviour of individual nurses influenced their medication administration practice. They started to recognise a mayhem surrounding medication administration on the ward. The mayhem of practice was captured within the themes; 'Workplace Context', 'Workplace Culture' and 'Ways of Working'.

5.2 Workplace Context: Findings from Action Spiral 1 & 2

Figure 5-4 Workplace Context spiral 1 & 2 sub theme

The MAG were concerned with how the workplace context enabled or inhibited medication safety. The term workplace refers to the ward in which this study took place, in particular the environment in which nurses prepared and administered medications. The context assessment index (CAI) was used in an attempt to make visible the complex nature of context and to understand the contextual factors which influenced nurses' medication practice and their ability to change it.

Context Assessment Index:

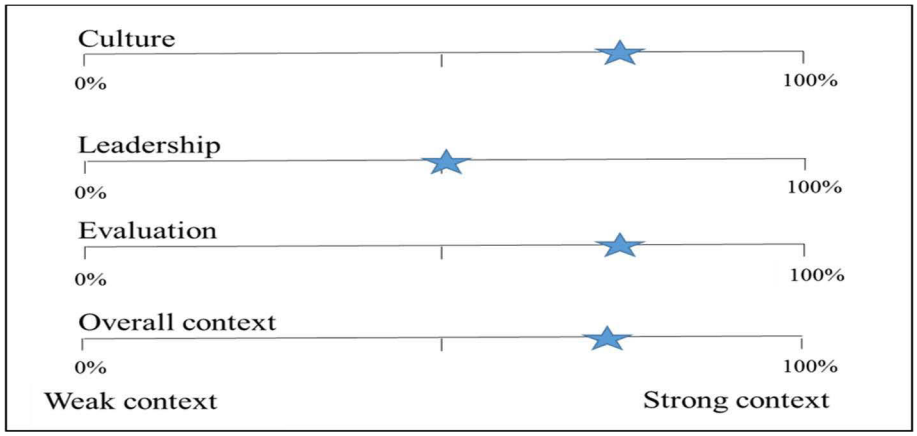

Figure 5-5 Context Assessment Index plotted scores

The ward nursing team context score was 3 out of a possible 4 (75%) illustrating that the nurses perceived the quality of the context to be strong and conducive to supporting practice change (Figure 5-5). However, they consistently scored the local leadership questions 2 out of 4 (50%) compared with the average context score of 3 (75%). The nurses showed they were aware of the limiting effect of frequent change in ward nursing leadership on their ability to elicit changes in medication practice. Nurse leaders can facilitate the implementation of evidence into practice, bringing about new ways of working. In this way they can create a context into which evidence based practice can be more easily integrated (Bamford-Wade & Moss 2010). The MAG reported how the (non) availability of the designated nurse leaders impacted on medication practice on the ward. *"You tend to, you know - do it correctly when you know the charge nurse is just out there and likely to walk in at any minute"* (M6). When the nurse leaders were present and visible, the process of medication checking was enhanced. In other words, nurses were more likely to conform to policy expectation and diligence in double checking when they thought a nurse leader may be able to observe their practice.

According to Reason's (2000) error theory, this would suggest that local leadership was a latent weakness within the workplace context.

Other CAI responses indicated that there was a reliance on didactic teaching but, as the literature on the problems of getting evidence into practice illustrates, providing information alone does not change practice (Baumbusch et al. 2008). Supporting evidence was provided during a MAG meeting. The members of the MAG believed that the lack of availability of a nurse educator for an extended period of time had resulted in a decrease in medication safety. On probing further, it became apparent that more recently employed nurses, whose orientation programme was overseen by a nurse educator from another ward, had received less education on the specific medications which were commonly used on the ward. Through critical reflection, the MAG realised that a lack of education by a nurse educator was not the real issue. Rather, it was the ward culture around the double check process which did not support new nurses to gain the required knowledge and experience. *"When I first started, I was told 'we haven't got time to go checking the dose, it will be alright"* (M5). In other words, new nurses were often discouraged from taking time to access and review information on medications they were not familiar with during the double check process. The impact of ward culture is discussed further in section 5.3 on page 166.

Another finding from the CAI was that the nursing team appeared to have a limited understanding of the impact the context was having on their medication practice. The nursing skill mix (discussed in section 4.3.2 on page 124 in relation to study participants) per se was not identified by the MAG as impacting on medication practice. However, they identified that on days where there was an increased number of higher acuity

patients, medication administration could be compromised "*...it's just really busy and you take shortcuts ... even though you know you should be following the 5Rs"*(M1). Not only did nurses make compromises with their individual practice, but patient care could be affected.

> *"sometimes you know they are hanging out for the morphine but everyone is so busy and you are waiting for the med chart, waiting for the keys, waiting for a double check"* (M3)

Workload was identified as a contributing factor in 11% of reported medication incidents as discussed later in the chapter (Figure 5-14 on page 185).

Patients are a component of the workplace context identified in the literature as having an impact on medication practice (e.g. Brady, Malone & Fleming 2009; Keers et al. 2013a). The average age of the children on the ward was eleven years and patient acuity ranged from those requiring high dependency care postoperatively for complex procedures to those requiring care for fractured limbs and cellulitis. The average length of stay for children on the ward was 3.2 days with an average of 14 admissions a day. Almost all children received some medication at some point during their admission and the most common medications prescribed and administered were analgesia or antibiotics. The nurses acknowledged that an independent double check was expected practice because they were administering medications to children. *"You have to get nearly everything checked to keep the children safe"* (RN1). While the literature identifies children are at high risk for medication errors (Holdsworth et al. 2003), the nurses in this study did not specifically identify patient population as a factor which impacted on medication administration practice. This may be because all patients in the study setting are children.

5.2.1 Chaotic and disruptive.

As the MAG moved into action spiral 2 and started revealing current medication practice, it became apparent that the workplace context posed many challenges to medication safety. During the observation of practice, the MAG documented how the systemic weaknesses associated with the medication room impacted on safe medication practice. In particular the small size, position in the ward, inadequate storage of medication and administration equipment, crowding during peak times of medication preparation and storage of non-medication related equipment. A list of the observations that resulted in the sub-theme of chaotic and distracting are presented in Table 5-1.

Table 5-1 Workplace context: chaotic & disruptive

Chaotic and Disruptive
Items required for medication preparation were stored in an arbitrary manner without consideration to the frequency they were used or the process in which they were needed
Searching for medications hidden behind another medication
Overstocked items spilling over onto benchtop
Nurses on toes to reach things
Reaching over one another to get items
Moving from one end of the room to the other to access supplies
Medication room benchtop used as general workspace
Staff frequently entering to get non medication related equipment which was kept in the room
Frequently leaving medication room to get additional supplies, checking information or assistance for checking and being interrupted
Drug checking interrupted by another nurse needing access to the fridge or other supplies
Medication room door wedged open and noise carried from workstation and charge nurse office
Multiple conversations within medication room

The medication room was very small and cluttered (Figure 5-6). All medication preparation for the ward took place in this room. The medications were kept in cabinets,

drawers or on shelves. While the majority of medication preparation equipment was stored in this room. It was not sorted with any due regard for workflow. The enteral /oral syringes were not kept beside the oral medications and the intravenous syringes and diluents were not co-located with intravenous medicines. Rather, both oral /enteral and intravenous syringes and diluents were kept in a line of storage containers attached to the wall or sitting on the benchtop. Further some equipment required for preparation of medication infusions, such as bags of intravenous fluids and volumetric administration sets were stored in a completely different room altogether. This was largely due to space issues within the medication room but also that these items were not managed via the pharmacy system. This was a particular issue for this ward as one of the most common medications administered routinely required dilution in a burette and administered over 60 minutes.

Figure 5-6 Photograph of “before” medication room

The medication room was situated off to the side of the central work station (Figure 5-7). This was an extremely busy area as it provided work stations for medical and nursing staff and is where they return to in order to complete their documentation. The central workstation also functioned as the ward reception area and served as a communication and coordination hub for the ward.

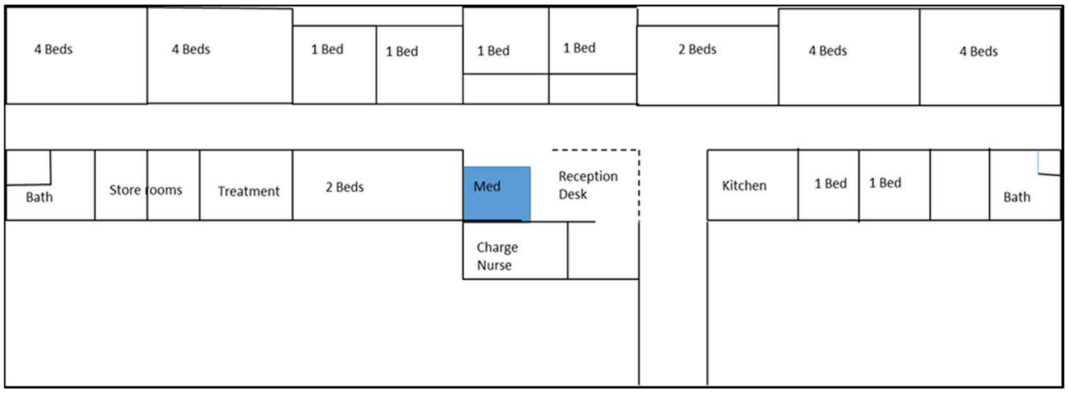

Figure 5-7 Ward layout

Due to its small size, the medication door was wedged open to avoid temperature build up in the room. In addition to the room being uncomfortable to work in, there was also a risk of the temperature being above the acceptable parameters for the storage of medications. As the medication room was situated at the side of the extremely busy clinical and clerical work station, having the door open resulted in the constant noise of people's conversations and ringing telephones in the adjoining work station distracting staff when they were trying to concentrate on medication preparation. The nurses also acknowledged that many conversations occurred within the medication room. The medication room was often treated as a space where nurses could have a confidential conversation. The workstation did not offer any privacy and the charge nurse office was perceived as being 'unavailable to the ward nurses' (FN). In addition to the distraction caused by constant noise, the visibility of nurses in the room, due to the open door, led

to many interruptions while preparing medications for administration. The nurse in the medication room was often the first port of call for assistance with a patient enquiry. *"The ward clerk consistently interrupts us in the medication room, it is the first place she looks for someone to take a call, even when it's not your patient"* (M2).

Observations of nurses preparing medications revealed that necessary supplies to prepare medications were stored in an arbitrary manner without consideration to the frequency they were used or the process in which they were needed. Nurses were observed reaching over one another to get items, moving from one end of the room to another and having to wait to access supplies. These behaviours were distracting particularly when several nurses were in the room at the same time as they were constantly moving and interrupting each other. Nurses' ways of working in the medication room often resulted in complicit interruptions as the nurses were observed to simultaneously prepare medications for their own patients while providing a double check for each other. Frequently, nurses had to leave the medication room to acquire the necessary supplies for a given medication administration or to access necessary medication information because there was no computer in the medication room. When this occurred they were likely to be interrupted for a variety of competing priorities (as outlined in the vignette in Figure 5-3 on page 154). A frequent cause of interruption came from a patient's family member, asking questions or requesting assistance (such as needing help moving the patient to the bathroom or letting the nurse know that an intravenous pump was alarming). While some of these interruptions can be considered justifiable for patient care, other types of interruptions for non-urgent or less important issues could be managed differently.

This medication incident report illustrates how easily nurses could be distracted. Fortunately no patient harm resulted.

> 'Nurse A gave a medication to a Patient B that was meant for Patient C- another patient in the room. The medication was double checked, right drug, right dose, right time in the medication room. When I entered the room, Patient C asked for a drink of water, which I attended to and then inadvertently gave her the medication as I did not check the name band of the patient against the drug chart' (IR).

The most frequent cause of distractions were from other healthcare workers. One nurse was observed to be interrupted 3 times during the preparation of one medication by a visiting healthcare team requesting an update on the patient's condition. Another nurse was interrupted to undertake a detailed review of patient care (not necessarily the patient the nurse was preparing the medication for) by medical staff who had been called to the ward in response to a change in the patient's clinical condition. Similar distractions also occurred when the nurse left the medication room to go to the patient room and administer the medication.

Distractions could also be specifically related to issues which arose during medication preparation. For example, the nurses described the impact of a medication not being available on the ward; they had to interrupt what they were doing to find the medication. This led to not only an interruption in the administration process but also a delay to the patient receiving the medication.

> *"It was really annoying, I had an oncology outlier … and I was trying to get their usual meds from pharmacy – it was taking so long to come from*

pharmacy that in the end, I actually left the ward and went upstairs to borrow some. By the time I came back and found someone else to check it, it was 90 minutes late - and the mum blames me for not being on time!"(M4).

Nurses were observed to be repeatedly distracted by colleagues entering the medication room for non-medication related reasons. Partly this was due to the medication room being used as a store room for ward equipment such as pulse oximeters or blood pressure monitors. As well as workplace context, the workplace culture also impacted nurses' medication practice and their ability to influence change and is discussed next.

5.3 Workplace Culture: Findings from Action Spiral 1 and 2

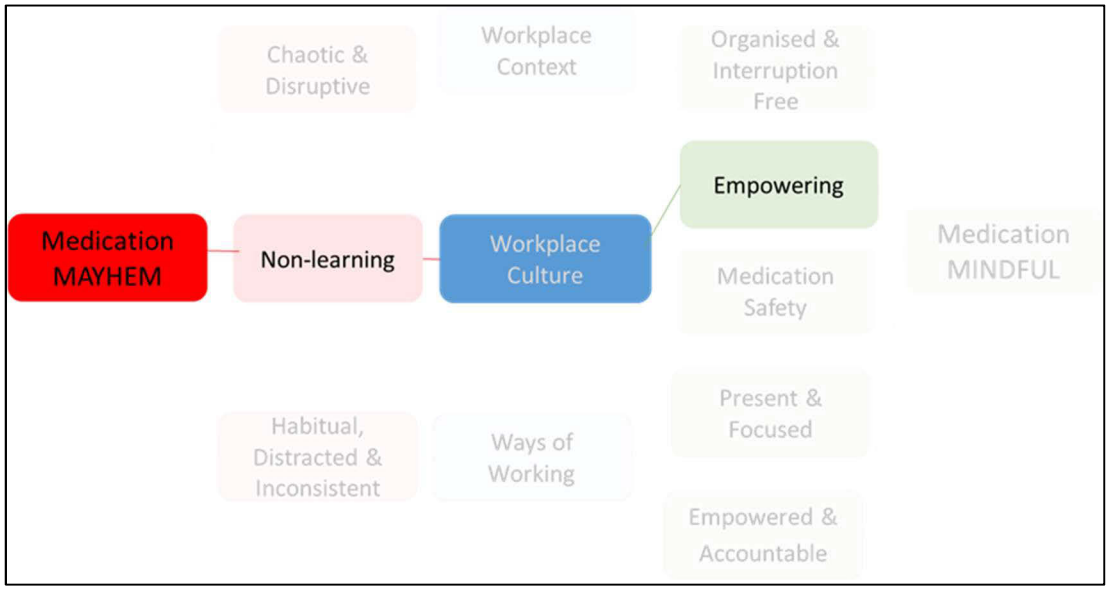

Figure 5-8 Workplace Culture spiral 1 & 2 sub themes

Each workplace has its own cultural characteristics which influences practice. The focus in this study was on what aspects of workplace culture enabled or inhibited medication safety. The initial data on the nursing team's perception of the workplace culture was measured by the Conditions for Work Effectiveness Questionnaire (CWEQ II) and

Medication Safety Culture instruments. The CWEQ II is a measure of structural empowerment. The overall finding indicated that the nurses perceived that they were working within an empowered environment. There was variability within the individual dimensions. The nursing team ranked medication safety highly overall, although a lack of staff feedback on medication incident reports was highlighted. Analysis of the survey findings in conjunction with observation of practice and group interview data enabled the emergence of the key themes empowering and non-learning in relation to influence of workplace culture on medication practice.

5.3.1 Empowering.

The CWEQ II instrument is based on Kanter's theory of structural empowerment. It measures 4 empowerment dimensions; perceived access to opportunity, support, information and resources, and 2 power dimensions; formal and informal, in the workplace. All individual scores were summed and averaged to calculate a nursing team score out of 5 for each dimension. The average score and range for each dimension is presented in Figure 5-9.

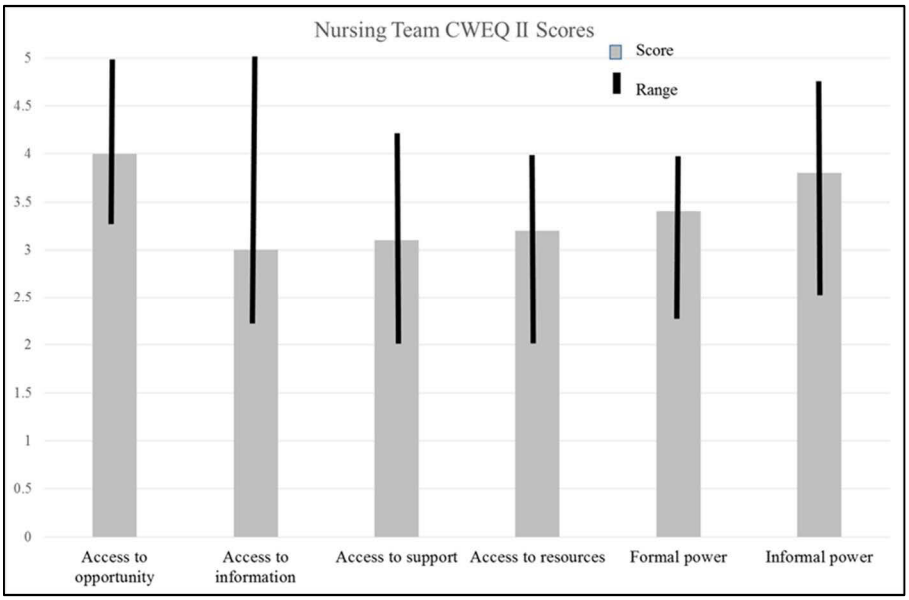

Figure 5-9 Nursing team CWEQ II scores

A mean empowerment score of 20.5 (potential range 6-30) was calculated by summing the 6 dimension scores which provided an objective measure of the ward nursing team's perception of workplace empowerment. This score suggested that in general, the nursing team perceived that there were relatively good levels of structural empowerment in the workplace. The scores for the individual dimensions varied. The nurses scored access to opportunities for professional growth and development within the ward highest and access to information and resources lower.

During action spiral 2, the MAG explored the potential reasons why the nurses had scored access to information and resources lower. The ward nurses acknowledged how the organisation's medication policy and medication administration guidelines could support their medication practice. They also identified that in reality, difficulty in accessing these and other resources was a barrier to safe medication practice.

Policy and guidelines:

Structural support for safe medication practice was provided by the organisational medication administration policy and guidelines. Inadvertently, however the policy could also be a barrier to safe medication practice. The aspect of the policy that the MAG and ward nursing team most talked about was the double check process.

> *"It's great we have a medication administration policy but when do we ever get the time to read it, I just make sure all new staff at least read the bit about double checking"* (RN2)

The double check process provided in the policy was very detailed and nurses perceived that it was difficult to achieve in practice and as a result short cuts were often taken (discussed further in section 5.5). Tension was created for some nurses who believed that adhering to a thorough independent double check of all the rights of medication practice required a bedside verification of patient identity which was incongruent with the organisation policy which does not require the double check process to go to the patient bedside.

> *"I can check the right medication, I can check the right dose, but I can't check the right route, I can't check the right time and I can't check the right patient because I'm not going to be there."* (RN5)

This contributed to staff questioning the value of the double check process and influenced their practice. Particularly for staff who had previously worked somewhere else and a double check at the patient bedside had been required. *"I don't really see the point, if you aren't checking all 5Rs"* (RN1).

Access to medication administration resources:

Having access to current medication information was identified by the MAG as enabling medication safety. Frontline nurses had access to medication resources e.g. intranet pharmacy site, reference viewer (portal on the organisation's intranet that co-locates all medication prescribing and administration resources) organisation policies and clinical guidelines. However, due to the complexity of medication administration to children, currently available resources were seen as contributing to delays and had the potential to be a barrier to safe practice as nurses may not take the time to check all the details "*...you have to look up three different resources to check all the prescription details"*(M1). Many of the resources were available electronically and to access the computer, nurses had to leave the medication room which often resulted in them being distracted by another activity.

Human resource accessibility was also viewed as important. When a designated pharmacist was available for assistance and support this was identified as enabling safe medication practice as nurses could seek advice regarding medications. However this could also be a barrier when they were not available, such as after hours, or difficult to access due to their workload. Similarly, difficulty accessing medical staff can be a barrier to safe medication practice. When the charge nurse and nurse educator were visible and readily accessible the process of medication checking was enhanced. However a lack of visibility and reduced numbers of nurses available in particular areas or at particular times of the day created barriers to safe medication practice.

Medication Safety Culture Questionnaire:

The Medication Safety Culture Questionnaire provided a measure of the ward's medication safety culture. Individual responses were scored and collated and a nursing team score was obtained. The result was 3.1 out of a possible 4. Thus the nursing team believed that a culture of medication safety existed on the ward. On one hand, this finding was consistent with discussions in the MAG meetings.

> "I *have worked here for many years and have seen many changes and I do have to say we have always had the patient's safety and care front and foremost"* (M2).

Conversely, the MAG identified how current ward routines did not promote a culture of medication safety.

Ward routines:

Medication management and medication safety were largely invisible within the routine structure and processes of the ward. This contributed to a culture where medication preparation and administration was viewed as a task to be done rather than a complex and high risk activity. *"On a busy day, I just think, get the obs done and the meds given."* (RN5). Medication safety was not viewed as a priority.

There were few formal support structures embedded in the ward routine related specifically to medication safety. The nursing staff worked 8 or 12 hour rostered shifts. Eight hour shifts were morning, afternoon and night shift and 12 hour shifts were day and night shift. When the nurses arrived on duty, they would assemble in the Charge Nurse Office to receive a verbal handover of patient details and care requirements for all the ward patients from the nurses currently on duty. There was no stated requirement

for the handover to include any information related to the patient's medication. Each nurse was then allocated a certain number of patients depending on their skill and knowledge level and the patient's care requirements. If required the nurses could then seek clarification on any specific patient details either from the nurse currently on duty assigned to care for the child or the child's clinical record. This may or may not have included medication related concerns depending on individual circumstances. The Charge Nurse would attend the medical ward round each morning and the ward nursing team would reassemble following the medical ward round so that the Charge Nurse could provide an update on care requirements as needed. However, changes to medications would not necessarily be highlighted as changes often occurred independent of the ward round. The nurses reported how this could lead to delays in medication being given *"... and I didn't realise that they had charted a new med at 1230 until I was writing my notes at 1830 ... it's really frustrating because then I was rushing around to give it before the next shift arrived"* (M4).

A key finding from the medication safety questionnaire indicated concerns related to the use of the medication incident report system and emerged as a culture sub-theme of non-learning.

5.3.2 Non learning.

An organisation that analyses medication incidents and then implements appropriate change is recognised as having a learning culture. At ward level, the Charge Nurse was responsible for providing feedback on the reported medication incidents. The nurses reported that there was generally very little feedback to staff on reported medication incidents. *"They disappear into cyberspace and you don't hear anything more"* (RN3).

The findings of the Medication Safety Culture Questionnaire and Context Assessment Index were congruent with the ward nurses viewpoint. The questions related to feedback and shared learning scored below average in both instruments (Table 5-2).

Table 5-2 Low scoring culture questions

Medication Safety Culture Questionnaire Likert scale 1-4	Result
Q1. The culture of ward ... makes it easy to learn from the medication mistakes of others	2.3
Q2. Medication errors are handled appropriately in ward ...	2.7
Q11. Ward … is doing more for medication safety now than it was 1 year ago	2.7
Q16. In ward … we have defined protocols about reporting and discussing medication mistakes that almost happened and could have harmed a patient but did not	2.7
CAI questions Likert scale 1-4	Result
Q9. Staff receive feedback on the outcomes of complaints	2.6
Q25. Organisational management has high regard for staff autonomy	2.5
Q35. The organisation is non-hierarchical	2.1

Any feedback that was received was generally to find out further information or recommendations for individual performance improvement based on an individual incident report *" ...well not unless you get a call into the office to be reminded to be more careful with checking the 5Rs next time"* (RN3).

In the study ward, there was no process in place for regular analysis of the cumulative ward incident data. Therefore frontline nursing staff did not have any appreciation of what medication incidents happened on the ward. As part of action spiral 2 to reveal current practice, the MAG reviewed the ward medication incident data. The effect this activity had on the group was noted during the meeting:

"It's easy for me now to see what is happening. People need to understand the importance of reporting so we can change the system, not think they will be punished if they do report" (M5).

Absence of feedback from the cumulated medication incident reports was similarly mirrored at higher levels of the organisation. As noted earlier, there had been a vacancy in the nurse leader position at the start of the study and this meant that many of the nursing organisational and service processes had lapsed. For instance, there was no sharing of information across wards to look for similar trends and learn from each other's mistakes. There were no organisational structures in place for providing staff feedback on serious reported incidents. The nurses often knew when significant incidents had happened in another ward, but they seldom received any feedback on the response or outcome.

"When a problem is reported in another department, I never get a report or hear back about what was done or what is going to be done to prevent it happening again" (RN4).

The ward non-learning culture was reinforced by the lack of organisational system support. As discussed above, reviews of significant medication incidents would occur, however they often took a prolonged period of time, the written reports were not circulated and recommendations were not followed up (FN).

In summary, the workplace context and workplace culture provided many challenges to safe medication practice. The physical environment was chaotic and full of distractions and the culture did not support learning with little feedback provided to staff, other than follow up with the nurses involved in any specific reported incident. Notwithstanding, the nurses reported a sense of empowerment through access to an organisational

medication administration policy and medication guidelines. The MAG therefore felt optimistic for successful practice change. The next section discusses the implementation and evaluation of practice changes undertaken in action spiral 3 related to both workplace context and workplace culture.

5.4 Workplace Context and Workplace Culture: Findings from Action Spiral 3

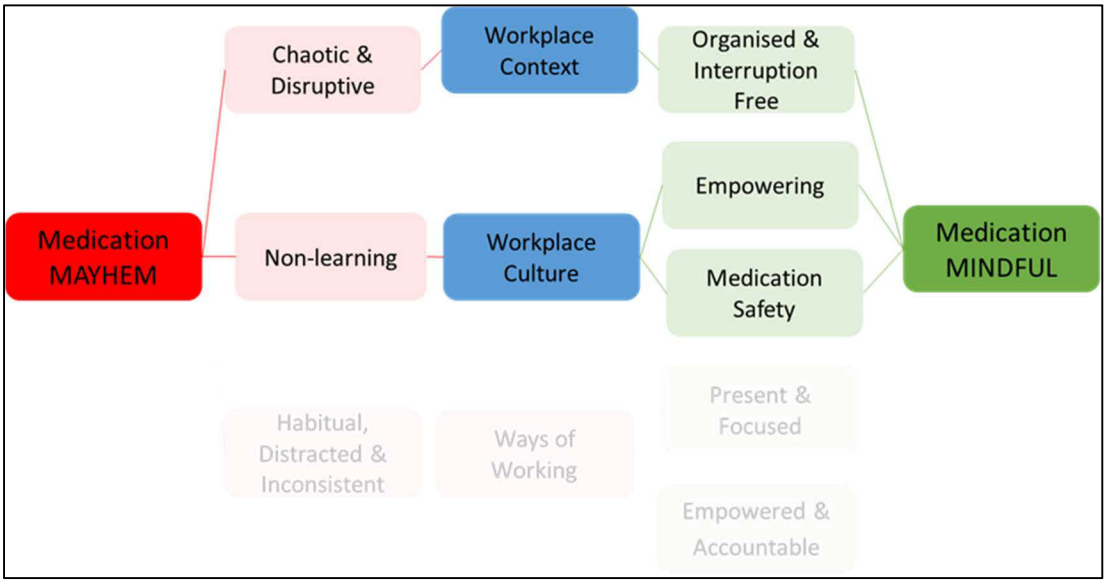

Figure 5-10 Workplace Context and Workplace Culture final sub themes

Feedback of the findings from the data analysis from action spiral one and two assisted in raising the MAG and nursing team consciousness of the strengths and weaknesses of the workplace context and workplace culture. The initial reaction of 'we don't have a problem', had slowly changed to 'how would we know if we had a problem?' to 'we need to work on…' as the action research developed. As I noted after a MAG meeting. 'I sense a change in mood today, for the first time, I think the MAG truly believe the ward nurses are with them' (FN). The initial problem related to the workplace context and culture that nurses encountered during medication administration was the chaos and disruption due to the disorganised and inefficient medication room. The MAG

established 3 improvement goals; (1) organise the medication room for efficient workflow, accessible supplies and equipment, (2) reduce interruptions and (3) improve medication safety culture through embedding medication safety practices within everyday nursing work (Table 5-3).

Table 5-3 Workplace context and culture interventions

Objective	Intention	Intervention
1. Improve the physical design and organisational layout of the medication room	Improve workflow within the medication room Reduce the need for staff to leave the room during medication preparation Make it 'harder' for staff to enter room	A. Redesign of medication room • Review medication stock levels with ward clinical pharmacist • Lobby for computer in medication room • Lobby for controlled access to medication room
2. Reduce interruptions during medication preparation and administration	Reduce the need for staff to enter medication room who are not involved with medication preparation Reduce the need for the medication room to be used for discussions	B. Remove any unnecessary equipment from the medication room C. *Promote the use of identified 'huddle bays' for nurses conversations
3. Embed medication safety practices within everyday practice	Promote safe medication practice as a 'way of how we do things around here'	D. Promote the review of medication charts during nursing handover and clinical care review
*Also an intervention in Ways of Working - discussed in section 5.6.2 on page 197		

5.4.1 Improvements to the medication room.

An opportunity to make substantial improvements in the medication room arose due to the ward closing for repainting. A simple and effective action which quickly achieved a level of confidence within the MAG that they could effect change, was their involvement in the physical redesign of the ward medication room. The MAG started the redesign by working in collaboration with pharmacy staff to identify the supplies

and equipment needed and establishing the quantities required based on routine biweekly replenishment. The specific location for each item was established depending on how and when in the medication preparation process it was used. The medications and relevant equipment were co-located according to route of administration (e.g. oral/enteral syringes with oral medications) into more defined areas of the medication room. All equipment that did not pertain to medication administration was removed from the medication room. Air-conditioning was installed which enabled the room door to be kept closed. The MAG successfully advocated for the door to be secured with swipe card access and for a computer to be installed in the room.

Once the changes were in place (Figure 5-11) the MAG were responsible for ongoing monitoring of the medication room. A feedback sheet was put up on the medication room notice board for ward nursing staff. Any additions or alterations to the medication room environment were evaluated by the MAG to ensure that any proposed changes did not affect the safety of nurses' practice during medication administration. An initiative that was proposed and supported by the MAG was to install a doorbell system in the medication room to allow easier communication with colleagues when seeking a second nurse to conduct an independent double check as discussed later in section 5.5.1 on page 183.

Figure 5-11 Photographs of redesigned medication room

Following the implemented changes to the medication room, observations of nurses preparing medications revealed a more streamlined workflow. Nurses entered the room, they could access the computer to check the prescription against the approved electronic resources, collect the required administration equipment and then they moved along to their right to obtain the required medication and prepare it on an uncluttered benchtop. Nurses noted the impact of the improvement on how they worked "*it doesn't feel so chaotic"* *(RN6)* and *"I feel that I am no longer having to constantly juggle past someone to get to what I need"* (RN4). All the equipment that was required for medication preparation was kept in the room. *"It is much better not having to duck out all the time to get a burette"* (RN2). All drawers and cupboards were clearly labelled with contents which supported nurses returning equipment to its correct place. An item commonly misplaced before the medication room layout was improved was the reusable blue plastic tray which the nurses used to transport the prepared medication from the medication room to the bedside. However, having a designated place for these to be kept resulted in a lot of time saved looking for them.

" ... and we never seem to run out of blue trays anymore ...everyone knows to ... put them back in the drawer ... I don't have to spend 10 minutes looking for one before I can even begin " (M6).

5.4.2 Reduction of interruptions.

Another way the changes to the medication room improved the safety of nurses' medication practice was through reducing the number of interruptions. The door to the medication room was no longer wedged open which reduced the constant background noise of people's conversations and ringing telephones distracting nurses when they were preparing medications *"you can actually concentrate on what you are doing now without the constant buzz from the workstation"* (M3). The closed door was also a physical barrier which greatly reduced the number of interruptions nurses were subjected to while preparing medications for administration. A poster was designed and put on the door (Figure 5-12). The nurses acknowledged a change in colleagues' behaviour *"Now they don't come barging in looking for someone to help them" (*M2) allowing them to improve the safety of their medication administration *"yeah, you actually get to start and finish in one go"* (M4). Thus the workplace context was transformed to be organised and interruption free. An 'interruption free zone' is discussed further in chapter 6, section 6.4 on page 241.

Figure 5-12 Interruption Free Zone door sign

5.4.3 Improving medication safety culture through embedding medication safety practices in everyday practice.

During the research study, a new model for nursing care delivery was implemented across the children's hospital. While the introduction of the model per se was independent of this study, the MAG took the opportunity provided by the model implementation to work on embedding medication safety practices in everyday practice. The MAG considered that two aspects of the model, a change in the way handover occurred on the ward and the implementation of scheduled patient clinical care reviews, complimented their aims to improve the culture of medication safety on the ward. The newly designed handover included a verbal handover component and a bedside visual component. The MAG promoted reviewing the medication administration record at each

bedside visual handover and scheduled clinical care review. The review was intended to cover when medications had been administered to the child and when they were next due. If there were any continuous medication or fluid infusions in progress, both nurses were expected to double check the prescription against the therapy. Prior to the implementation of always reviewing the medication chart during nursing handover, omission of medications was a leading cause of reported medication incidents on the ward. Omissions were eliminated as a cause of reported medication incidents post the inclusion of medication chart review at nursing handover (refer to section 5.7 on page 200). In addition, the aim of the nursing model was for nurses of differing skill level to work together with an assigned group of patients matching clinical expertise with patient nursing care needs. Medication safety was improved as the nurses worked as a team to plan and deliver care. This resulted in greater consistency in medication independent double checks. *"There is much better practice on the ward, well at least when anyone checks a medication with me, they pay much more attention to doing the independent double check right"* (M4). A culture of medication safety started to emerge on the ward.

In summary, the synthesis of data from multiple sources enabled the MAG to see that the safety of their medication administration was influenced due to the chaotic and disruptive environment that they worked within. While there were aspects of the environment, such as written and human resources which supported medication safety, there were also missed opportunities to learn from each other's mistakes. The MAG worked with the ward nursing team to implement interventions which resulted in an organised and interruption free medication room and promoted a culture of medication safety. Thus following implementation of interventions in spiral 3, the sub themes, organised and interruption free (workplace context) and medication safety (culture)

subsequently emerged. The findings now move to the second overarching theme, Ways of Working which includes the sub themes habitual, distracted and inconsistent (spiral 1 and 2), empowered and accountable and present and focused (spiral 3).

5.5 Ways of Working: Findings from Action Spiral 1 and 2

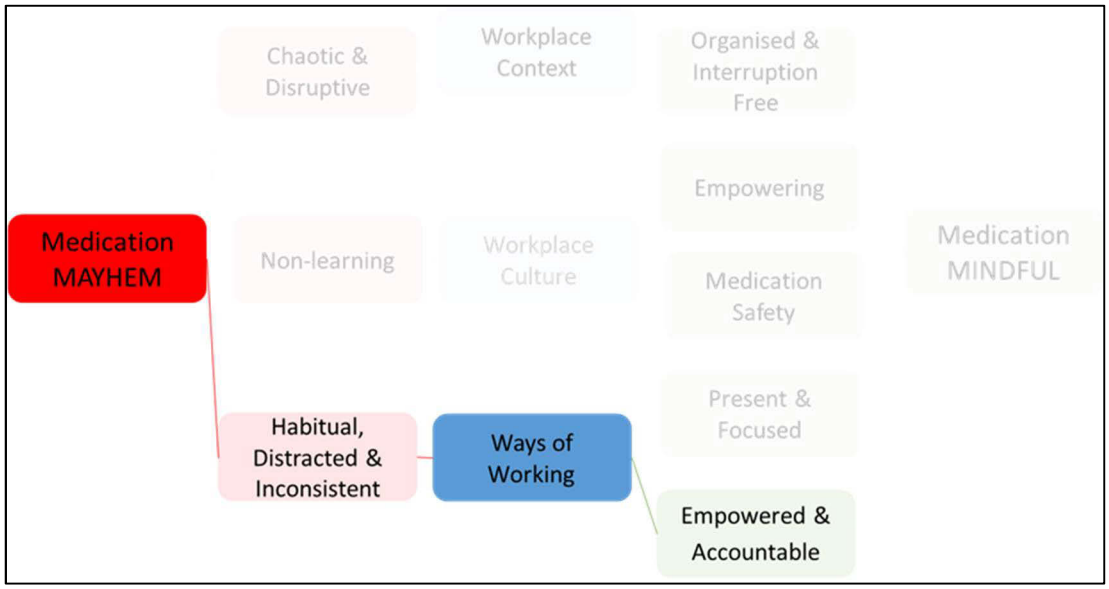

Figure 5-13 Ways of Working spiral 1 & 2 sub themes

The third theme to emerge from the synthesis of data collected during action spirals 1 and 2, which influenced the safety of nurses' medication practice was nurses' ways of working. The majority of nurses' medication administration practice was habitual and distracted. Workarounds had become accepted practice and there was great inconsistency in practice (Table 5-4). While the context and culture played a large part in shaping how nurses worked. Whether nurses felt empowered to challenge practice or took accountability for their practice also impacted on the safety of medication administration. By far the greatest barrier to safe medication administration was frequent interruptions. As discussed earlier, the workplace context and workplace culture

supported chaos and disruption, in this section distraction is discussed in relation to the way nurses worked.

Table 5-4 Ways of working: habitual, distracted and inconsistent

Examples of observations related to nursing practice
Reliance on practice rituals
Asking colleagues rather than consulting written references
Inattention on the medication administration activity being undertaken
Difficulty in finding someone to complete a double check
Saving time by not completing the steps of the double check process
Taking shortcuts in the double check procedure
Administering nurse preparing the medication on own and then asking for a checker who quickly glances at the prepared syringe
Constant noise and competing priorities contributed to multiple distractions

5.5.1 Habitual, distracted and inconsistent.

Within the chaotic environment, the majority of nurses' way of working was observed to have developed predictable patterns which resulted in medication practice that was automatic and habit-driven. As nurses administered medications many times a day practice had become rote. The nurses were observed accomplishing the preparation of medications for administration, but lacked attention and focus on what they were doing. This was particularly relevant during the double check procedure where routine checking was often little more than ritual. It was noted during several periods of observation that nurses attempted to speed up the double check process. The response when asked to comment on the observation was *'If you prepare beforehand you feel like you aren't wasting anyone's time…'* (RN4). In doing this, the nurses inadvertently impacted the safety of practice. The short cut in process encouraged the checking nurse to quickly glance at the prepared syringe and 'confirm' that the volume was accurate. At times the administrating nurse talked through their calculation so avoiding the need

for the checking nurse to do their own calculation. The notion of ritual and workarounds emerged when exploring the observation data with the MAG, *'... nearly always we will get it ready and show the empty containers and the syringe with the final volume*' *(M4)* due to *'the pressure to get through the work' (*M3). Even when two nurses were readily available, the double check process was not always completed as per hospital policy.

While nurses in the study could readily recite the five rights, there was less evidence of these being thoroughly followed in practice. There was an espoused belief that nurses were following the 5 rights but the evidence suggested that this was not always happening due to workarounds and distractions. There was little evidence of nursing staff challenging their own practice, or that of nursing colleagues or members of the multidisciplinary team.

Safety and accuracy in medication administration requires attention to each step of the process. The observation data highlighted that some nurses were better than others at managing distractions. Critical reflection on the observation findings enabled the members of the MAG to share their different strategies for managing distractions. The majority of the group identified that they usually stopped preparing the medication to attend to the other activity. After completing the secondary activity, the nurses came back to complete the medication preparation which required them to re-orientate to where they were in the process before they were interrupted. At times, the secondary activity was of higher priority, for example, emergency alarms that needed to be attended to immediately. However this was not always the case, particularly when another colleague requested assistance, for example, to help with getting a patient ready for timely transfer to the operating theatre.

Another response to distraction was for nurses to try and multi-task by dividing attention between both activities at the same time. Distractions from visiting healthcare professionals often lead to nurses trying to do two activities at once, "*...I have to catch him when I can"* (RN7). Occasionally, nurses deflected the secondary activity to another nurse and maintained a focus on medication preparation.

The habitual and distracted way of working resulted in great inconsistency in medication administration observed on the ward. A tension between striving to adhere to an independent double check of the rights of medication administration in the face of many contextual barriers resulted in a number of inconsistencies in nursing practice. Inconsistency existed between practice and policy and between nurses' practice. The inconsistency in practice posed a threat to medication safety as it led to an inadequate independent double check being undertaken. The inadequacy of the independent double check featured strongly as a contributing factor in the analysis of the study ward's reported medication incidents (see Figure 5-14).

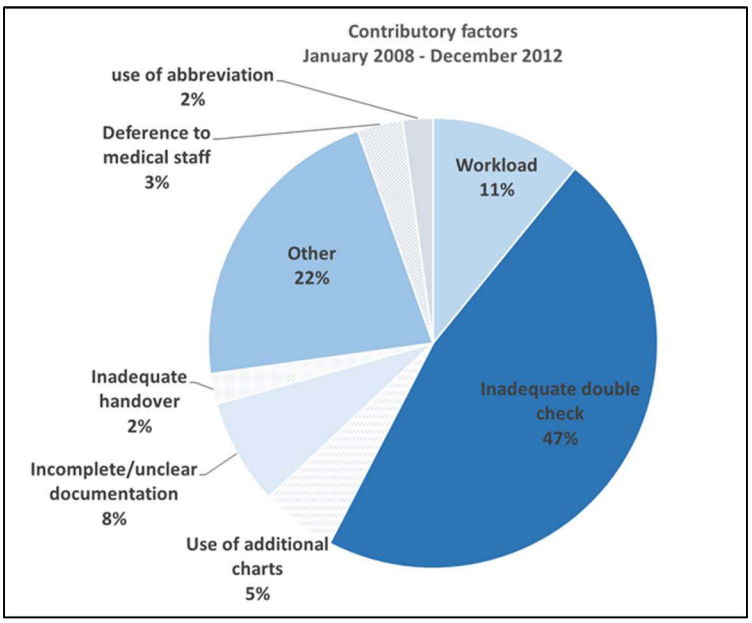

Figure 5-14 Reported medication incidents; contributory factors

The notions of 'finding someone', 'saving time' and 'taking shortcuts' were identified as ways of working which led to the inconsistency in independent double checking during medication administration. It was often difficult to find a second person to undertake the double check when preparing medications because the ward was long and the medication room was in the middle. The difficulty in obtaining a second nurse to undertake the double check was a barrier to medication safety as it resulted in attempts to make the process quicker which lost the independent nature of the double check.

The ward did have an overhead intercom system "*...so you can put out a call for someone to do a check and then wait for someone to turn up…"* (M2). However, at times no one responded to the intercom so "*...you have to physically go find the nearest person"* (M5). Facilitating the MAG to question the apparent acceptance of this situation, that no-one responds to the intercom, it became apparent that when nurses were involved in nursing care, the intercom message is inaudible or not readily understandable. Following the redesign of the medication room, a doorbell was situated in the medication room (as discussed in section 5.5.1 on page 176). Nurses used the door chime to signal that they were in the medication room and required a medication check. Nurses in the ward immediately knew what was required resulting in a more prompt response. A seemingly small intervention which had a big impact on practice.

At times, even if a second person was readily available, the double check process was not always completed thoroughly resulting in a medication error as the following excerpt from an incident report demonstrates.

> '500mg of Flucloxacillin was double checked and still inadvertently given IV instead of oral. Nurse A had looked after the patient previously, when

they were on IV medication and assumed they were still on IV. Nurse A prepared the medication and showed it to nurse B who checked the volume of medication but not the route it was to be given.' (IR)

Nurses were observed to have an inconsistent approach to managing illegible handwriting and shorthand abbreviations. The nurses were aware that if they were unsure of the medication prescribed, they should not administer it without checking with the prescriber. However due to the time taken for a member of the medical team to be contacted and arrive on the ward to rewrite the prescription, nurses would risk safe medication practice by conferring and agreeing on what they thought an illegible prescription was supposed to be rather than contacting the prescriber to ask what the prescription actually was *'...it just takes more time for nursing staff to follow up when prescriptions aren't clear ... so sometimes you rely on each other instead...'* (M5).

When nurses were not paying attention and being focused on medication preparation, any part of the process was susceptible to mistakes. The initial check that the prescribed dose is appropriate for the patient is not always checked by the second nurse and often it is also not independently checked against a written prescribing resource by the first nurse. There were 2 reasons given when this observation was followed up in the group interviews. One reason was the availability of medication resources. Some nurses were observed to review up to 3 medication resources, while others were observed to only look in one particular resource which provided information on how to prepare the medication but did not provide dosage information. The group discussion highlighted that nurses found it difficult and time consuming to navigate 3 or 4 different resources to find the dose range to check against. Nurses reported feeling like this part of the

process was asking them to ‘check up on the doctors’. They appeared to work from a position of trust expecting the doctors not to get it wrong rather than see themselves as the last safety defence to detect a mistake (FN). The local medication incident data indicated that wrong dose was one of the top three causes of reported medication incidents (refer to Figure 5-17 on page 196). However, as discussed previously, when the study began there were no structures in place for the cumulative medication incident report data to be shared with the ward nursing team.

Inconsistency in practice extended to completion of documentation. It is the organisation’s expectation that both nurses sign the medication administration record following administration of the medication to provide evidence that the medication has been administered to the patient. Signing the medication chart before the medication has been administered is a risk, as the patient may refuse their medication or, the nurse may get distracted before administering the medication and subsequently it appears that the medication has been administered. Similarly, failing to sign when a medication has been administered creates the risk that another nurse may assume that it has not been administered, and repeat that dose.

5.5.2 Empowered and accountable.

A key influence on medication safety was if nurses felt empowered to challenge practice. Contradictory to the result of the CWEQII survey that the nursing team felt they were working within an empowered environment (previous discussion in section 5.3.1 on page 166), data from the group interviews highlighted that nurses perceived medical staff were in an authoritarian position in the ward. This latter finding was congruent with the ward medication incident reports where deference to medical staff was identified as

a contributory factor in reported medication incidents (refer to Figure 5-14 on page 185). Particularly nurses newer to the ward who stated that it was difficult to question a prescription. While it was less uncomfortable asking for clarification of illegible writing it *"took a lot of nerve"* (M3) to question a prescribed dose of medication. In addition, when nurses did question a prescribed dose they talked about how they accepted the answer given by the medical staff even if they still felt uneasy. In a sense, feeling disempowered, therefore complying with the prescriber's direction rather than following their instincts.

While the context and culture played a large part in shaping how nurses worked, data obtained during follow up of observation of practice, identified that whether or not nurses took accountability for their practice also impacted medication safety. Within the study organisation, a nurse is deemed competent in medication administration provided they received an orientation to organisational policies, undertook education on the expected standards of practice and passed a written test and medication administration competency assessment. At the commencement of the study, all nurses were deemed competent at medication administration. During the research, each new nurse to join the ward team had 4 weeks to demonstrate competency. There were no nurses who did not attain competency within this time frame. It is important to recognise that being assessed as competent does not necessarily mean being accountable for attaining best practice. Also, the demonstration of competency is at one predetermined time and under direct supervision, therefore is unlikely to reveal what actually happens in clinical practice. At the end of each observation period, the observer clarified what they had seen with the nurses that were being observed. One point of clarification was to ask how they had decided who to ask to double check the medication. It became apparent that the choice

of who would carry out a medication double check depended on their perception of a colleague's competency, which was not always based on the organisation's view of competency. The nurses indicated that double checking with a senior nurse was valued due to the process being accomplished more quickly. While double checking with less experienced nurses often resulted in the process taking longer due to the nurse's lack of knowledge and inexperience.

Accountability for safe medication practice, understood by nurses as *"…fulfilling RN responsibility to correctly administer medications"* (RN4) was identified as a key characteristic required to maintain patient safety. Accountability encompassed being fully informed about both the medication being given and the patient receiving the medication, and adhering to the correct process for independent double checking. Accountability could directly influence medication safety through individual practice during medication administration or indirectly through promoting and encouraging other nurses' medication practice. Similar to a nurse's competence, a nurse's accountability influenced who might be asked to undertake the double check. There were concerns raised that sometimes senior nurses did not complete a full independent double check process whereas less experienced nurses paid more attention to detail, *'Junior nurses are much better at double checking than the senior nurses'* (M5). Overt displays of accountability for best practice as evidenced by designated nurse leader's role modelling was considered an important influence on the safety of medication administration *'The leadership team have to be consistent…because they are the staff that a lot of people look up to'* (RN1).

In summary, on the one hand, nurses' habitual, distracted and inconsistent way of working compromised medication safety on the ward. In contrast, medication safety was enhanced when nurses felt empowered to challenge practice and took accountability to uphold a thorough independent double checking process. The next section discusses the implementation and evaluation of practice changes undertaken in action spiral 3 related to changes to nurses ways of working.

5.6 Ways of Working: Findings from Action Spiral 3

Figure 5-15 Ways of Working final sub themes

During the third action spiral, the interventions directed at improving nurses' ways of working were aimed at raising the ward nursing team's awareness of the impact of current ways of working on the safety of medication administration. Specifically, the goals were to improve conscious presence and focused attention on the independent double checking process and reduce the significant contribution of distractions to safe medication practice (Table 5-5). The MAG conducted a values clarification exercise and shared the emerging findings from the action research to raise staff awareness of

medication safety. The MAG committed to role modelling best practice and coaching colleagues whenever they were checking or administering medications.

Table 5-5 Ways of working interventions

Objective	Intention	Interventions
1. Raise ward staff awareness of medication safety	Increase staff knowledge of ward reported medication incidents	A. Develop a medication safety culture • Values clarification and development of ward vision statement B. Share local data; reported medication incidents, survey and observation feedback
2. Reduce distractions during medication preparation and administration	Enable nurses to manage distractions Increase availability of nurse to check medications	C. Reduction of distractions • Role model best practice • Coach colleagues about medication safety • New Medication Safety Distraction Free poster • Manage distractions • Implementation of huddle bays
3. Increase conscious presence and focused attention during medication administration	Increase compliance with complete independent double check	D. Increase conscious presence and focused attention during medication administration • Role model best practice • Coach colleagues about medication safety • Use the new model of nursing care delivery to improve availability of colleague for medication independent double check

5.6.1 Develop a medication safety culture.

Values clarification and development of shared vison.

The MAG facilitated a ward nursing team values clarification exercise over a 6 week period. The values clarification exercise as described by Warfield and Manley (1990) was undertaken with the aim of raising nurses' awareness of medication safety on the

ward. The exercise was used to uncover the values and beliefs held in the ward about safe medication practice. The responses obtained indicated that the ward nursing team believed that medication safety was all about medication error. In other words protecting the patient from error associated with medication administration and protecting the nurse administering the medication from making an error. This was believed to be attained by following best practice when administering medications. The values clarification exercise was successful in enabling the nurses to become aware of their own personally held values on medication safety and of the way in which their values compared to those of colleagues, and what influences this had on their practice In particular, the similarity of values enabled a shared vision for safe medication practice to be created (Figure 5-16).

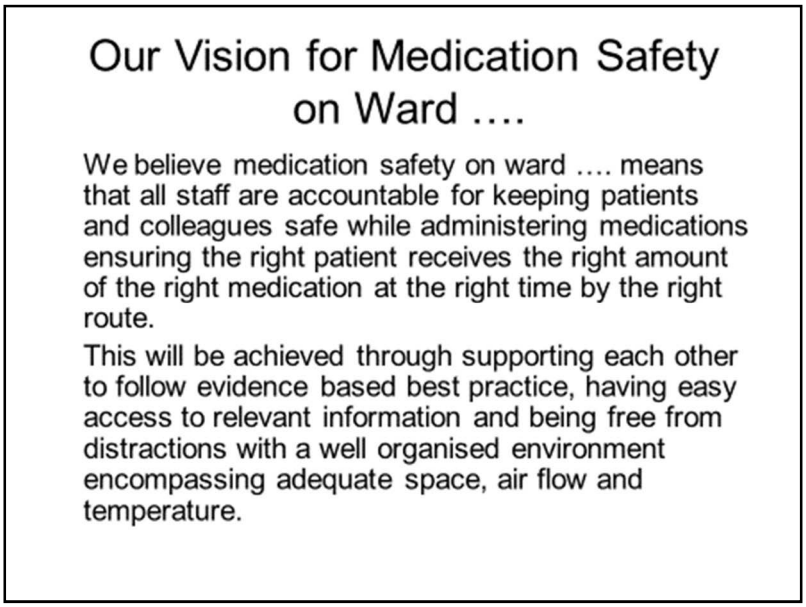

Figure 5-16 Ward vision statement

As the ward nurses' awareness of their values on medication safety increased, it was at this stage, that nurses began questioning their own perceptions that 'we don't have a problem with medication on this ward' (*FN).* In every conversation the MAG or myself had with ward nurses individually or in a group, the nurses started to share stories from

practice where they perceived that something could be done differently to improve safety of practice. The MAG started to become self-directed and the ward nursing team started to become more engaged with the activities the MAG were carrying out on the ward.

Sharing local data.

While the ward nurses had knowledge and skill of the process of administering medications, they had a narrow view of medication safety best practice. The values clarification exercise had been successful in getting the nursing team to start thinking about medication safety. They started to realise that they did not know the impact of current ward medication practice on the infant, children or young person's clinical outcome. The nurses started to ask, 'How would we know if we had a problem'? (FN) Initially, the MAG reviewed the ward's reported medication incidents with a view to identify common themes to add to the findings from the context survey, group interview and observation data. Subsequently the MAG shared the findings from the combined thematic analysis with the ward nursing team.

The MAG explored the previous 5 years of reported incidents to help develop a picture of the impact of current practice. Initially they looked for general trends in the data and then carried out a thematic analysis of the specific details of each reported incident. There were 99 medication incidents reported between January 2008 and December 2012, making medication delivery the number one cause of reported incidents for this ward. Wednesday appeared to be associated with fewest medication incidents and Friday with the most. The actual numbers per day were too small to be conclusive. Wednesday was the ward's busiest clinical day and consequently there were generally more nurses rostered on this day. In addition, 0800, 1400 and 2000 appeared to be 3 times in the day

which were associated with an increased number of errors. Notably nursing handover occurred at 0700 and 1900 and nurses may not have yet reviewed their patients' medication requirements by 0800 and 2000hr. Not unsurprisingly, the most common stage of the medication delivery process involved was administration. This is likely because the vast majority of healthcare staff who complete incident reports are nurses. There were a few prescribing errors identified and 'good catches' where errors were picked up before they reached the patient. The most common medications involved in the reported medication incidents were also the most commonly administered medications on the ward, namely antibiotics, and analgesia including controlled medications.

Two incidents reported actual patient harm which could have been prevented (preventable ADE) and both involved topical application of cream. In one case, local anaesthetic cream had been left in situ for a prolonged period of time causing local erythema and in the other, topical steroid cream had been omitted and the child's dermatitis was noted to be increased. There was one incident in which there was no medication error but the patient had an adverse reaction to the medication which was administered and this was considered an adverse drug reaction (ADR).

The top three types of error were identified as incorrect time, omission and incorrect dose (Figure 5-17). The omissions and incorrect times most commonly occurred overnight and were often associated with competing workload priorities. For example, one incident report noted that,

'There were 2 sick calls, one for pm and one for night shift which were unable to be replaced. The intravenous antibiotic was given 6 hours late as ward short staffed and antibiotic was temporarily overlooked' (IR).

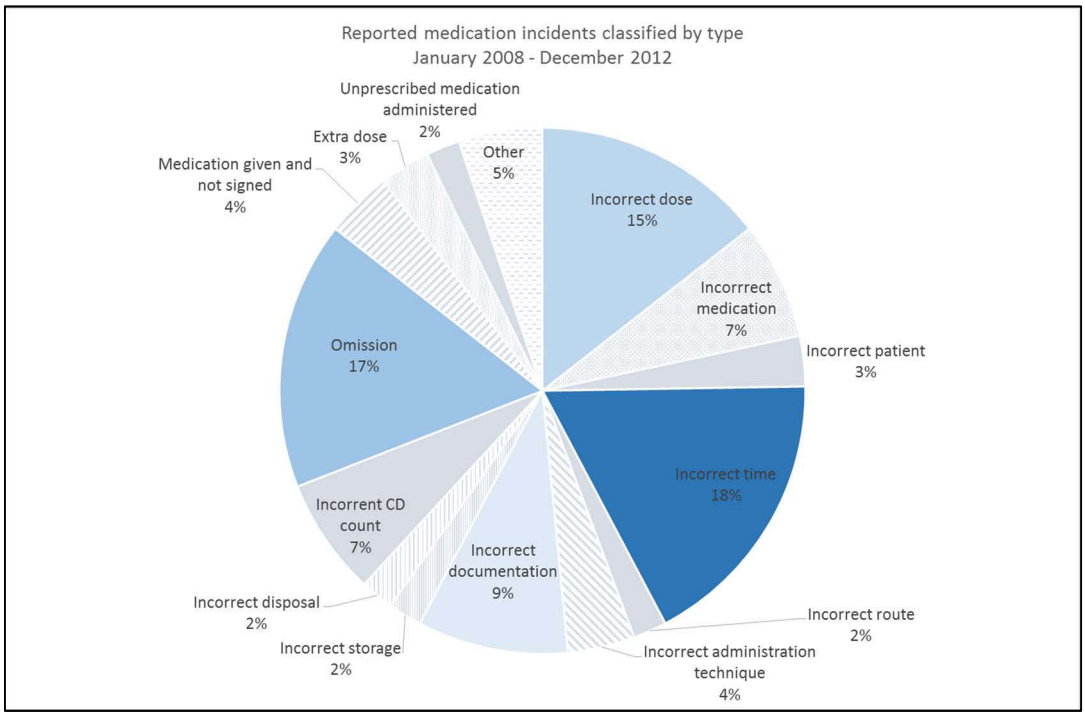

Figure 5-17 Reported medication incidents by type

The MAG envisaged that sharing the reported medication incident data with ward staff would be a regular occurrence. This would support the development of a culture which was open to learning from mistakes. However this never became embedded in practice during the study, due in part to the change in local nursing leadership. Only the ward nurse leader has access to the incident database to retrieve reports. Subsequent organisational implementation of the collection, reporting and display of local monthly nursing metrics included medication error. While this enabled the ward nursing team to know how many medication errors were reported for the month, the report does not routinely include any analysis of the errors. Any analysis is dependent on the ward nurse

leader. During the study, the MAG sought to work with the nurse leader to highlight any key learning from reported incidents as part of the ward team discussion on the monthly metrics.

As part of the action research, the incident data reviewed by the MAG contributed to the data synthesis from the other multiple data sources, informing the identification of the fundamental concerns and eventual development of the three key themes. The MAG shared the emerging findings, as discussed in this chapter, with the ward nursing team to enable them to become consciously aware of what medication practice looked like on the ward.

5.6.2 Reducing distractions.

The MAG, considered the literature on distractions. Initially the thought of changing practice on the ward felt overwhelming for the members of the MAG. However facilitated critical reflection enabled them to see the change as a series of small steps, and provided them with the confidence to try. Initially they contemplated how they could change their own practice. A seemingly straight forward action, which all agreed to, was for the MAG to practice not interrupting anyone undertaking medication administration. At subsequent MAG meetings, the members reflected on what went well and what required more attention. A seemingly straight forward action however, was challenging in practice. The group members could all recall times when they interrupted a colleague during medication administration when they believed it was necessary. However the MAG were sufficiently encouraged that the practice change was in the best interest of patient safety that they planned to continue to role model best practice and engage colleagues in ongoing critical dialogue about the advantages of not interrupting each

other during medication preparation and administration. In the first instance the message was for nurses to stop and consider whether they really needed to interrupt a colleague in the middle of medication preparation. Signs were used to alert all healthcare professionals not to interrupt nurses during medication administration. A later strategy was aimed at the other side of the practice; providing some guidance for the nurse who was being distracted on how to mediate the interruption. Refer to Figure 5-18 for an example of coaching undertaken by members of the MAG to empower nursing colleagues to improve the safety of their medication practice by managing interruptions to enable them to be consciously present and focused during medication administration.

Saying no was challenging for the nurses. It required a different mind-set because the nurses had learned that saying yes to everything was equated with being a good nurse or a committed team player. However, the members of the MAG supported each other and colleagues to step back and consider what was best for patient safety. The members of the MAG prepared helpful phrases to support nurses to say no to interruptions. The key message was that the nurse was not saying no to helping, but that at that moment, they were prioritising their focus on safe medication preparation. 'I can't help 'right now' as I am involved in important work that requires my full attention, but I can help later'.

Figure 5-18 Exemplar: Saying NO to Interruptions

As previously mentioned, a new model for nursing care delivery was implemented across the children's hospital during the study period. One aspect of the model was the identification of 'huddle bays' within each of the wards where nurses could come together to discuss patient concerns. The MAG used this opportunity to promote the idea

that the medication room was no longer the chosen space for nurses to have a confidential conversation. In conjunction with the closed door and no interruption sign, nurses noted an almost immediate effect as discussed earlier in section 5.4.2 on page 197.

5.6.3 Increasing conscious presence and focused attention during medication administration.

The interventions aimed at increasing nurses' presence and focus during medication administration began with the MAG holding themselves and each other accountable for best practice with independent double checking. *"I try not to get distracted while drawing up medications. I aim to be focused and here now" M3.* When asked to double check a medication, they role modelled paying purposeful attention to the independent double check. When the member of the MAG was the administering nurse and asked a colleague for a double check, they held this nurse accountable to undertake a diligent independent double check. *"I just say, don't let others make me or you make a mistake, we need to make certain these syringes contain what they say they contain"* M4. The members of the MAG sought to make it safe and easy for staff to remind each other to be fully present and focused whilst undertaking an independent double check by including 'Thank you for reminding me' when another nurse (initially role modelled by the MAG members) prompted their practice. To further engage colleagues in practice change, members of the MAG participated in one-to-one coaching with the ward team. The MAG supported the ward team to come to recognise the potential effect of interruptions and distractions on the safety of their medication administration practice. They sought to ensure the practice change was not perceived as a simple 'be more careful' message. Rather the MAG supported the nursing team to develop mindful

behaviours or ways of working that reduced the risks associated with interruptions and distractions during medication preparation and administration.

The interventions aimed at improving nurses' ways of working through; sharing values and knowledge of local practice, empowered nurses to become accountable for being present and focused during medication administration (Table 5-6). The following section discusses whether the overall impact of the implemented interventions to improve nurses' medication safety practice made a difference.

Table 5-6 Ways of working: Present and focused

Observation of nursing practice after implementation of interventions
Increased awareness of impact of workplace and culture on medication practice
Quicker response for a medication independent double check
Increased conscious awareness of when colleagues require a medication independent double check
Increased attention to the process of independent double check
Less distractions within the medication room
Decreased conversations within the medication room
Review of medication chart at nursing handover
Exploration of incidents using rights framework

5.7 Transformation of Practice

A number of planned interventions were simultaneously implemented to address the influence of workplace context, workplace culture and ways of working on nurses' medication safety, therefore it is difficult to attribute outcomes to specific activities. The MAG had identified four key outcome measures to evaluate effectiveness of the implementation of practice changes:

1. The proportion of reported medication incidents with incomplete double check as contributory factor

2. The proportion of reported medication incidents with distraction as a contributory factor
3. Differences in pattern of reported medication incidents
4. Differences in nursing medication practice

The differences in medication administration practice as a result of the action research journey (outcome 4) and its success in improving safety, have been discussed throughout this chapter. To evaluate the impact of the changes in practice on reported medication incidents (outcome 1, 2 & 3), incident data for a 2 year period before (January 2011 – December 2012) and the two year study period (January 2013-December 2014) were reviewed. Medication incidents were the number one cause of reported incidents in both time periods. The number of reported medication incidents was similar in both time periods with slightly more incidents reported for the study period. This may be a positive result of the nurses becoming more aware of the importance of incident reporting and starting to see that actions were being taken to address medication incidents. Antibiotics and controlled drugs were the most common medications involved in the reported medication incidents in both time periods.

There was a change in the impact of medication incidents and type of medication error reported between period 1 and 2 as shown in Figure 5-19. There was an increase in the number of ‘good catches’ or ‘near misses’ reported. This is an encouraging change as reporting near misses is an important medication safety strategy which enables ward teams to prospectively identify and strengthen latent system, process or practice weaknesses before patient harm occurs. The number of medication incidents reported that had the potential for patient harm was decreased.

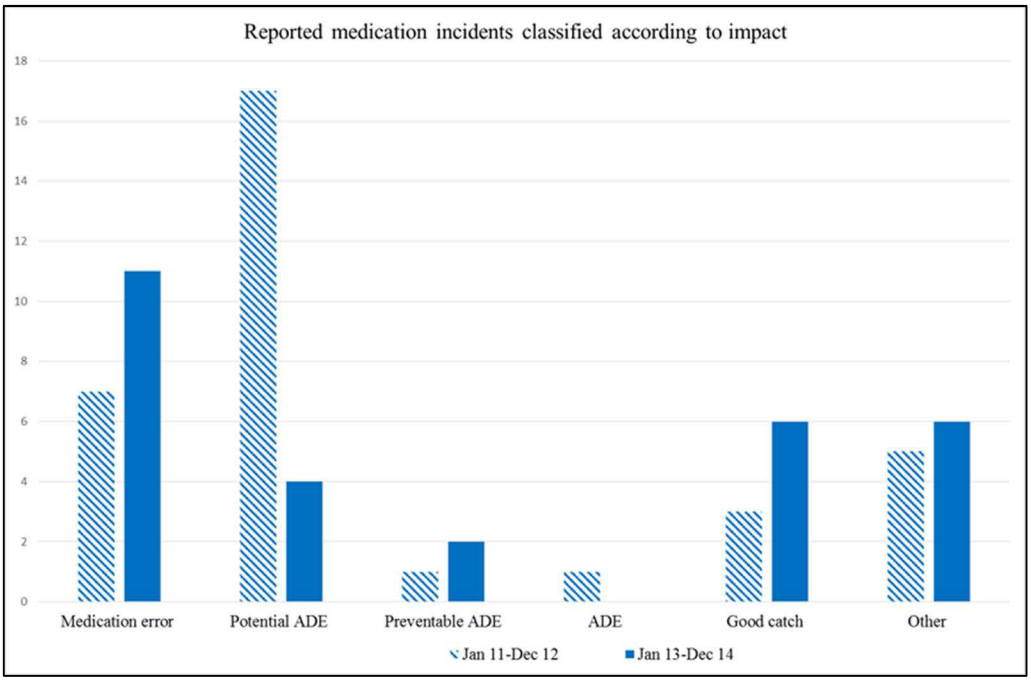

Figure 5-19 Comparison of the impact of reported medication incidents

There was a change in the type of medication error reported between period 1 and 2 as shown in Figure 5-20. The number of incidents related to incorrect medication was decreased and reported incidents due to omissions were eliminated.

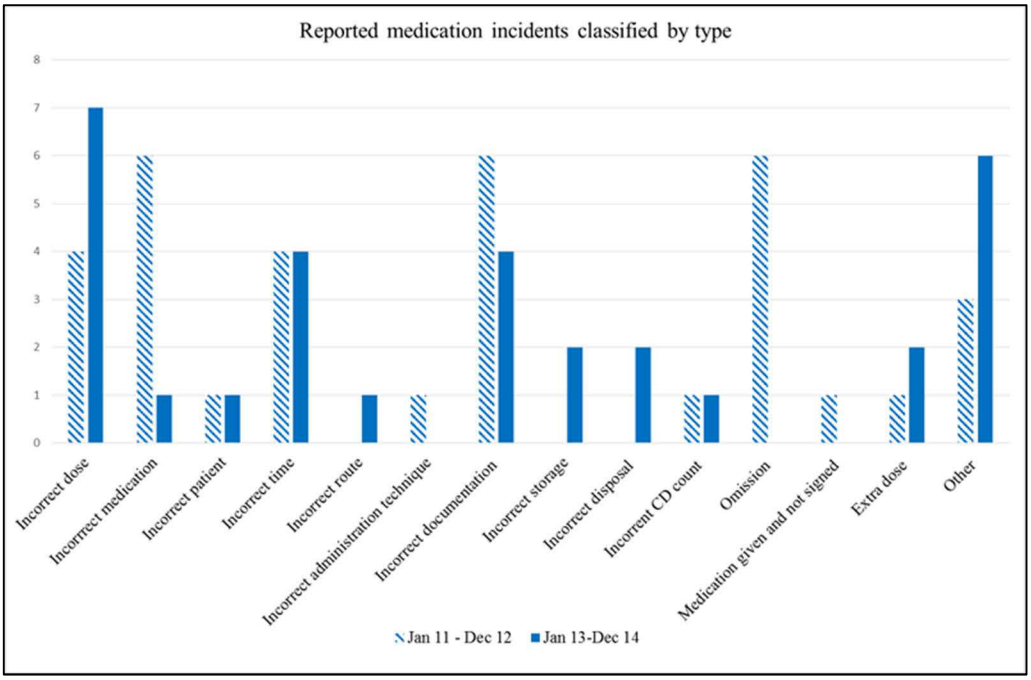

Figure 5-20 Comparison of the type of reported medication incidents

Both the adequacy of the double check process and workload as contributory factors had decreased between the two time frames. In the second time period (January 2013 - December 2014), the use of additional medication charts such as those designed specifically for use in the operating theatre or emergency department was noted as a contributory factor to reported medication incidents (Figure 5-21). In these incidents, additional doses of medication were administered as the nurses had not checked the 'other' chart to see if or when the medication had previously been administered. This had not been previously identified as a contributory factor for medication errors. As a result, the MAG escalated the information to organisational Medicine Safety Committee who carried out some further exploration of reported incident data across the organisation and developed an organisational risk mitigation strategy.

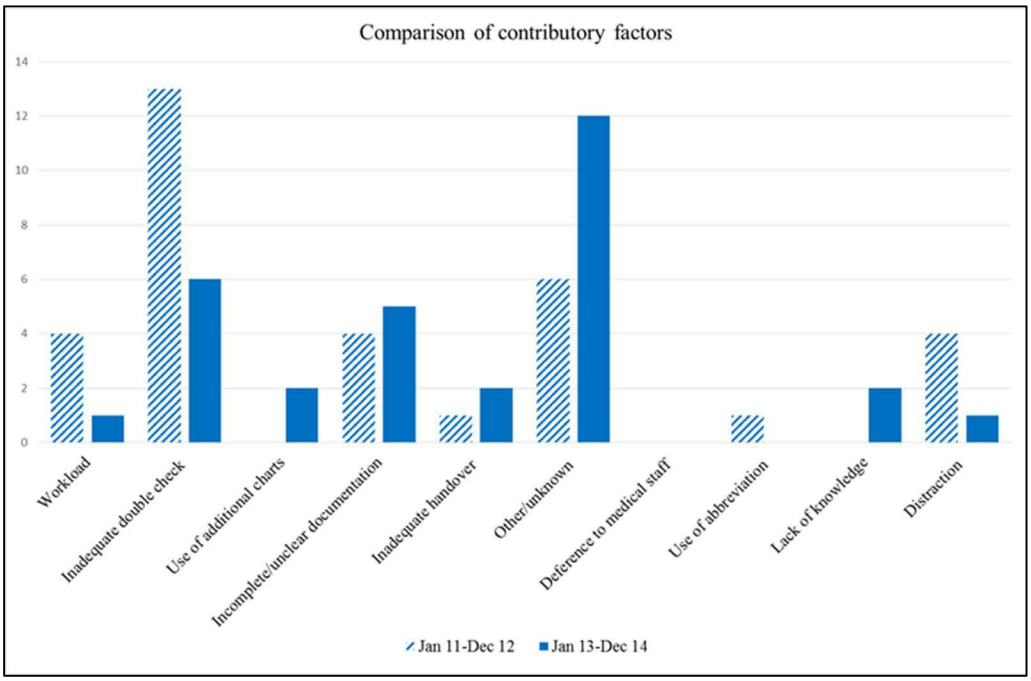

Figure 5-21 Comparison of contributory factors to reported medication incidents

Changing established behaviour of any kind is difficult. It is particularly challenging in healthcare because of the complicated relationship between a wide range of

professionals within complex organisations. Even small changes can have a positive impact, especially if the change involves commonly performed practice. Whilst the changes for objective 1, 2, and 3 are small there have been improvements in nurses' practice, ward context and culture which can lead to sustained improvement in medication safety practice. Encouragingly, due to the developing culture of medication safety on the ward, the nurses are using the incident reporting system to notify, learn from and take action to improve medication administration practice.

5.8 Conclusion

By working closely with a MAG of frontline nurses, I was able to share in the expectations and limitations experienced by them and the ward nursing team. Together we found effective ways of using the findings from talking with nurses, looking at practice and reviewing ward medication incident data to develop improvements in practice. Nurses' medication safety was found to be influenced by the interaction of individuals with the challenges posed within the workplace context resulting in inconsistent medication administration practice. In trying to improve medication safety it was not as simple as implementing intervention X to get effect Y. Multifaceted action plans were developed and implemented which raised ward staff awareness of medication safety. The physical design and organisational layout of the medication room was improved. Interruptions and distractions during medication preparation and administration were reduced. Nurses were supported to pay increased attention and focus during medication preparation. Evaluation of the implemented changes demonstrated that medication administration practice had been transformed and medication safety improved.

The findings of this study reveal that in today's complex healthcare organisations, improving the safety of medication administration locally needs an approach which considers the broader contextual and cultural factors that impact on the safety of nurses' medication practice. As culture is context-specific and nurses are at the centre of medication administration, frontline nurses are ideally placed to improve the safety of medication administration. This action research study involved nurses' critically reflecting on their ways of working, changing the prevailing context and culture so that they felt responsible for their actions, collaboratively seeking, implementing and evaluating evidence informed strategies to improve medication safety. At the beginning, an exploration of the clinical context and practice demonstrated that nurses' medication administration was mayhem; a habitual, distracted and inconsistent process undertaken in a chaotic and disruptive environment. There was a tension between striving to adhere to best practice in the face of many contextual barriers resulting in variability of the safety of medication practice on the ward. As the research spirals unfolded, nurses were empowered and accountable to be consciously present and focused during medication preparation and administration in a well organised and interruption free environment. The research journey enabled nurses to develop safer ways of working to move beyond the MAYHEM to ensure MINDFUL medication administration.

To enable the findings of the study to contribute to knowledge generation globally, in the following chapter, the findings are discussed and synthesised with current literature to develop an understanding of what happened during the action research process which explains the improvements in nurses' practice. This enabled the development of the Model for Improving the Safety of Medication Administration (MISMA) which explains nurses' medication administration safety as an outcome of the interplay between

personal and contextual factors. As Rycroft-Malone (2004, p. 297) noted, implementing practice change is a 'complex, messy and demanding task' which takes time. The MISMA can support nursing teams implement and sustain evidence informed medication safety practice change. Nursing teams can use the MISMA to develop initial improvements, and also to support them to continue to work together on medication safety improvements after the initial implementation phase and ensure that improvements are sustained.

CHAPTER 6 DISCUSSION: MIND FULL to MINDFUL

This study investigated the use of action research to improve the safety of nurses' medication administration. A key result of the programme as described in the previous chapter, was how frontline nurses transformed their medication administration practice when they were empowered and accountable to be consciously present and focused during medication preparation and administration in a well organised and interruption free environment. Practice transformation improved medication safety when nurses' medication administration was mindful.

Previous research on mindfulness for healthcare professionals has largely focused on the benefits of mindfulness training in reducing stress. Mindfulness-based stress reduction (MBSR) (Kabat-Zinn 2003), has been reported to improve the ability to focus and decrease distractive thought and behaviours (Jain et al. 2007; Shapiro et al. 2005) increase attention and awareness (Cohen-Katz et al. 2005), increase concentration (Birnbaum 2008), decrease confusion (Rosenzweig et al. 2003), reduce self-reported stress symptoms (Pipe et al. 2009) and increase individual resilience (Foureur et al. 2013). There has been relatively little research on how mindfulness influences work performance (Dane 2011). Ludwig and Kabat-Zinn (2008) support mindfulness as a way to improve the quality of healthcare but recognised that there is a lack of knowledge about how mindfulness might work. In this chapter, mindfulness as an enabler of improving the safety of medication administration is explored further. Initially an overview of mindfulness as it was uncovered in this study is presented. The discussion then focuses on mindfulness in relation to three major influences on medication safety highlighted by this study; ways of working, clinical context, and distractions. Although each will be discussed separately, there is by necessity some overlap in discussion. The

observation that the safety of medication administration practice within the ward team improved through the influential spread of mindful medication administration by members of the medication action group (MAG) led to the emergence and development of the model for Improving the Safety of Medication Administration (MISMA) which is presented to conclude this chapter.

6.1 Mindfulness

Historically, mindfulness has been viewed as a state of consciousness cultivated through meditative practice (Bodhi 2011). Yet, mindfulness does not specifically require meditation (Brown & Ryan 2003). Kabat-Zinn (2003, p. 145) described mindfulness as "The awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment to moment". Several definitions of mindfulness can be found in the literature with the commonality between them summed up as, the state of being aware of and attentive to what's taking place in the present (Brown & Ryan 2003; Epstein 1999; Kabat-Zinn 2003). In the context of this research, being mindful is concerned with the particular qualities of conscious awareness and purposeful attention in the present. That is the ability to be intentionally aware of and focused on the present moment while holding back thoughts about what might be happening elsewhere, previously happened, or may happen in the future. Rather than worrying about what may be going on elsewhere on the ward, or what happened earlier in the shift or what may happen later in the shift, the attention of the mindful nurse rested in the here and now on preparing and administering medication. Some definitions of mindfulness also include attending to internal feelings as part of attending to the present moment (Brown & Ryan 2003). For nurses in the current study, this aspect of mindfulness was limited to becoming consciously aware that their

attention had wandered from the activity of preparing a medication and then intentionally refocusing on their actions.

Mindfulness is conceptualised as a personal attribute (some people may be more mindful than others) (Baer, Smith & Allen 2004), a process (mindful practice) and an outcome (mindful awareness) (Shapiro et al. 2006). As a personal attribute of study participants, mindful practice is a cognitive process founded on shared values and takes into account; knowledge of self, contextual factors, practice wisdom and evidence informed practice, to support safe medication administration. Mindful awareness is the quiet cognitive space which enabled nurses to have an increased presence and focus on medication preparation. This research did not set out to test mindfulness as an intervention introduced to improve medication safety rather it is the construct that best describes the researcher's interpretation of what happened during the action research study which led to improved medication safety.

The journey to mindfulness started at an individual level with members of the medication action group (MAG). Facilitated critical reflection, a fundamental component of the action research study enabled the members of the MAG to explore their assumptions of everyday practices resulting in them becoming aware of the habitual and routine nature of their medication practice. Becoming consciously aware of how they worked and exploring how this influenced medication safety, resulted in enlightenment. In other words, they became conscious of the influence of self on the taken for granted everyday medication administration practices. In a particularly memorable meeting, members of the MAG discussed a 'light bulb' moment when they realised that they needed to change their own way of working and be mindful of their

own practice. The MAG members were discussing the distraction caused by noise in the medication room. An initial rhetoric was of 'other staff' having conversations within the medication room. As the group facilitator, I used high challenge/high support, a technique used in practice development (McCormack et al. 2007), to challenge and support the MAG to critically reflect on their practice. For example, I used enabling questions to challenge the MAG members' assumptions about 'other staff' being responsible for the conversations in the medication room. The group's responses were best captured as *'actually, when I'm in charge that's where I take staff if we need to talk confidentially' (M6).* I also supported the group to explore what they routinely assumed to be a good way of working (Manley, Solman & Jackson 2013) while providing an opportunity to explore different ways of viewing the world (Wilson, McCormack & Ives 2006). *'I suppose I could use the equipment room, I've never really thought about it before' (M4).* In other words, the MAG were supported to look at how the workplace context and culture and nurses ways of working impacted on practice, including reflection on what their contribution to this practice may be and to find suggestions for how to change the practice.

Existing models describe mindfulness as primarily an individual intrapersonal cognitive state (Isbel & Mahar 2015), however, in this research mindfulness encompassed an understanding of the shared experience of medication administration. Mindfulness was also at an interpersonal interaction level. As Epstein (1999) noted, collective awareness within teams can be fostered through sharing individual reflective practice. The opportunity to share individual reflection within the small group setting created a rich learning environment. Though members of the MAG were initially uncomfortable sharing their reflections over time this became a highlight of the action research

experience. It quickly became apparent that learning was occurring through reflection on their own experiences but also while reflecting and sharing in the experiences of each other. The sharing of each other's experience, thoughts, feelings, and perspective created empathy (DasGuptas & Charon 2004), raised awareness of local medication administration practice and contributed to developing a shared understanding of their professional values.

Clarifying individual values and beliefs and then agreeing on shared values and beliefs was the first step in developing a collaborative approach to the programme of work (McCormack & Dewing 2013). The MAG used the values clarification to develop their vision or shared understanding of what enhanced medication safety would look like, an essential element of successful emancipatory practice development (Stokes 2004). Articulating the differences between the espoused values and their practice, the MAG came to see that there were practice situations where they lowered their expectations and practice in ways that were not congruent with their professional values. Such as, not taking the time to do a thorough independent double check. The members of the MAG became mindful of the discrepancy between their perception of what constitutes safe medication practice and what they were able to achieve in practice due to contextual challenges including but not limited to poor role models, time pressure, constant interruptions and distractions and competing workload. The emotional suffering that is experienced when external constraints prevent someone from taking the action that they believe is right has been defined as moral distress (Pendry 2007). The dilemma for the members of the MAG was safeguarding patient safety by remaining true to their values and beliefs on medication safety in the face of what they perceived as dominant organisational messages and initiatives aimed at increasing efficiency within financial

constraint. Walston (2003) notes that nurses who consistently base their practice and decisions on their values regardless of personal risk are acting with moral courage. During this study, transformative action was only realised when the MAG were enabled to act with moral courage. Their moral courage was supported through; reaffirming their strengths and resolve, endorsing their commitment to the shared vision, supporting each other to take action against the contextual barriers to safe practice and remaining intentionally focused (mindful) when administering medications.

Mindfulness was a challenging practice to maintain. The MAG identified what the barriers were to maintaining attention during medication administration practice. By acknowledging the competing commitments directly, they were able to consciously decide not to let them stand in the way of mindful medication administration. The MAG members' commitment to mindful practice was strengthened by the evidence they derived from practice. Critical reflection and collaborative theming of local data enabled them to reach a depth of understanding of practice that resulted in them wanting to change how they practiced. From a theoretical change management perspective, the MAG moved through the stages of change from precontemplation and contemplation to preparation and action by creating the conditions for change and working through the processes that produce change (Prochaska, Prochaska & Levesque 2001). The MAG meetings enabled the group to become more aware of the problem of medication safety and to start to develop potential solutions. They started to see how their own mindfulness during medication practice could make a difference and made a firm commitment to change themselves (light bulb moment discussed earlier).

The MAG started to weave theory and praxis together as they developed their understanding of local contextual influences on medication practice, and knowledge of current evidence from literature, such as interventions to minimise distractions, and used this to challenge practice. The MAG members supported each other to grow personally and professionally. They developed the knowledge, skills and resources to enable them to progress with effectively changing their practice. In other words critical reflection empowered them to take control over their own practice and change it as necessary; becoming mindful. As they became empowered they were more able to be effective change agents (Berwick 2003) influencing the context and behaviours of those around them in relation to medication safety.

Initially the members of the MAG were hesitant about their ability to influence practice transformation beyond their own practice. They were aware that there was a shared belief amongst the ward nurses that 'we don't have any problems with medication error here'FN. A notion Fay (1987) described as 'false consciousness'; a false perception or shared understanding of a group of people. The MAG members were concerned that this shared belief may lead to apathy, where the nurses were not necessarily opposed to change, they just did not perceive it important enough to invest in the effort required to change their practice (Giangreco & Peccei 2005). Another concern was passive resistance, where colleagues did not openly resist change but they had no intention of changing how they practiced (Parkin 2009). *"... will say all the right things, but you know – they're never going to do it any differently"(M3)* At the same time, the MAG's developing knowledge of change management taught them that becoming collaborators in the process of changing practice could provide personal inspiration for nurses to work in a different way. Their awareness of emancipatory practice development methodology,

enabled them to identify that medication practice on the ward was influenced by a complex mix of individual and group values, beliefs, norms and the social and historical context of the ward (Parlour & McCormack 2012). Thus they sought to explore not just what current practice was but why it was this way and what influenced it. The ward nursing team was an important source of information regarding why things were done the way they were. A 'bottom up' approach fostered ownership of the action research programme empowering the nursing team to engage with the change process. Reflecting on attitudes, behaviours, and practice enabled the creation of a culture which valued and respected medication safety.

The MAG shared the themes generated from the ward medication incident data in support of developing a sense of urgency of the need for change with the ward nursing team (Shirey 2011). Creating urgency helped the team see and feel first hand why a change needed to occur (Campbell 2008). Interestingly, the ward nursing team could readily articulate how the physical environment, ward culture and colleagues' practice influenced ward medication practice.

> *'It's really hard, you have a poor kid whose waiting for some morphine, and your waiting - waiting - waiting - until someone is free to check it out, - and then you're in such a hurry you just hope you haven't made a mistake"(RN4)*

This may be due in part to reframing the conversations around medication administration problems and not medication error. The ward nurses started to realise how the mayhem surrounding medication administration was impacting on their ability to safely administer medications. This is what Fay (1987) called 'consciousness raising' and is similar to mindfulness with respect to developing a conscious awareness of actions (Chuaprapaisilp 1997). The state of mindfulness helped overcome the nurses' false

consciousness and enabled them to see things as they truly were. This in turn enabled them to start their journey from the espoused vision to translating it into practice (Wilson 2005a). The study provided an opportunity for the ward nurses to become mindful about medication safety rather than view medication administration as simply a task to be done. The MAG sought to build on the strengths of individuals and the team and what they were doing well. They facilitated transformative practice change by moving from individual action plans to creating team action plans, meeting the principles of collaborative, inclusive and participatory ways of working necessary for successful emancipatory practice development (Manley, Titchen & McCormack 2013).

To ensure historical practice and peer influence would not continue to direct practice, I facilitated the MAG's critical reflection on practice to raise awareness of concerns and develop solutions. In addition, the members of the MAG encouraged ward nurses to participate in decision-making. The MAG enabled members of the ward nursing team to also share their 'tacit' knowledge of practice. Titchen and McGinley (2003b) argued that the tacit knowledge embedded in practice can be made more widely available through critical reflection on practice. Uncovering and sharing the tacit knowledge or everyday clinical experiences was a key factor in the success of innovative change in the messy and complicated world of practice. In other words practice informed research and research informed practice.

The members of the MAG further influenced the ward nursing team's medication administration practice through creating an environment and culture which supported mindful practice while demonstrating mindfulness in practice. Pragmatically, the initial action plans were focused on environmental changes to improve workflow and reduce

potential distractions. As the MAG gained confidence, they influenced colleagues' medication administration practice through raising awareness and advocating for colleagues to focus and actively engage with what they are doing while administering medications. The transformation of practice which occurred was summed up by one of the ward team as *'I am so much more mindful of the importance of what I am doing when I am giving a child their medication' (RN1)*. Throughout the continuous cycles of reflective learning and improvement, the MAG supported the ward nursing team to become more aware of the impact of how they work and how the clinical environment influenced medication safety.

6.2 Ways of Working

Medication safety was improved when nurses were empowered to be intentionally focused during medication preparation and administration and accountable for the safety of medication administration practice on the ward. In the beginning, the nurses' ways of working involved predictable patterns which resulted in medication practice that was automatic and habit-driven, challenging their ability to maintain medication administration safety. Nurses' way of working can be explained by the cognitive concepts, automaticity and confirmation bias, and how workarounds and problem solving were socially constructed in practice. There was a reliance on 'automatic pilot' where their bodies operated in a routine pattern while their minds were somewhere else. In psychology, this phenomenon is also called involuntary automaticity and describes the skilled action that people develop through repeatedly practising the same activity (Toft & Mascie-Taylor 2005). Generally in life, automaticity is beneficial as it enables us to multitask, however automatic behaviour in healthcare procedures makes us prone to slips and lapses and reduces patient safety (Reason 1995). Slips can be thought of as

actions not carried out as intended or planned, for example a ‘Freudian slip’ when saying something. Lapses are missed actions, that is, when someone fails to do something (Reason 2000). Nichols et al. (2008) have previously demonstrated that many medication errors are due to lapses in attention that occur from being distracted during the medication administration process. An example from the current study is when nurses would forget to check the operating theatre medication record before administering analgesia postoperatively. Therefore analgesia was administered before it was due, e.g. paracetamol prescribed to be administered no more frequently than 4 hourly was administered on the ward within 2 hours of the dose administered in the post anaesthesia care unit (OB). Slips and lapses occurred while nurses’ attention was diverted and they were not consciously aware of the actions they were doing.

When nurses were working on automatic pilot, they were not truly present. Although they could accomplish an activity there was a lack of awareness or focus on being present in the experience. Medication administration is a large part of nurses’ daily work with research reports suggesting that nurses spend between 25 percent and 40 percent of their time administering medications (Armitage & Knapman 2003; Keohane et al. 2008). As nurses administered medications many times a day practice had become routine and ritualistic. Walsh and Ford (1989, p. 26) defined ritual as "carrying out a task without thinking". Schön (1987, p. 3) described rituals in nursing as a purely technical and rational approach to practice and advocated that professional practice should be “beyond the canons of technical rationality”. Technical rationality attempts to reduce practice to precise and standardised procedures. If something goes wrong, systems of control are increased and procedures improved rather than questioned. Schön is therefore advocating that an alternative approach is required within professional practice. One

which supports questioning to learn and taking action to improve. In other words, reflection in action which encompass the multifactorial and socially constructed nature of knowledge (Schön 1987). Hence rituals are generally perceived as undesirable. However, Strange argued that a ritual is simply a way of describing an action or series of actions and is neither positive nor negative (Strange 2001). Wolf (Wolf 2014) argues that rituals are important in nursing and should coexist with science. For Rituals can contain a vast amount of human experience (Strange 1996) and provide a way to pass on personal knowledge (Carper 1978). For example, the nurses were seldom observed to consult the many written medication guidelines, rather, the details of medication administration was often passed from nurse to nurse by discussion or demonstration during practice *(FN).*

In this study, ritualisation of medication administration impacted on safety. In particular, routine checking of medication administration was often little more than ritual. The ritualisation of medication practice is in part supported by the traditional approach to medication safety known as the five rights of medication administration. This approach implies that if you follow the five rights; right patient, right medicine, right dose, right route, and right time, a medication error will not occur (Macdonald 2010). Indeed, many authors on medication safety have all too readily identified additional rights, which currently stands at nine (Elliott & Liu 2010). While the rights are an expectation of safe medication practice, they offer nurses little guidance on how to ensure medication safety, as they in themselves build upon and support rote practice. While nurses in the study could readily recite the five rights, there was less evidence of critical thinking or problem solving of how to achieve these goals in practice. It appeared that as the nurses attended to the same activity day after day, the five rights took the form of a “litany” where

eventually the literal meaning of the message was ignored and practice had become automatic and mindless. There was an espoused belief that nurses were following the 5 rights but the evidence suggests that this was not always happening due to lapses in attention and workarounds.

Mindful medication practice, on the other hand, required the nurses to be consciously aware of their practice and maintain attention on what they were doing during medication preparation and administration. They shifted from habitually unconscious automatic functioning to consciously focus on what was occurring in the present (White 2014). When nurses were not consciously aware in the present and focused on medication preparation, the right medication or right dose were particularly susceptible to mistakes. Nurses who had prepared the medication often flashed the prepared syringe in front of the checking nurse. Nurses completing the double check tended to have a quick glance at the prescription and/or medication vial and/or the prepared medication, say, 'Yeah, that's fine', and sign the administration record *(OB)*. But they had not actually been consciously aware and purposefully attentive during the check particularly when it was a familiar medication. The independence of the double check was absent. An independent double check is recommended to minimise the weaknesses associated with the process of double checking (Grissinger 2003).

The members of the MAG team engaged in several interventions to improve this aspect of practice, based on their developing knowledge of human factors or how human cognitive 'wiring' predisposes us to certain kinds of errors (Carayon & Gurses 2008). The MAG held themselves and each other accountable to role model a diligent independent double check, sought to make it psychologically safe for staff to remind

each other to be fully present and focused whilst undertaking an independent double check and used one-to-one coaching with the ward team.

Confirmation bias, another barrier in creating mindful practice, is a cognitive phenomenon which influences medication safety. The brain sees what it wants to see based on familiarity, expectancy, similarity, and experience and fails to see something when attention is not focused (Grissinger 2012). Confirmation bias leads people to see or hear what is familiar to them or what they expect to see or hear, regardless of the actual information (ISMP 2003). For instance, when a nurse read a poorly written medication name, they inadvertently 'saw' the name of a medication that they were familiar with. When another nurse heard the name of a medication, they mistakenly saw that name on the medication label or prescription chart. From a human factors perspective, look alike and sound alike medication names increase the risk of confirmation bias due to similarity and have a greater potential to result in an incorrect medication being administered to a patient (ISMP 2009). Tall man lettering, a technique which uses a combination of lower and upper case letters to highlight the difference in medication names, is a medication safety strategy to reduce the risk of error with look-alike medicine names (ACSQHC 2011c). However as this safety strategy is mainly aimed at electronic health initiatives which are not available within the study organisation, current practice is that medication names are printed in capital letters (HQSC 2012). Nurses are accountable for correctly interpreting the prescription despite the challenges of confirmation bias. Within the action research study, habitual and therefore mindless practice was seen when nurses unquestioningly followed illegible or confusing prescriptions. When practicing mindfully, the nurses did not proceed with

administering a medication if the prescription was unclear until after they had clarified the prescription directly with the prescriber.

Confirmation bias makes finding your own mistakes difficult. As a result independent double checking is viewed as a medication safety strategy which can overcome confirmation bias. However, both nurses involved in the double check could make the same mistake, particularly if the prescription or the medication label is hard to read or confusing (ISMP 2003). In the current study, nurses shared calculations or undertook the double check together which enabled mistakes to happen. When a mistake was present and the double check was not completed independently, the person checking the work was more easily drawn into the same mistake. For example, an error in the volume of a medication to be administered will be detected more often if the person checking the medication performs all calculations independently, without knowledge of any prior calculations (Dickinson et al. 2010). Double checks are therefore more effective if they are performed independently. Refer to Figure 6-1 for an example of how an independent double check can catch a potential error due to confirmation bias. As most cognitive processing occurs outside of conscious awareness, the ward nurses were unaware of the effect of confirmation bias on their practice. Becoming alert to the influence of confirmation bias required developing mindfulness. In changing practice, the MAG made use of the knowledge of how confirmation bias can lead to an error in wrong medication administration. For example, the ward team became mindful of requesting 'a medication check' rather than a request to 'check my *name of the medication*' *(OB).* The MAG further supported improvements to attain best practice by refining and reducing the number of steps in the recommended independent double check process to strengthen the effectiveness of this safeguarding practice.

A nurse had prepared a 125 milligram dose of paracetamol for a child and had asked a colleague for a double check. When the nurse independently double checked the prescription she noted that 125 grams had been prescribed. On discussion and review, the appropriate dose for the child was identified as 125 milligrams. The first nurse, who was an experienced nurse realised that she had 'expected to see milligrams' as she knew the patient was an infant. She called the prescriber, the prescription was amended, the appropriate amount of medication administered and any future potential mistakes avoided. The nurse also submitted an incident notification. With agreement, the members of the MAG presented the case and prompted discussions on, reporting near misses as opportunities for learning, and focused attention during the independent double check process. In other words, how mindful practice can ameliorate confirmation bias.

Figure 6-1 Exemplar: Mindful of confirmation bias

Another cognitive influence on how nurses work is the natural tendency to look for quicker and easier ways to accomplish activities. As already noted, medication preparation and administration takes up a significant part of a nurse's day. Nurses are continually balancing the need for both thoroughness and efficiency. That is, the challenge between working safely, thoroughly complying with best practice expectations, and efficiently getting the job done. To achieve this, nurses had developed shortcuts or workarounds which were not so easy to change. Workarounds had become part of the ward's culture. As Halbesleben, Wakefield and Wakefield (2008) have identified workarounds are developed because they are viewed as beneficial. Workarounds circumvent or temporarily fix an evident or perceived workflow hindrance in order to meet a goal more readily" (Debono et al. 2013, p. 2). However, workarounds can undermine patient safety through by-passing intended safety defences (Halbesleben et al. 2010). For instance, Koppel et al. (2008) identified 15 different workarounds classified as, omitted steps, incorrect sequence and unauthorised steps, that nurses had

developed with regard to bar code medication administration (BCMA) technology. Omitted steps referred to workarounds in which a key process step, such as scanning the patient's identity bracelet was missed. Steps performed out of sequence included workarounds where medication was documented as administered before it actually had been. Unauthorized process steps, described workarounds that changed the process such as disabling audio alarms (Koppel et al. 2008). While the BCMA system had been put in place to improve medication safety, each workaround was associated with six potential errors (Koppel et al. 2008). In other words, the workarounds decreased the safety of medication practice by creating 90 new opportunities for error. Nelson et al. (2005) found similar responses to an electronic medication administration record (EMAR) system, whereby nurses found ways of bypassing the built-in alerts and warnings. Although technology is intended to improve medication safety, this aim will only be achieved if it is integrated into the reality of complex clinical practice to be efficient as well as safe (Koppel et al. 2008).

When viewed as negatively impacting on patient safety, workarounds have also been called unsafe practice (Rittman & Osburn 1995) or at-risk behaviours (Smetzer 2005). Unsafe practice, relates to an individual's incapacity to critically question their own practice and show an alertness to the possibility of making an error (Rittman & Osburn 1995). At-risk behaviours are actions taken to achieve an immediate reward when the risk of patient harm seems remote. They differ from organisationally prescribed or intended procedures. The implementation of policies, procedures and guidelines for practitioners is a common strategy aimed at improving medication safety (Armitage & Knapman 2003). As many medication errors result from a violation of hospital procedures (Keers et al. 2013a), it can be argued that the existence of policies,

procedures and guidelines in themselves is not adequate to improve medication safety. Workarounds emerged on the study ward because of system-based problems and unnecessary complexity in processes. For example, medication administration in paediatric practice requires more time and concentration due to the need for weight based dosing resulting in the need for multiple calculations. A widely recommended safety strategy to increase medication administration safety as highlighted earlier, is independent double checking (ISMP 2013). However, organisational expectation of the independent double checking practice was very prescriptive and involved 36 individual steps, resulting in varied interpretations in practice, a feature commonly noted in literature (Alsulami, Choonara & Conroy 2014; Dickinson et al. 2010; Gill et al. 2012). Dickinson et al. found "confusion regarding what constituted a double-check and the process of double-checking" (2010, p. 731). In the study by Alsulami, Choonara and Conroy (2014), only 1 of 48 survey respondents was able to correctly define an independent double check. Gill et al. (2012, p. 136) found that "Noncompliance was widespread in…double-checking medications". Davis et al. (2005) identified four key issues; accessibility of information, time constraints, practice issues and professional conflict as influencing staff in adhering to the hospital medication administration policy. Participants in the Davis' (2005) study identified that it was more difficult to adhere to policy when they perceived that parts of the policy were inappropriate.

At risk behaviours or workarounds can be shared or passed on informally, through being observed and absorbed by colleagues and can become part of group behaviour (Debono et al. 2013). Unsafe practice or at-risk behaviour makes a system vulnerable and individuals or teams should be coached to understand the risks resulting from their actions or inactions. During the action research, at times of increased workload, rather

than the independent double check being viewed as a cognitive activity requiring total focus and concentration, it became a task to be accomplished as quickly as possible and given little active thought *(FN).* Indeed the independent double checking process was itself perceived as time-consuming, resource-intensive (White et al. 2010) and contributing to the mayhem of practice. Working around the required independent double check by, for example, only glancing at the final volume of medication in a syringe shown to the nurse after another nurse has calculated and prepared the medication (Dickinson et al. 2010), created the conditions for error. While the workaround provided a temporary solution to the immediate problem, it created conditions that bypassed safety defences and increased the risk of error, thereby reducing patient safety. The workaround had become part of the normal ward process and was no longer seen as different as it was viewed as being efficient (ISMP 2004a).

Over several action cycles, changes to the physical environment minimised distractions and supported nurses to focus more thoroughly on the double checking process. However, environmental modifications in themselves were not always sufficient to change practice. The MAG worked with the ward nursing team to collaboratively identify the crucial aspects of the medication preparation process. Together they changed expectations of practice so that only those crucial aspects were independently double checked. Practice transformation and enhanced patient safety was achieved by raising awareness and enabling a greater focus on crucial parts of the medication administration process. While this approach to the independent double check has not been described in the literature, it aligns with the notion that fewer well-placed double checks will be much more successful than an overabundance of double checks (U 2003). Enabling nurses' mindfulness of common workarounds and at risk behaviours observed

in practice and reducing their acceptance of these behaviours had a greater impact on medication safety than previous improvement interventions which had simply extorted nurses to increase compliance with independent double checking best practice (McCall 2011). Nurses started to become accountable for their own practice and their working environment and culture including holding each other accountable for mindful medication administration.

Sometimes workarounds can provide an opportunity for improvement (Lalley & Malloch 2010) but only if the workaround is visible to the team. Contributing to medication mayhem was nurses' hidden problem solving. There were several types of problems relevant to medication practice: missing or incorrect information (prescription or guideline); missing or broken equipment; delay in getting a resource (human or equipment); missing or incorrect supplies; and simultaneous demands on their time. Problems were typically complex, however some were very simple. Nurses generally responded to all problems with short-term fixes or what Tucker and Edmondson describe as first-order problem solving (2003). Already busy nurses did not want to spend any more time away from patient care engaged in additional work beyond the immediate solution which allowed them to continue and complete the medication administration as quickly as possible. In doing so, the nurses focused on the solution without thinking about what caused the problem to occur in the first place. For example, one nurse noted how she often borrowed a glass of fruit cordial from the neighbouring ward to entice a child to take their oral medication. As the nurses did not address the underlying cause of the problem, they did not reduce the chance of a similar problem happening again. There was no organisational learning, in this case, an increase in the number of bottles of fruit cordial stocked on the ward. Management of problems was ineffective as the nature of

the problems were not identified and addressed (Hewitt-Taylor 2012). This reactionary approach to problem solving is contrary to the proactive problem-solving approach all nurses should be familiar with; the nursing process, which involves identifying the problem, develop a plan and implement the solution to effectively manage the problem. It appeared that the nursing process was used to plan nursing care and a different process was used to problem solve during the provision of nursing care.

In addition to not looking into the cause of the problem, the nurses often did not inform the nurse leader of the problems they encountered, which prevented the opportunity for improvement by hiding the existence of the problems. Systems and processes to prevent the same problems from happening again did not have a chance to be considered and implemented. In other words, second-order problem solving, where action is taken to prevent recurrence of the problem, including communicating about the problem to someone in a position to remove the underlying causes or suggest countermeasures (Tucker 2004) did not occur. During the study the MAG reflected on nurses' problem solving in the ward. It appeared that their way of working had developed due to a perception of economic pressure and financial constraint founded on a legacy of cost effectiveness and process efficiency reengineering (McCloskey & Diers 2005). In further considering the way of working, the MAG agreed that it was largely counterproductive. Although the immediate problem was resolved, any communication tended to remain within the bedside nursing team, often leading to frustration with each new time the same problem arose. While first-order problem solving, seemed successful because patient care continued in the short term, it hindered real improvement from occurring because the lack of communication about problems meant the nurse leader was unaware of the need for change, and therefore problems were not investigated and

underlying causes remedied (Tucker & Edmondson 2003). Although the ward nurses perceived quick fixes as being efficient, they were largely ineffective. The MAG aimed to proactively identify the underlying cause of some common problems and create effective solutions. In other words, they acted as role models of second order problem solving. For example, the MAG explored the impact of running out of medications on the ward. Each time a medication was not available on the ward, the nurse spent a variable period of time trying to source the medication from elsewhere with a resultant delay in administration of the medication to the child. Cumulatively this resulted in a notable amount of time spent chasing up medications over a period of time.

An idea central to improvement science is to make small changes incrementally and learn from experience while doing so (Berwick 2008). Making small changes takes less effort and courage than making big changes, and if the change does not have the desired effect, a choice between abandoning the plan or increasing the amount of time and effort invested can be made. On the other hand, it is often the case that a small change can have a large impact. Creating a short-term win helped keep the momentum of the action research going. The MAG developed a plan to put a sheet of paper up in the medication room and asked their colleagues to note down every time a medication ran out. This information would be used to review the medication stock levels on the ward. The initial perception of the ward team was that this just added to their workload. The MAG supported one another to emphasise the importance of the initiative. They explained the benefit that would be seen when the ward medication stock list was reviewed and the frequency of missing medications was reduced. Changes in practice are more likely to be successful if those required to change their behaviour or working practice understand why the change is necessary (Kotter 1998). Feedback on the ‘medication out of stock’

strategy deemed it to have been successful by both the ward nursing team and pharmacy staff. Subsequent to a suggestion from one of the ward nurses, the MAG negotiated with the nurse leader to get a whiteboard fixed to the wall of the medication room. The board supported nurses to be mindful of timely communication on stock issues directly with the pharmacy staff.

Nursing empowerment was a critical feature of the action research work undertaken. Empowerment has been defined as a process by which people gain mastery over their own lives (Kuokkanen et al. 2007). In the context of this work, empowerment refers to supporting the nurses to overcome their sense of powerlessness and lack of influence (Kuokkanen & Leino-Kilpi 2000), so that they recognised and used the resources and opportunities to improve their own and team medication administration practice. Empowerment had an individual or psychological component as well as an organisational or structural component, in terms of factors which promoted nurses ability to improve how they worked. The process of individual empowerment was supported by critical reflection and challenging practice patterns accordingly. Psychological empowerment consists of an individual's beliefs about their capacity to work more effectively (Spreitzer 1995). Spreitzer (1995) identified four intrinsic psychological beliefs related to work; (1) meaning is congruence between individual values and workplace values; (2) impact refers to an individual's beliefs that they can make a significant difference at work; (3) self-determination is related to workplace autonomy or an individual's control over their work; and (4) competence is associated with work-related self-efficacy beliefs. Participation in the action research enabled the nurses to develop shared values, critically reflect and gain insight and self-knowledge empowering them to make the necessary changes to their own practice. Medication

safety on the ward was improved when nurses were mindful of the impact of how they worked and became accountable for focused attention during medication preparation and administration.

At the team level, empowerment was understood as uniting the ward nurses to achieve the common goal of improving medication practice. The focus was on the nursing team. Much of the research on teamwork has focused on interdisciplinary teams with the exception of Kalish, Weaver and Salas (2009) who examined nursing-specific teams. In their qualitative study of acute care nurses, they identified the presence of several team processes that were also relevant in the current study including shared mental models (shared vision), support from colleagues (MAG leadership) and communication (Kalisch, Weaver & Salas 2009). However, their study did not address contextual factors that influenced these processes. According to Kanter's theory of structural empowerment, structural factors within the work environment have a greater influence on employee work attitudes and behaviours than do personality or socialisation experiences (Laschinger et al. 2001). Laschinger et al. (2001) explained that nurses are empowered through (a) access to information, (b) support from organisational leaders and peers, (c) being given adequate resources to do the work, and (d) having opportunities for personal and professional development, resulting in increased work effectiveness. The ward nurses perceived that they were working in an empowered environment as measured by the Conditions for Workplace Effectiveness Questionnaire II (Laschinger et al. 2001). Nurses were moderately empowered as identified by a mean score of 21, similar to other hospital-based nurses as reported in a multilevel study (Laschinger, Finegan & Wilk 2009), where structural empowerment was analysed at the group level and mean score was nineteen.

Nursing leadership has been shown to have an important influence on the quality of the nursing work environment (Cummings et al. 2010). It is reasonable to expect that nursing leadership plays an essential role in establishing empowering conditions in the workplace. The ward nurse leader in the current study was extremely supportive of the MAG. While the ward nurse leader was not part of the MAG, she allocated protected time for the members of the MAG to attend meetings. The ward nurse leader provided encouragement for the MAG's ongoing participation by showing interest and valuing the action research programme of work. For example, the ward nurse leader took the opportunity to share the ward vision statement and to talk about the importance of medication safety improvement with the ward nursing team during team meetings if none of the MAG were present. This was an important illustration of leading through example and sent a supportive message to the ward team.

The nurse leader actively supported the implementation of the safety initiatives developed by the MAG. One example was that she arranged a computer as part of the medication room redesign. The nurse leader relinquished some of the power and control she had within the ward to the extent that the MAG felt they could make decisions in relation to medication safety improvement on the ward. Research has identified supportive nurse leadership and nurse participation in decision making as components of the clinical environment which influence patient outcomes (Flynn et al. 2012; Lake 2007; Warshawsky & Havens 2011). Nurse leaders who promote a healthy clinical environment will enable nurses to provide quality care (Shirey 2006). Supporting the notion that a healthy clinical environment is also one in which nurses feel empowered (Cummings et al. 2010).

A clinical environment that promotes work effectiveness by increasing the nurses' access to information and resources, support and guidance, and opportunities to develop skills can enable nurses to improve the safety of their practice (Laschinger & Leiter 2006). Actions taken to strengthen the ward nurses' structural empowerment included increasing their access to medication resources (such as the computer in the medication room) and creating a learning environment, where experienced nurses were encouraged to be more available to less experienced nurses for medication double checks. For nurses to develop the sound clinical judgment needed for safe medication practice; they need a combination of knowledge and skill along with extensive experience. Peer support and role modelling by experienced nurses is an important component of medication safety development (Manias, Aiken & Dunning 2005).

The MAG were able to shape organisational policy and ward practice related to medication administration. As previously mentioned, the MAG enabled a change in the approach to an independent double check. Spence Laschinger & Leiter (2006) found that ward nurses involvement in policy development was linked to increased patient safety. Furthermore, the MAG were instrumental in redesigning the medication room using their expert knowledge of how the workflow was a barrier to safe medication practice. Weston (2008) coined the phrase 'control over nursing practice' to describe nurses ability to participate in decision making related to the context of nursing practice including organisational policy and clinical autonomy. Where clinical autonomy relates to the ability to make decisions about clinical practice and both of which lead to increased patient safety (Weston, 2008). The action research enabled the nursing team to value patient safety and increased their understanding of how the clinical environment and culture impacted on medication safety. They became accountable for identifying

what systems, processes, and conditions could be improved to support practice change in medication administration.

6.3 Workplace Context and Culture

This study demonstrated that the clinical environment (McCormack et al. 2002) and workplace culture (Manley et al. 2011) within which the nurses practiced, permitted the existence of activities which influenced the safety of medication practice (Reason 1990). There were several dimensions of mindfulness in relation to workplace context and culture and improving medication safety uncovered during this programme of action research. Developing conscious awareness of the impact of the chaotic clinical environment assisted nurses to pay attention to developing and implementing changes to reduce distractions and organise the environment. Mindful practice enabled the nurses to improve the safety of their medication practice by changing the way they experienced the mayhem of practice (mindful awareness). Becoming mindful of how the workplace context and culture supported interruptions and distractions enabled the nurses to better manage them and to focus on their actions during medication administration. Becoming accountable for learning from one's own and other's experiences further supported the nurses' willingness to make changes to the clinical environment and their medication practice and ultimately started shifting the workplace culture to one focused on improving medication safety specifically and patient safety in general.

The findings of this study contribute to and build on what nurses have expressed for a long time; patient safety is highly dependent on the quality of nursing care received which is itself dependent on the context within which nurses work. Over 150 years ago Florence Nightingale wrote about the impact of the environment on the quality of care

(Nightingale 1860). Nightingale believed that the introduction of trained nurses were responsible for vastly improving patient outcomes through creating a safe care environment (Cheung et al. 2008). The knowledge Nightingale generated about the environmental impact on care in places like Scutari during the Crimean war has contributed significantly to modern nursing practice and hospital design (Gill & Gill 2005). While today's nurses face different problems and different contexts, there is a substantial body of international evidence which indicates that the workplace context continues to have a substantial influence on the quality of nursing care (Aiken et al. 2011; Ausserhofer et al. 2014; Duffield et al. 2011; Finlayson, Aiken & Nakarada-Kordic 2007; Needleman et al. 2011) and is central to achieving safe patient outcomes (Aiken et al. 2012; Erickson 2010; Reiling 2006).

Studies have linked characteristics of the workplace context and culture to patient adverse events at ward, organisation and country level (Aiken et al. 2012; Aiken et al. 2011; Cho et al. 2016; Kirwan, Matthews & Scott 2013; Manley et al. 2011; McCloskey & Diers 2005). The survey conducted by Kirwan, Mathews and Scott (2013) identified that positive ward environments were associated with higher levels of nurse reported patient safety. The survey conducted by Aiken et al (2011) across multiple countries found that hospitals with a reported poor work environment were associated with a significantly lower reported quality of care. McCloskey and Diers (2005) suggested that New Zealand's healthcare policy reengineering resulted in a decreased quality of care nationally. Many authors have exposed the problems associated with the impact of the work environment on quality of care. However, few evidence-based interventions have been identified that effectively mitigate these patient safety problems or provide tools to improve nurses' environments (Lake 2007). This is the first study which has identified

how being mindful of the impact of the workplace context and culture enabled nurses to improve medication safety.

Flynn et al. (2012) examined the relationship between characteristics of the clinical environment and inpatient medication error in 14 U.S. acute care hospitals. The authors concluded that a supportive nurse manager, collaborative physician relationships and nursing participation in decision making were significantly associated with prevention of medication errors. Other studies have also linked medication error to problems around nurse–doctor relations such as communication breakdown (ISMP 2004b; Suresh et al. 2004). However, it was how the physical space impacted safe medication practice which stood out as a key feature of the clinical environment within the present study.

The physical space increased nursing workload and contributed to distractions and interruptions. Distractions and interruptions are discussed further in section 6.4 on page 241. A high nursing workload has been identified as a major threat to patient safety (Carayon & Gurses 2008; Holden et al. 2011) as professionals inevitably move to less safe spaces when under pressure (Amalberti et al. 2006). Specifically, increased nursing workload has been associated with unintended increases in patient adverse events (McCloskey & Diers 2005). Nursing workload has most often been defined in terms of nurse staffing levels and skill mix, however this does not adequately explain the story uncovered during this action research. During the exploratory phase of the action research cycle, ‘we never have enough staff on the ward’ *(FN)* was a key feature of conversations about medication safety with ward nursing staff. This prompted the MAG to explore the literature on nursing workload and medication safety. Holden et al. (2011) conducted a survey of nurses from two tertiary paediatric hospitals in the United States

of America. Nursing workload was considered as the amount of work to be done and the difficulty of the work to be done, including the amount of concentration or attention required to do the work. The authors highlighted that medication errors were predicted by high task and ward workload (Holden et al. 2011). Where ward workload implied additional work due to the design of the healthcare microsystem. When nurses workload was increased due to interruptions, being rushed or poor workflow there was an increased likelihood of medication error (Holden et al. 2011).

In uncovering the concept of nursing workload as more than the number of physical body's available dependent on the number of patients or staff to patient ratio, the MAG was able to change the recurrent conversations on the ward. When colleagues raised concerns regarding insufficient number of nurses compromising medication safety, the MAG members discussed how changes to the environment and ways of working would ultimately decrease nursing workload and improve medication safety. While environmental changes were relatively straightforward to achieve, supporting changes to the ways of working required a change in the workplace culture.

The workplace culture influenced mediation safety on the ward. Drennan stated that culture is established from the prevailing attitudes, habits and behaviours of members of an organisation and is manifested as 'the way things are done around here' (Drennan 1992). In the patient safety literature, culture is more often than not viewed as part of the organisational context rather than ward context, and does not acknowledge the influence of the shared experience of nurses who regularly work together on a ward. As noted by McCormack et al. (2002) gaining insight into the 'culture of a practice context,' is essential to sustain practice change. One of the strengths of this study was working

with frontline nurses, to explore and challenge the locally relevant workplace culture to promote medication safety on the ward.

The MAG identified that the commonly held discourse on the ward relative to medication practice was largely centred on medication error. The prevailing view of the ward nurses was that reporting medication incidents was punitive and lacked utility, factors identified as contributing to unacceptably high number of healthcare errors (Institute Of Medicine 2004; Khatri, Brown & Hicks 2009). While, patient safety leaders advocate for a shift of focus from understanding human error to understanding what poses a risk to patient safety (Kohn, Corrigan & Donaldson 2000), the approach to clinical risk management and quality improvement of the organisation in which the study took place resulted in a continued focus on individual responsibility and wrong doing. An approach which is also still found in the literature, Farley et al. (2008) conducted a survey of incident reporting practices in a large representative sample of U.S. hospitals and concluded that a blame culture was the norm in the majority of the hospitals.

The perception of a punitive culture, in the organisation within which the study was undertaken, included follow-up of medication incident notifications which focused on identifying the individual nurse responsible and punishing that individual. Thus nurses were reluctant to report medication incidences for fear of any personal and professional impact on their colleague or themselves (Covell & Ritchie 2009). Unfortunately, this approach which punished individual nurses without challenging or changing the system did not necessarily solve the problem nor reduce the potential of a similar incident happing in the future (Fung, Koh & Chow 2012; Throckmorton & Etchegaray 2007).

The MAG aimed to alter the perception of incident reporting as a punitive system and raised awareness within the ward team of the intent of the incident reporting system as a tool primarily being focused on supporting shared learning and make healthcare safer.

Before the action research, each incident report was reviewed by the ward nurse leader and discussed with the individual nurse concerned in the incident. There was no structure in place to review the collective medication incidents to look for system factors and practice patterns and no feedback was given to the rest of the nursing team about the incident or what could be learned from it, factors which are known to contribute to significant under-reporting (Barach & Small 2000). In an anonymous survey of 186 doctors and 587 nurses from six South Australian hospitals, Evans et al. (2006) found that a lack of feedback was the most frequently stated barrier to reporting.

The MAG aimed to promote a culture of medication safety, where there was an openness to learn from each other's mistakes. Feedback from reporting systems is essential to raise awareness and improve nurses' knowledge of safety problems and close the learning loop (Benn et al. 2009; Gray & Williams 2011). The MAG provided feedback to the ward nursing staff on the locally reported medication incidents to raise their awareness of the benefits of reporting medication incidents. We expected to see a rise in the number of incidents reported due to the increased awareness about the importance of reporting. While there wasn't a significant increase in the number of medication incidents reported, there was a change in the pattern of contributing factors to reported incidents indicating successful implementation of the interventions to increase awareness and attention during medication administration. The feedback on the iterative themes from the reported incidents was framed as a positive learning experience. This was achieved by

focusing on practice problems which impacted on medication safety rather than the previous way of responding which was to view as a medication error and simply command staff to do better. Raising awareness of the frequency of medication practice problems, rather than numbers of medication errors, made it safer and less confrontational for the MAG and ward nurses to engage with the study work. A notably successful strategy used by the MAG was to feedback the findings from the action research activities to colleagues, individually, rather than trying to organise a meeting. While initially this appeared time consuming, it achieved greater engagement of nurses and was more efficient in the long term. The MAG worked directly with the other ward nurses to foster their medication safety beliefs, knowledge and skills. An unforeseen benefit of this approach was that it enabled relationships between nurses and provided a shared platform from which to start any potentially 'difficult' discussions when there were concerns regarding the safety of a colleague's medication practice (for example, continually interrupting someone during medication administration). Thus an outcome of the action research was the empowerment of nurses to hold themselves and their colleagues accountable for the safety of medication administration practice. A member of the MAG recounted how engagement in the action research empowered her to work differently.

> *'For me, it has given me arguments to silence those who were against the double check process…questions still get raised, but now I have an answer… it is the right thing to do… So, now I practice what I think… and have the confidence to ask others to do the same' (M5)*

Rainer (2015) discussed the need for verbal advocacy or nurses speaking up for their patient as a requisite to improve patient safety and protect patients' from harm. Scott (2004, p. 170) points out that, "Nurses have long remained silent, convinced that their

silence is the best way to preserve relationships, get the work done, and survive". It is no longer an option to keep silent. Nurses must speak out to safeguard patients. Sound communication skills are essential for medication safety (Eisenhauer, Hurley & Dolan 2007).

The MAG and subsequently the ward nursing team were encouraged to see medication incident reporting from a different perspective. It was not sufficient to simply provide the means (feedback on medication incidents) and expect practice to change (nurses question practice), a new perspective of the ward norms and expectations was required. In a recent concept analysis McDonald (2012, p. 5) defined perception as "a personal manifestation of how one views the world that is colored by many sociocultural elements". In the context of the action research study, this was seen when nurses changed from talking about 'who made the error' to 'how did that medication incident happen?'*(FN).* Moving from a punitive culture to a just culture has emerged as an imperative for improving the safety of patient care (Frankel, Leonard & Denham 2006; Khatri, Brown & Hicks 2009). A just culture requires a change in focus from error outcomes to system design and management of the behavioural choices of healthcare professionals. Nurses' central role in medication administration puts them in a critical position to identify challenges to safe medication practice (Cullen, Bates & Leape 2000; Leape et al. 1995; Rothschild, Landrigan, et al. 2005) and they need to feel able to speak up (Scott-Cawiezell et al. 2006). When fully achieved, a just ward culture has individuals feeling as accountable for maintaining the workplace environment as they do for delivering outstanding care. Individuals would be accountable for their actions, and not blamed for system faults beyond their control. Everyone would be accountable for

maintaining an environment where it is safe to speak up if concerned about patient safety.

Participating in the action research afforded an opportunity for the MAG to engage in improving medication safety by providing a space for them to speak up and have their concerns heard. Part of my role in the current study as facilitator of the MAG was to support the group members to speak up and challenge practice. A strategy employed to support the MAG and ward nurses to speak up was to reframe the situation. Reframing means to change the way people see things; to find alternative ways of perceiving ideas, events, or situations (Throop 2013) with the aim to change the perspective from a negative into a positive and change behaviour (Lachman 2010). In this study, reframing involved ensuring the intent of the action research work was to help one another be open to learn from mistakes while putting patient safety central in all conversations about change. A specific practice change that the MAG embarked on was reframing the role of interruptions and distractions in practice.

6.4 Interruptions and Distractions

Interruptions and distractions as a result of the way nurses worked and the context within which they worked was a key influence on nurses' medication practice. Interruptions and distractions was identified as a contributory factor in the wards reported medication incidents and a key feature of nurses observed practice. There is increasing evidence that interruptions to nurses during preparation and administration of medication has a large impact on medication safety (Biron, Loiselle & Lavoie-Tremblay 2009). Research that involved directly observing the process of medication administration found that nurses are interrupted as frequently as once every two minutes (Relihan et al. 2010). Paediatric

wards appear to be at increased risk for interruption related errors. Examining a total of 5325 interruptions in a paediatric tertiary care setting, McGillis Hall et al. (2010) found that two-thirds of interruptions resulted in a delay in the original task, and one-fourth related to a loss of concentration or focus. A study of 57 paediatric nurses across six units found that interruptions and increased workload were identified as the main contributory factors for medication errors (Stratton et al. 2004).

The MAG further explored interruptions and distractions during observation of clinical practice. The interruptions and distractions were noted to be compounded by poor workflow as a result of poor medication room design. Nurses frequently had to leave the medication room to acquire the necessary supplies or to look up medication information. When this occurred they were likely to be approached for assistance by colleagues or patients' families, resulting in their attention being diverted from the process of medication administration. In cognitive psychology terms, interruptions result in what is termed a capture error, an error that occurs when sequences from 2 different actions overlap resulting in performing the more familiar action rather than the intended action (Simmons, Graves & Flynn 2009). This is similar to the notion of working on automatic pilot as discussed earlier in relation to ways of working.

Environmental factors that cause interruptions divert nurses' attention away from the cognitive task of medication preparation and administration, thereby increasing the risk of error. Thus reducing interruptions will improve medication safety through reducing the risk of error. However, strong evidence on how to mitigate the effects of interruptions is lacking. A no interruption zone (Anthony et al. 2010) for medication administration, also referred to as a Safe Zone (Yoder, Schadewald & Dietrich 2015) or Healthcare

Sterile Cockpit (Hohenhaus & Powell 2008), is one strategy which has been evaluated. This strategy is based on the concept of the 'sterile cockpit' which aims that an aircraft's pilot has no interruptions when performing the critical tasks of take-off and landing (Pape 2003). A systematic review concluded that there is weak evidence that a no interruption zone is effective in reducing interruptions and reducing medication error (Raban & Westbrook 2014). A similar intervention, where nurses wear a 'no interruption vest' during medication administration has also been evaluated, however not without controversy. In 2011 a hospital abandoned the practice of nurses wearing vests printed with the words 'Do not disturb' aimed at discouraging interruptions during medication administration, as the message was perceived that patients should not bother nurses (Macfarlane 2011). The following year, a study by Tomietto et al. (2012) highlighted that while wearing a red tabard stopped patients asking for assistance it was ineffective with colleagues. The MAG made an informed choice not to pursue the option of designing and implementing a no interruption vest as they believed this option would not be supported by the current ward culture, but they did aim to establish the medication room as a no interruption zone.

There were many challenges in the clinical environment which influenced the adoption of a no interruption zone in practice. As part of previous medication safety education campaigns (McCall 2008, 2009, 2010, 2011) many presentations were given and signs erected, but there was little change to practice. Distractions and interruptions were viewed as the 'way we do business' *(FN)* thus were supported by the workplace culture. During the action research, initially nurses gave little consideration to how interruptions could be better managed. Nurses appeared resigned to interruptions being part of the everyday routine and felt powerless to influence or change this. I encouraged the MAG

to make reflective notes on how interruptions related to medication administration. In this situation, reflection encompassed the nurses taking time at the end of the shift to think back over an episode of medication administration and assess it and their behaviour and thoughts related to the event. Schön (1983) refers to this as 'reflection on action'. Similarly, critical reflection in emancipatory practice development involves looking back on an experience to learn from it, gaining a deeper understanding and developing different ways of acting in the future. A key feature of critical reflection is the capacity to uncover assumptions about ourselves, others and context.

A facilitated critical conversation based around an individual reflection, feedback from MAG members, local contextual data and evidence based literature created a shared heightened awareness of how interruptions decrease medication safety. As a result, the MAG took the time needed to pay increased attention to what they were doing during medication administration. As the MAG's medication practice became mindful, they better managed interruptions while maintaining the safety of their practice. They debated amongst themselves and reviewed the literature before deciding that some interruptions were potentially important and beneficial and should be managed in a way which promoted medication safety rather than avoiding them completely as advocated elsewhere (Biron, Loiselle & Lavoie-Tremblay 2009; Westbrook et al. 2010). A relatively simple yet powerful strategy was that they themselves stopped interrupting other nurses during medication administration, unless it was an emergency. The MAG members came to be viewed as role models of mindful practice within the ward team.

Sharing the themes generated from the analysis of the contextual data, built on the role modelling strategy. Thus the ward nursing team were supported to gain a deeper

understanding of what and how interruptions impacted their medication administration practice. In other words, the consequences of the mayhem of practice became more visible. The ward nurses became aware of how the medication space impacted on how they worked as individuals and also as a team. They were encouraged to capture and discuss everyday practice habits in relation to medication practice with the MAG, in an effort to work together to foster their beliefs and knowledge in medication safety.

As the action research progressed, the MAG started to examine their behaviour and thoughts while preparing and administering medications, rather than reflecting back on the situation at the end of their shift. Schön described this as reflection-in-action (Schön 1983). The MAG transformed their medication administration to be mindful, which can be considered an extension of reflection in action. Where reflection is looking back to learn, mindfulness is learning from being aware in the present. While changes were made to the physical environment which supported nurses to have a greater focus on medication preparation (see discussion of results in chapter five), practice change would not have occurred without a shift in nurses thinking. Over time, the team started practicing mindfully, that is the nurses paid more attention and were less distracted during the process of medication preparation and administration and a 'no interruption zone' became a reality. A strategy developed by the MAG and employed within the nursing team was having prepared statements which enabled nurses to manage interruptions.

A no interruption zone is theoretically a defence against medication error built in by the organisation. However as discussed there were many aspects of the workplace environment that impeded nurses' ability to achieve this practice. Features which,

according to James Reason an eminent patient safety advocate, acted as latent conditions for error (Reason 2000). Reason's Swiss cheese model acknowledges that humans are fallible and active failures, errors in the form of slips, lapse or mistakes, are to be expected (Reason 2000). There are also latent conditions, or systemic deficiencies in the workplace environment (Reason 1990). In the seminal work on patient safety, the Institute of Medicine acknowledged that system failures in healthcare organisations are important underlying contributory factors for medication errors (Kohn, Corrigan & Donaldson 2000). Patient safety is improved by building in defences to protect against both latent conditions and active failures. If the latent conditions which allow active failures are minimised, the result should be less human error, leading to fewer adverse events and improved patient safety (Reason 2000).

Building on the notion of latent conditions in the workplace, human factors theory recognises the complex interrelationships between humans, the equipment they use, and the environment in which they work (Norris 2009). From a human factors perspective, clearly understanding and improving how nurses' work (workflow) within the workplace environment can inform patient safety improvement. Optimizing the design of the medication room to streamline workflow, included ensuring all relevant medication, equipment and knowledge resources were available within the room, was an effective and cost-neutral way to increase medication safety. The physical redesign of the medication room resulted in decreased numbers of additional staff in the room and eliminated the noise from the ward environment thus reducing the potential for interruptions and distractions during medication preparation. Thereby, enabling nurses to manage the mayhem including reducing distractions, delays, wasted activity and frustrations associated with medication practice. In turn, this improved the safety of

nurses' medication practice by enabling nurses' mindful awareness during medication preparation and administration.

A key to the success in changing the context and practice was the involvement of the MAG and their engagement with the broader ward team. Patient safety is enhanced when the people with the specific knowledge and expertise to make the best decision do so (Reason 2000). In relation to medication safety, this is achieved by giving nursing staff greater control over their practice. Nurses at the bedside are in the best position to make decisions as they are experts in how to get the work done and how to make the ward function smoothly. Harnessing the experience and knowledge of frontline staff is well-established in high-reliability organisational and resilience literature (Hollnagel 2012; Weick & Sutcliffe 2007). In hospitals where nurses have a high degree of autonomy and empowerment patients have better outcomes (McClure & Hinshaw 2002). The MAG had a deep personal commitment to ensure the multifaceted changes were made and sustained as it directly impacted on their practice. The members of the MAG and the ward nursing team developed a conscious awareness of how the mayhem of practice decreased the safety of medication administration on the ward. Becoming mindful of how nurses' ways of working within the clinical environment and workplace culture inspired them to practice mindful medication administration and thus improved the safety of medication administration. In other words the nurses became aware of the clinical context of practice and learned how to work more safely within it.

6.5 Model for Improving the Safety of Medication Administration (MISMA)

Clarke and Proctor (1999) suggest that practice development is context-based and that knowledge generated cannot necessarily be generalised. However, knowledge can be

transferred. In order to take the learning from this study to other clinical contexts the Model for Improving the Safety of Medication Administration (MISMA) was developed from the synthesis of the data across the action research journey. The model (Figure 6-2) illustrates how becoming mindful can be used as a strategy to improve the safety of medication administration.

The model is depicted by 3 concentric rings surrounding an inner circle. The inner circle is labelled 'improving medication administration safety' and is the aim or outcome of interest. The innermost ring closest to the aim describes how nurses improved the safety of medication administration in clinical practice and is named 'becoming mindful'. For this model, becoming mindful is the cognitive process concerned with developing conscious awareness of the influence of the interplay of personal and contextual factors and enabling purposeful attention in the here and now during medication preparation and administration by nurses. Becoming mindful is facilitated by critical reflection. The middle ring titled 'ways of working' describes the personal factors (conscious awareness, purposeful attention, focused, in the present and empowered) that enable nurses to work mindfully during medication administration. The outer ring represents the elements of the clinical environment and workplace culture (well organised, minimal interruptions and distractions, empowering and open to learning) which support nurses' mindful practice. The components of the model are interconnected. For mindfulness to improve the safety of medication administration, it requires a clinical context which supports nurses to become mindfully aware and practice mindfully.

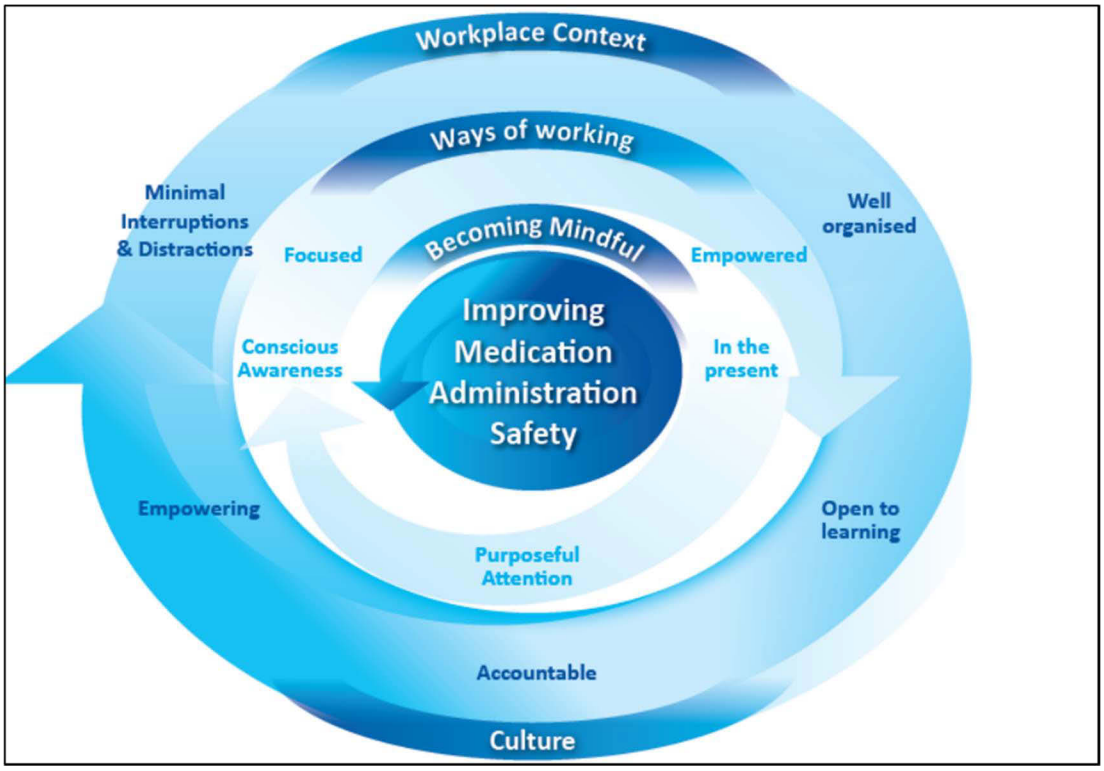

Figure 6-2 Model for Improving the Safety of Medication Administration (MISMA)

Previous literature reviews have identified several personal factors which contribute to medication error such as, mathematical skills, medication knowledge, failure to adhere to policy, and nursing experience (Armitage & Knapman 2003; Brady, Malone & Fleming 2009; McBride-Henry & Foureur 2006). No literature has identified the personal traits; automaticity, confirmation bias, and workarounds which emerged as major influencing factors in this study. Becoming mindful enabled nurses in this clinical research setting to increase their self-awareness and alter their way of working to become more focused on medication preparation and administration to improve the safety of practice. In contrast, the nursing literature perseveres with the recommendation that to improve medication safety, nurses should follow medication policies and procedures and check that all 'five rights' are correct before administering any medications to a patient (Agyemang & While 2010), despite this approach making little

headway in sustaining improvement in the rate of medication administration errors. As identified in this study, if a deeper understanding of the impact of how people work from both a psychological and social perspective is not considered, there is unlikely to be sustainable or transformative practice change and no increase in medication safety. Sustained practice change is enabled through nurses using opportunities to gain knowledge of self, practice, workplace context and culture, which supports them to hold one another accountable and enable them to challenge one another. Within the model, sustained practice change is successful when nurses are supported to develop the capacity to create and implement their own action plans, that is, they are empowered and accountable for the development of own and team practice.

The contextual factors which influence medication safety identified in the literature to date, include inadequate staffing levels, inadequate access to resources, increased workload, high acuity and interruptions or distractions (Biron, Loiselle & Lavoie-Tremblay 2009; Tang et al. 2007; Tissot et al. 2003). As shown in the MISMA, the elements of the context which challenged medication safety included aspects of the workplace context and culture. Interruptions and distractions featured highly and are contextually dependent on the ward layout, patient care requirements, and the experience of the nurses involved (Potter et al. 2005). They are generally perceived as contributing to the risk of medication error (Westbrook et al. 2010). However, at times, interruptions in healthcare settings are essential for patient safety (Rivera & Karsh 2010), such as interrupting medication preparation to respond to a clinical emergency or when speaking up about a safety concern requires that a nurse interrupts a colleague to intercept a potential error. While the large impact of distractions and interruptions in the environment is well recorded in literature (Raban & Westbrook 2014), less is known

about the impact of clutter and disorganisation (Simmons, Graves & Flynn 2009) on the safety of medication administration. In addition, less is known about the impact of the interaction of contextual and personal factors. From the experience gained during the study, a cluttered and fast-paced environment of interruptions, distractions, and multitasking promoted automatic habit driven ritualistic practice, providing plenty of opportunity for slips, lapses or mistakes and the potential to cause a medication error. In a well organised environment, mindfulness provided a framework for the nurses to work effectively in the context of reduced interruptions and distractions to improve the safety of medication administration. Several influential reports on patient safety have highlighted the importance of developing effective ways of learning from errors to reduce the occurrence of preventable patient safety incidents (AHRQ 2001; Kohn, Corrigan & Donaldson 2000). This was also a key finding of this study, when nurses work in a culture that supports sharing of feedback and being open to learn from reported medication incidents, evidence from practice and evidence from literature, practice change is enabled and medication safety is improved. In other words, changes to the clinical context and workplace culture supported nurses' to change their way of working to be mindful during medication administration. Nursing leadership is commonly noted in patient safety literature as important to achieving culture change (Sammer et al. 2010). This was not specifically highlighted within this study, which may be due in part to the empowerment and leadership displayed by the medication action group members.

It is important to note that the MISMA emerged from a study using a critical and participatory framework and thus is suitable for implementation within a similar approach to change. The model incorporates the essential components to be considered in enabling transformative practice change within a clinical setting. The model can be

used by nurses to develop a programme of activity which enables them to critically analyse their own and team practice and develop, implement and evaluate evidence based improvements in practice. The model supports the team to consider activities which enable nurses' accountability; that is to ensure nurses have the required knowledge and consistently use best practice. The team should consider whether the environment provides easy access to resources, including guidelines, supportive ward routines and personnel and change as necessary to empower frontline nurses (Laschinger et al. 2001). This can result in increasing nurses' willingness to be part of activities aimed at improving practice now and in the future. Raising nurses' conscious awareness of the impact of the clinical context and workplace culture and enabling them to intentionally focus on the activity being carried out will improve the safety of practice through supporting nurses to reduce the barriers and enhance the enablers of safe practice.

I have presented the results of the action research in several forums to date and the findings clearly resonated with the audience, suggesting that the MISMA represents a credible interpretation of the ways nurses used mindfulness to improve the safety of medication practice.

6.6 Conclusion

Mindfulness enabled nurses to make sense of the mayhem of practice. It enabled nurses to see the mayhem, question practice, and develop ways of working to move beyond the mayhem (MIND FULL) to ensure safer medication administration (MINDFUL). By focusing on the journey from mayhem to mindfulness in medication practice, this action research study has demonstrated that a critical and participatory approach to change can

result in improved safety of medication administration. The MISMA illustrates how mindfulness can be used to enable a nurse to be more mindful in their clinical practice, particularly where patient safety and quality of care is important. However, extending the MISMA as a general safety model would require further testing. Implications for practice, education and research are considered further in the following concluding chapter.

CHAPTER 7 CONCLUSION, LIMITATIONS, IMPLICATIONS AND REFLECTIONS ON THE RESEARCH

Medication errors happen often, they are costly and they can be harmful. There are many challenges to safe medication administration within the busy clinical environment. This doctoral thesis investigated nurses' medication practice. It was my contention that enabling frontline nurses to participate in emancipatory practice development processes would result in improved safety of medication administration. It is not possible to eliminate human error, but it is possible to manage human behaviour and design processes which support safe medication administration. This study demonstrated that the safety of nurses' medication administration was improved when practice was transformed from mayhem to mindful. Over the course of the study, all study objectives were met.

1. Enable frontline nurses to critically analyse practice and implement change

Participation in practice development processes enabled nurses' to gain insight into, critically reflect on and transform their own practice. The medication action group meeting provided a trigger and a space for the group members to reflect on practice. 'Nancy's near miss' is provided to illustrate this achievement. Pseudonyms are used for both nurses and the child involved. An initial step in the reflective process was for Nancy to describe the experience (Figure 7-1) and become aware of the feelings the experience had generated for her (Horton-Deutsch & Sherwood 2008). Nancy identified the stressful nature of the experience as she was rushing to get Sam's medication as he appeared to be in significant pain. She trusted that the nurse she had asked to check the medication had worked out the correct dose and drawn that amount up. Nancy had hastily looked at the syringe and believed that it held the correct amount. Nancy was

becoming cognisant of her developing self-awareness. She discussed how she had felt burdened by this situation for several weeks. Nancy shared with the other members of the medication action group (MAG) how she *"tried to talk about it [the incident]with a couple of other nurses…but it was difficult to get anyone to really listen"* because *"that way we don't feel that we have to do something about it"*.

I was working on the ward one morning when I noted that Sam was upset and crying and appeared to be in significant pain. He was trying to be so still in bed, trying not to move. He grimaced every time someone went past the end of the bed … anticipating every potential bump or jolt. I checked Sam's prescription chart and he was able to have some intravenous morphine. I went to find the nurse in charge and obtained the key for the locked medication cupboard. I asked Jean to double check the removal of the medication from the cupboard and enter it into the controlled drug book. While I was preparing the medication, the ward clerk asked me to take a telephone call from a parent of one my other patients. Jean finished the medication preparation for me and subsequently got called away from the medication room. I collected the prepared medication and took it to Sam's room. As I was just starting to administer the medication, Sam's dad commented that there appeared to be rather a lot of medication in the syringe compared to what Sam had previously been administered. I felt a cold shiver go through me as I realised that the total amount in the syringe was ten times the dose prescribed. I immediately recalculated the dose Sam was due and made sure that he received the correct dose.

Figure 7-1 Exemplar: Nancy's near miss

Nancy's self reflection enabled her to articulate that she had not previously considered the impact of interruptions during medication preparation. She was able to identify the

effects of interruptions on cognitive ability, making a link between interruptions and loss of concentration.

> *"I didn't pay much attention to being interrupted during medication administration before this research programme, now thinking about my near miss experience, I can see that interruptions can significantly affect concentration".*

All members of the MAG had clinical practice experiences to share. The MAG members became aware of how easy it was to make a mistake. Group reflection enabled a heightened understanding of their responsibilities related to managing interruptions to enable a thorough double check of medications each and every time. Identifying the risks associated with interruptions and how they as individuals respond, enabled the MAG to develop a depth of self-awareness whereby they were able to evaluate their experiences in order to gain new perspectives (Horton-Deutsch & Sherwood 2008). The MAG members practiced not interrupting anyone undertaking medication administration. Nancy took the lead in developing guidance for the MAG and ward nurses on how to mediate interruptions during medication administration. The MAG and ward nursing team worked together to transform their own medication administration practice. They held each other accountable to be consciously present and focused during medication preparation and administration. In other words, through increased self-awareness, nurses practiced mindfully during medication administration.

2. Further develop the body of knowledge on contextual factors that enhance or inhibit safe medication administration.

Previous research has identified distractions and interruptions, nursing workload, problems with communication, access to equipment and resources as contextual factors

which challenge safe medication administration(Keers et al. 2013a). Similarly, this study demonstrated that a chaotic and disruptive clinical environment reduced the safety of medication practice. Conversely, some aspects of the clinical environment, such as access to written and human resources supported medication safety. Also noted to be important in this study was the impact of the workplace culture. The culture supported ways of working that compromised medication safety. Unique to this study is how becoming mindful of the workplace context and culture improved medication safety. By raising nurses' awareness of the impact of the chaotic clinical environment, they transformed their own practice to be present and focused during medication preparation and administration. Mindful practice enabled the nurses to improve the safety of their medication practice by changing the way they experienced the mayhem of practice. The ward culture was transformed from one in which medication safety was rarely considered to one where medication safety was embedded in everyday practice. Rather than simply identify the contextual barriers to medication safety, the action research approach of this study enabled the participants to use that knowledge to make practice changes which improved medication safety. Thus extending the discourse from barriers and enablers of medication safety to improving the safety of nurses' medication administration practice.

3. Develop a new model/approach to improving medication safety that is evaluated in practice.

Nurses engaged in practice change when they had a greater understanding of why it was required. Sharing the learning from the observation data and reported medication incidents enabled the ward team to 'see' their practice reality. The Model for Improving the Safety of Medication Administration (MISMA) (refer to Figure 6-2 on page 249)

was developed from the synthesis of study findings with contemporary literature. The MISMA illustrates how becoming mindful can be used as a strategy to improve the safety of medication administration. Implications of the MISMA for education, practice and research are discussed later in this chapter in section 7.2 on page 262.

4. Add to the evidence-base for emancipatory practice development as an approach for generating effective workplace cultures

Emancipatory practice development guided the action research programme activities, enabling the MAG and ward nurses to gain insight into their own medication practice. Stepping back and facilitating rather than fixing was a skill the researcher and the MAG, in turn, had to learn. Early in the course of the study, the MAG approached the researcher with their frustrations with regard to the planning being done for the refurbished medication room. They were concerned that there were no plans to have a computer in the room or to have controlled access to the door. An initial response was that I would 'discuss what was needed' with the hospital nursing leader who had oversight of the ward refurbishment project. After reflecting on my conversation with the MAG, instead, I facilitated a meeting with the MAG, the hospital nurse leader and the ward Charge Nurse. The outcome was that two of the MAG were designated as leads in planning the medication room refurbishment and they successfully negotiated a computer and controlled card access for the door.

The MAG's participation in developing and implementing practice changes on the ward, enabled a shift in the prevailing culture so that the ward nurses felt responsible for their actions and held each other accountable for their practice. For example, data from observations of practice and group interviews demonstrated an incongruence between

nurses' stated values related to medication safety and their behaviour during medication practice. While nurses stated that they believed an independent double check was best practice to keep patients safe from medication error, their practice often fell short. The MAG shared the emerging themes from the data analysis, supported nurses to reflect on their practice and provided examples of best practice (role modelling) which raised ward nurses' awareness of their habitual, distracted and inconsistent ways of working within a chaotic and disruptive environment. Nurses came to see the mayhem of practice and were supported to be present and focused (mindful) during medication administration.

The MAG participants identified that there were many positive outcomes from participating in the study. They indicated that an emancipatory approach to improving medication safety was a worthy undertaking. "*I have learned so much from being involved in the medication safety work that I am no longer afraid to suggest changes to improve patient care"M3.*

7.1 Limitations

This action research study was undertaken in one ward of a tertiary paediatric hospital. In addition, it focused on the practice of a single healthcare professional group; nursing. The delivery of medication to children in hospital is a complex activity involving the collaboration of many healthcare professionals. The combination of few technological system checks during administration and the potential for nurses to either be a safety defence or a latent patient safety risk (Pape et al, 2015), provided the rationale for the MAG to focus on nursing medication administration practice. The study can be criticised because its situational nature suggests a lack of generalisability. Conversely taking into account contextual factors and engaging participants in changing their own practice can

be a strength of the research method enabling improvement to occur. Action research seeks to consider multiple perspectives from individuals and groups which some researchers would see as bias (and very limiting). However, advocates of action research view this as a strength in that the researcher and participants are fully engaged in the research and learning process. The findings from action research may shed light on similar situations. It is important to recognise that in healthcare contexts nothing is ever exactly the same as in any other context, neither is it always completely different (Ferlie & Dopson 2005). The in-depth description provided in this thesis enables the reader to make an informed decision regarding transferability of findings (Guba & Lincoln 1994).

I used three interpretative criteria to increase validity of the findings: authenticity, plausibility, and criticality (Greenhalgh & Swinglehurst 2011). Authenticity is concerned with the conduct of fieldwork and has been described as "immersion in the case through extended fieldwork" (Greenhalgh & Swinglehurst 2011, p. 45). In this study, extended fieldwork comprised of 2 years of researcher engagement with the MAG and ward nursing team. The MAG members and ward nursing team were all frontline nurses immersed in daily clinical practice and therefore they had an in-depth understanding of nursing medication administration practice. The authenticity of the fieldwork is demonstrated in the thesis by providing examples of a range of raw data, such as participant interview responses, observation findings, and analysis of medication incident reports, in support of the data interpretation undertaken by the researcher in collaboration with the MAG members.

Plausibility concerns the write up of research findings to provide "explanations of local phenomena which made sense to participants and drawing these together into a coherent

overall narrative" (Greenhalgh & Swinglehurst 2011). Plausibility is demonstrated when the research findings offer a distinctive contribution to a disciplinary body of knowledge and are useful knowledge for practitioners. The identification of mindfulness as a facilitator of improving medication safety is a unique finding of this study. The plausibility of the findings are strengthened as the MAG members and researcher collaboratively collected, analysed and themed the study data.

Criticality is the systematic questioning of assumptions made during data analysis (Greenhalgh & Swinglehurst 2011). Criticality was achieved as data analysis and code and theme generation was undertaken in collaboration with the MAG. Data were discussed until everyone agreed on the final codes, themes and sub-themes. In addition, the themes were presented back to the ward nursing staff who recognised and supported the relevance of the themes to their practice. A detailed description of the way in which codes, themes and sub-themes were developed is provided in chapter four.

Rigour and trustworthiness of the research was aided by data triangulation using multiple data collection methods, multiple data collectors and multiple people analysing the data (Groenkjaer 2002). Although the use of interviews depended upon accurate recall by the participants, this was less of an issue because they were guided to describe and discuss a recent situation, rather than rely on memory. Interviews always carry the inherent risk that participants will provide the socially desirable response to give a good impression to the researcher. It was recognised as important to reflect different views, rather than seeing one participant's response as 'the truth' and to acknowledge that there is no one truth but that participants' views were influenced by their own experience of practice. The observations of practice were able to corroborate interview data. All data

were compared and contrasted several times by members of the MAG, thus providing a check for credibility, confirmability and dependability (Guba & Lincoln 1994). In addition to the study findings being deemed credible by the MAG and ward nursing team, I had the opportunity to share the findings with several different groups of nurses who recognised the themes presented in the study in relation to their own experiences of practice.

7.2 Implications for Nursing Research, Education and Practice

The Model for Improving the Safety of Medication Administration (MISMA) (refer to Figure 6-2 on page 249) provides direction for research, education and practice.

7.2.1 Research.

I did not set out to test mindfulness as an intervention to improve medication safety, rather it is my interpretation of the data which explains what happened during the action research study, to improve medication safety. Therefore examination of mindful practice as an innovative intervention to address medication error is warranted, including exploration in different clinical contexts. This research focused on nursing medication administration, however other health care professionals and other parts of the medication delivery process are also susceptible to error. Research which examines the potential of mindfulness to reduce other medication errors is merited. This would add value and deeper understanding of how mindfulness can improve medication safety. It would be useful to test the MISMA model with a multi-disciplinary research study aimed at improving medication safety. In addition, mindfulness could be tested as an innovative intervention to improve the safety of other aspects of nursing practice. This could extend the MISMA as a general safety improvement model.

7.2.2 Education.

Current medication management education for nurses is inadequate (Bullock & Manias 2002). It consists of pharmacology, the five rights for administration safety and medication calculation assessment (Hayes, Power, et al. 2015). The influence of a rapidly changing and complex clinical environment on the safety of nurses' medication practice is not included. In particular the growing body of knowledge on the impact of distractions and interruptions on safety of medication administration is not routinely considered. To improve the safety of medication administration, nurses need to understand the impact of interruptions and be empowered with the knowledge and skills to respond effectively. In addition, medication safety education should address concerns regarding nurses' non-adherence (the development of workarounds) with medication safety practices. The MISMA can be used to raise awareness of the reality of the complexity of medication administration in clinical practice and provide a framework for developing safe medication administration practices for undergraduate, recently registered nurses and experienced nurses.

7.2.3 Practice.

The study findings have contributed to a greater understanding of the complexity of clinical nursing practice. Practice complexity arises from the impact of the interaction of personal and contextual factors on nursing practice. This research highlighted the benefit of the observational approach to look and see nursing practice in the clinical setting, which enabled visualisation of practices that are not always recognised or reported by nurses in practice. This study has identified through empirical research that the way forward to address the complexity of nursing clinical practice problems can be summed up by participation, observation and innovation. In other words, a tangible place

to start implementing evidence based practice change is to work in partnership with frontline nurses to observe and critically reflect on practice to truly understand the problem and develop local innovative solutions in alignment with evidence based practice.

Nurses often say they feel change is imposed on them and that their views are not taken into consideration (ICN 2014). This perception does little to encourage the adoption of behaviour change to improve practice. Sustainable practice change requires a commitment to new ways of working. Although the processes of exploring practice and developing changes were time consuming, they proved indispensable in engaging as many of the ward nurses as possible in what was happening related to improving medication practice on the ward (Cook, Macaulay & Coldicott 2004) and encouraged the team to own the new ways of working. The complexity of practice problems required an investment of time and expertise to successfully engage nurses in developing and implementing local innovation in alignment with best practice. This is at odds with today's healthcare organisational culture of wanting successive changes rapidly embedded in business as usual.

While the focus in this study was improving medication safety, it is possible that the centre aim of the MISMA could be replaced and adapted for any nursing practice (as previously noted as potential future research). Table 7-1 on page 265-267 outlines how the model emerged from practice in the current study with suggestion for how it could be used to improve the safety of another aspect of nursing practice; high flow oxygen therapy to illustrate its use.

Table 7-1 Example of applying the MISMA in practice

Aim		Improving medication safety	Improving high flow oxygen therapy
Becoming mindful		Critically reflecting on shared values and practice to enable the development of conscious awareness of the influence of self and context on paying attention on purpose and in the present to medication preparation and administration.	Critically reflecting on shared values and practice to raise conscious awareness of the influence of self and context on paying attention on purpose and in the present to preparation and administration of high flow oxygen therapy
Way of working	**Focused**	Paying purposeful attention to medication preparation and administration. Saying no to interruptions unless in an emergency. Able to block out distractions Not interrupting colleagues during medication preparation and administration.	Paying purposeful attention to choosing and setting up appropriate equipment including prescribed therapy settings. Saying no to interruptions unless in an emergency. Able to block out distractions Not interrupting colleagues during set up and commencement of high flow oxygen therapy
	Empowered	Enabled to challenge one another to pause and consider when it might be inappropriate to interrupt. The nursing team leads the development and implementation of the programme of activities The nursing team has access to resources such as electronic or written guidelines and personnel The nursing team has access to educational preparation on medication knowledge and also best practice in medication safety	Enabled to challenge one another to pause and consider when it might be inappropriate to interrupt. The nursing team leads the development and implementation of the programme of activities The nursing team has access to resources such as electronic or written guidelines and technical support The nursing team has access to educational preparation on technical and safe nursing practice (e.g. risk of gastric distension)

	Accountable	• The nursing team hold each other accountable for consistently using best practice in medication preparation and administration. • The nursing team hold each accountable for identifying personal learning needs and accessing the opportunities provided • The nursing team has opportunity to increase knowledge of self through reflection. Becoming consciously aware and attending to the influence of cognitive hardwiring; automaticity, confirmation bias and work-around as they relate to administering medications.	• The nursing team hold each other accountable for consistently using best practice in delivering high flow oxygen therapy. • The nursing team hold each accountable for identifying personal learning needs and accessing the opportunities provided • The nursing team has opportunity to increase knowledge of self through reflection. Becoming consciously aware and attending to the influence of cognitive hardwiring; automaticity, confirmation bias and work-around as they relate to administering prescribed high flow oxygen therapy
Clinical Context	**Well organised**	Increased awareness of impact of clinical context on ability to safely administer medications Redesign medication room to enable good nursing workflow	• Increase awareness of impact of clinical context on ability to set up equipment and safely deliver high flow therapy • Easily accessible storage of all necessary equipment. • Develop guidelines for placement at bedside including access to bedside emergency equipment
	Openness to learn	• Regularly review any near miss and reported medication incidents • Display feedback to enable learning and inform practice change Facilitate the nursing team in developing the what and how of practice change	• Review any near miss or reported incidents related to high flow oxygen therapy. • Display feedback to enable learning and inform practice change Facilitate the nursing team in developing the what and how of practice change
	Minimise interruption and distraction	Redesign medication room and workflow to minimise distractions and interruptions Create no interruption zone	• Quiet space to prepare and set up equipment including choosing appropriate settings

7.3 Reflection on Research Process

Generally, the translation of evidence into nursing practice is inconsistent (Baker et al. 2015) and unsustained (Fineout-Overholt & Johnston 2006). For example, there is good evidence that normal saline instillation into the trachea via an artificial airway is unlikely to be beneficial, and may in fact be harmful (Branson 2007; Morrow & Argent 2008; Owen et al. 2016; Trueman et al. 2008; Woodgate & Flenady 2001). Therefore, it should not be routinely performed prior to performing endotracheal suctioning. However, routine normal saline instillation into an artificial airway is still commonplace in nursing clinical practice (Leddy & Wilkinson 2015). Leddy and Wilkinson (2015) used a self-reported survey to examine the suctioning practices of registered nurses and registered respiratory therapists in six hospital intensive care units in Canada. Survey respondents reported a high use of normal saline instillation in practice. Notably, a significant number of participants were unaware of the existence of suctioning and/or normal saline installation evidence based practice guidelines in their unit. There was a gap between what was considered best practice and the reality of clinical practice. Evidence based practice was limited due to a lack of robust implementation (Estabrooks et al. 2006).

Appropriately evaluated organisational interventions which promote evidence based nursing are still lacking (Flodgren et al. 2012). Despite extensive searching, Flodgren et al. (2012) identified only one low-quality study which showed a standardised evidence-based nursing bundle of care for patients at risk of developing a healthcare-acquired pressure injury had little effect. A series of Cochrane reviews showed that printed education material (Giguère et al. 2012), local opinion leaders (Flodgren et al. 2011), and continuing education (Forsetlund et al. 2009) including inter-professional education (Reeves et al. 2013) are inconsistently effective in supporting professional practice

change. However all reviewers noted that practice improvement may be effective with a combination of interventions. Each of these types of interventions were used throughout action spiral 3 to support the implementation of practice change.

Implementation of evidence into practice has many challenges and obstacles. To get the evidence about medication safety translated into everyday practice, it was necessary to step outside of system and process changes. In this study, I have demonstrated how nurses can become innovators of practice improvement when supported to take ownership of change (Balfour & Clarke 2001) through a facilitated and participatory approach. Similarly, Wilson (2005b) demonstrated how emancipatory practice development enabled nurses to change the way in which they worked with patients and families in a special care nursery, to improve the effectiveness of family centred care. Giving credence to the notion that successful change is implemented and sustained when driven by the nurses directly providing care (Balfour & Clarke 2001).

The results of this thesis endorses and validates action research method as relevant to nursing. Critical and participatory action research, while not an easy process for the researcher, is able to engage frontline nurses in the research process enabling them to define their own problems and issues of practice. The creation of a communicative space (action research meetings) brought together a group of nurses who, through mutually agreed values and shared understanding of their practice, became a supportive and cohesive group. Carr and Kemmis (1986, p 204), state that "in emancipatory action research, the practitioner group takes responsibility for its own emancipation from the dictates of irrationality, injustice, alienation and unfulfillment". Working together as a self-reflective group, the members of the MAG were able to critically explore their

medication practice highlighting where there were issues for change. The collaborative approach enabled them to act as leaders in the world of clinical practice. The members of the MAG successfully persuaded their colleagues that it was vital their routinised and distracted way of working during medication administration was changed to improve patient safety.

We started the process of change by creating a communicative space which enabled nurses to voice their concerns, enabling what Kritek (2001) referred to as the collective silence to be broken. The nurses felt safe to give a true account of their practice and what guided and constrained it. As the nurses explored their medication practice, their perspective shifted. They became more aware of what was happening around them and also of how they themselves reacted to their surroundings and each other. Initially, the examples of practice provided during group discussion were largely examples of poor practice; distracted and chaotic. As the research programme progressed there were appreciably fewer examples of poor practice and more examples of best practice; present and focused.

The MAG and ward nursing team collectively developed a vision for ward medication practice. However, everyday practice is challenging and stressful. The MAG reflected on the difficulties in implementing their action plans. They cited three main features of their daily working life that were seen as interfering with their ability to implement changes. These were clinical workload, multiple pressures of top down changes to nursing practice and a high level of senior nurse turnover. This resulted in giving the nurses daily working lives a chaotic feel in which it was difficult to plan or reflect. These obstacles will continue to challenge the ability to successfully conduct research in a practice setting, where the

primary responsibility of nurses is as a direct patient care provider. However they are not a reason not to try. The shared feeling of the members of the MAG at the conclusion of the study is captured in the words of one participant "*I feel so much more able to discuss with other bedside nurses how we can make a difference to our patients, we really can influence the safety of medication practice on the ward"*M1.

A unique finding in this study was the conceptualisation of mindfulness as a facilitator of practice improvement. Mindfulness enabled nurses to manage the mayhem of practice. The ward nursing team's medication safety was observed to improve through the influential spread of mindful medication administration by members of the MAG. The concept of mindfulness was first introduced into health care in the form of mindfulness-based stress reduction (MBSR) programmes (Chiesa & Serretti 2009). In clinical populations, evidence suggests mindfulness-based interventions can reduce symptoms linked to various conditions, including chronic pain, cardiovascular disease, cancer, anxiety and depression (Baer 2003; Mars & Abbey 2010; Smith et al. 2005; White 2014). Mindfulness has also been adapted for use with a variety of healthy populations, including health care professionals (Chiesa & Serretti 2009). Among healthcare professionals, mindfulness has been advocated to reduce stress and burnout and improve therapeutic relationships with patients (Hunter 2016). Through focused, clear, non-judgemental thinking, healthcare professionals are able to take control of their actions, make better decisions and become more resilient (Foureur et al. 2013; Ludwig & Kabat-Zinn 2008). This is the first study which has identified mindfulness as a facilitator of improving medication safety.

7.4 Personal Reflection

As I take time to reflect upon this incredible learning experience, I realise that the experience has had a large personal influence. While parts of this experience has been easy going and exciting, others I have gone through with some difficulties and frustrations. Keeping reflective notes and digital recordings of conversations with my critical companion throughout the research study assisted me to not only understand the action research process but also to understand my own personal and professional growth as a result of undertaking my doctoral study.

When considering the purpose of the study, it became clear that I was interested in exploring how reconnecting nurses with their professional values and beliefs could improve the safety of medication practice. I wanted to do this not from a distance but rather I wanted to see and understand through the lens of nurses within the realities of clinical practice. An action research approach to the study grew from a desire to do something that would not only benefit me as a doctoral student but would have the potential to benefit the nurses who participated and result in practice change. I was particularly intrigued by the opportunity to work closely with nurses. At the same time, I was daunted by the degree of flexibility required for this type of research.

My role varied during the research journey; sometimes researcher, educator, facilitator or participant. As a researcher, I gathered data through the use of questionnaire, observation, field notes, and by conducting group interviews. While functioning as the facilitator of the MAG meetings, I created an agenda with the input of the MAG and guided the discussions and activities. I provided relevant professional literature to guide discussion on evidence based medication safety practice. As a study participant, I engaged in group

discussion and activities such as giving feedback to the ward team. Because of my novice skills with action research and emancipatory practice development, balancing the various roles was a challenge. Although integrating the roles was the ultimate goal, I recognised that it was not always seamless as I would have liked. The action research meetings generally got smoother as they went along, but there was a steep learning curve. I probably also relaxed a little more with each meeting. As the study progressed my role became less central to the process and the roles of the MAG members expanded to include that of co-researcher, educator and facilitator.

Coming into the study, I was consciously aware of being true to the methodological approach. I was enthusiastic and resolute that the MAG should be 'in control'. I did not want to do things for the group but to give them freedom to find their own way and exercise their own judgment. Following the initial workshop I delegated planning of the next and ongoing meetings to the group. After several weeks with no action taken to set up a meeting, I critically reflected on my concerns with my critical companion who suggested that I review John Heron's (1999) work on facilitation. I learned that I was trying to work in an autonomous facilitator mode where I had assigned the group responsibility which they were not yet ready to accept. I then had to revert to a cooperative mode of facilitation where I negotiated and coordinated planning the ongoing meetings. We negotiated that we would arrange the date of subsequent meetings at the conclusion of each meeting. This was a challenge to manage within my work schedule but I made it happen. At approximately the 12 month mark, a member of the group took responsibility to arrange a series of monthly meetings, one indication of the evolvement of the MAG which enabled me to work in an autonomous facilitator mode.

During my interaction with the MAG, I further developed my skills in active listening and enabling questioning. I was able to offer constructive criticism and redirection in a respectful manner while appreciating the differences in viewpoints. I also encouraged them to challenge my viewpoints if they contrasted with their own. Initially, the MAG had difficulty reconciling the multiplicity of my roles. They indicated that because this study was directly associated with my doctoral work, I was ultimately the person in control. This was particularly noticeable when planning upcoming meeting agendas or conflicts in opinions occurred; they looked to me as the person with the final voice. I also noted that when I was participating with a member of the MAG in providing feedback and discussion with the ward nursing team, the ward nurses often directed questions or responses to me rather than to the MAG member. Approximately a year into the research journey, this deference to me had all but disappeared as noted by one of my doctoral supervisors when they joined a MAG meeting.

A new experience and practical issue was managing a large amount of data. Well-honed organisational skills and a methodical approach to filing and storage meant that data were readily accessible and safe. However dealing with such a large amount of data from different sources was not an insubstantial task and one which had the potential to (if not managed appropriately) impact on the data analysis and findings. Wrestling with this amount of data was complex and often challenging, particularly ensuring participation of the MAG in data analysis and synthesis. A very methodical approach to coding data and emerging themes facilitated the analytical process. I discovered what it meant to "let the data speak to you" which happened after working with the data for countless hours and was suddenly awakened from a perfectly good sleep to a revelation about the data analysis.

Overall, undertaking the study and reviewing the findings have given me important insights into the complexities of facilitating nursing practice change. It has emphasised what I knew about the contentious nature of evidence and highlighted that these debates will not be readily concluded. It has shown the critical impact of context and culture which needs to be given the importance that it deserves when implementing evidence based practice change.

This research project has confirmed an insight that I have suspected for some time about myself but have not critically reflected upon until now. I have no patience for my own shortcomings. Pursuing an action research study forced me to confront my personal shortcomings in multiple areas including; knowledge of the action research process, managing a programme of work that was constantly evolving, and failing to meet my own self-imposed (and most often unrealistic) time frames. I realised toward the end of the study that this lack of patience makes me frustrated and negatively affects my sense of well-being. I am trying to be kinder and more realistic with my expectations of myself while also trying to focus on the process rather than rushing ahead to the outcome.

In retrospect, the shaping of my thesis was a slow (and sometimes frustrating) process, but I was always encouraged by the people around me and my supervisors. Indeed, I found that it was important to have time to think alone and work alone, but also to have time to share thoughts and develop ideas with other people. During the writing process, I encountered the difficulty of depending too much on other authorities rather than my own ideas. I have tried to organise my materials in such a way that allows my original data to stand relatively free, and to use secondary sources to support my arguments. Although putting this to practice was not always easy, I became conscious that unless this is done

one may end up proving other peoples' work rather than my own thesis. From my experience the key to completing such a big project is perseverance, hard work and good time management.

Finally, no work of this magnitude can be without personal challenges. For me, these were the demands of adjusting to the challenges of being a mature student, having to juggle multiple demands on time, energy and resources. Sustaining motivation over such a long period of time was challenging at times. However, my final reflection is that it has not only proved to be possible, but well worth it. On a visit to the ward some 12 months after the conclusion of the study, I was enthusiastically greeted by a nurse who had been a member of the MAG. They were proud to show that the changes to the medication room environment had been sustained. More importantly, I was able to observe two ward nurses in the medication room who were diligently focused on medication preparation.

7.5 Conclusion

In conclusion, the findings of this study have demonstrated how ward nurses were enabled to gain insight into their medication practice within their own context, identify the need for change and were supported to develop and implement sustainable practice change. Nursing practice change included an improved workflow and reduced interruptions as a result of redesign of the medication room. Individual nurses' practice was transformed from habitually unconscious automatic functioning to consciously focusing on what was occurring in the present moment while preparing and administering medications. The following image (Figure 7-2) captures 2 nurses focusing on double checking a child's medication administration. The safety of their practice was improved through the transformation of practice from MAYHEM (MIND FULL) to MINDFUL.

Figure 7-2 Mindful medication double check

Appendices

APPENDIX A LITERATURE SUMMARY TABLES

1. Computerised Physician Order Entry (CPOE) n=17

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Ammenwerth, Schnell-Inderst , Machan & Siebert, 2008 Journal of the American Medical Informatics Association	Systematic Review Majority of included studies were before and after implementation studies and 2 Randomised controlled trials	All inpatient populations	Commercial and home grown CPOE systems	Relative risk reduction of medication error by CPOE	13% - 99% reduction in medication error
Beuscart-Zéphir et al., 2005 International Journal of Medical Informatics	Activity Analysis & Usability Assessment	Designated inpatient departments of 3 French Hospitals	Comparison of CPOE and paper based medication chart	Characteristics of Dr – Nurse cooperation and communication related to medication timing	Paper system = synchronous communication and cooperation CPOE system= asynchronous communication and cooperation
Cordero et al., 2004 Journal of Perinatology	Retrospective review	Very low birth weight infants in a NICU in USA	CPOE	1. Medication error rate (caffeine and Gentamicin) 2. Initiation to completion of medication order	Decrease in gentamicin dose error from 14 to 0. Significant reduction in medication turnaround time (10.5 ± 9.8SD vs 2.8 ± 3.3SD)

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Devine et al., 2010 Journal of the American Medical Informatics Association	Before and after implementation study	Community-based, multispecialty health system in the USA	Comparison of handwritten prescriptions (n=5016) with electronic prescriptions (n=5153)	Medication error	70% reduction in medication errors (OR: 0.30; 95% CI 0.23 to 0.40) related to use of abbreviations, missing information and prescription illegibility.
Georgiou et al., 2009 International Journal of Medical Informatics	Qualitative study Semi-structured interviews and focus groups	Doctors, nurses, managers, pharmacists and senior health executives in a large Australian teaching hospital		Staff perceptions of CPOE before implementation	Concerns were related to: 1. Will it help? 2. Will it work? 3. Will we cope? 4. Will it impair existing interaction?
Han et al., 2005 Pediatrics	Retrospective review	1942 Children admitted to a tertiary care academic children's hospital in the USA	Commercially available CPOE	Mortality rate	Mortality rate significantly increased from 2.8% (39 of 1394) to 6.6% (36 of 548) Odds ratio: 3.28; 95% CI 1.94-5.55.
Holdsworth et al., 2007 Pediatrics	Comparative study with prospective and historical groups	Hospitalised children in a tertiary care children's hospital and 2 children's community hospitals in the USA	CPOE	Preventable adverse drug events Potential adverse drug events	Reduction in preventable adverse drug events (46 vs 26) and potential adverse drug events (94 vs 35).

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Longhurst, et al., 2010 Pediatrics	Cohort study with historical controls	97 495 patient discharges at a quaternary care academic children's hospital in the USA	Locally modified commercial CPOE system	Mortality rate	20% decrease in mean monthly mortality rate. 1.008 - 0.716 deaths per 100 discharges per month (95% confidence interval: 0.8%-40%)
Nuckols et al., 2014 Systematic Reviews	Systematic Review Majority of included studies were before and after implementation studies	Adult inpatients	Studies (16) which compared CPOE with paper order entry	Rate of preventable adverse drug events (pADE) Rate of 'higher risk' medication errors	CPOE was associated with half as many pADEs (RR= 0.47, 95% CI 0.31-0.710 and medication errors (RR= 0.46, 95% CI 0.35-0.60) as paper system
Pirnejad et al., 2008 International Journal of Medical Informatics	Before and after implementation study Questionnaires and Interviews	Nurses and medical staff from 6 medical wards in one hospital in the Netherlands	CPOE	Staff attitudes to CPOE and paper based system	CPOE disrupted nursing and medical medicine related communication
Radley, Wasserman & Olsho, 2013 Journal of the American Medical Informatics Association,	Meta-analysis and survey data	Hospital in-patients	CPOE	Pooled estimate of medication error rate	48% reduction in medication errors when using CPOE
Slight et al., 2015 Journal of the American Medical Informatics Association	Prospective evaluation	63 040 medication error reports from the US Pharmacopeia MEDMARX reporting system were entered into the CPOE systems	13 commercial and home-grown CPOE systems from USA and Canada	Generation of electronic alert warnings. Success of workarounds which enabled errors to be programmed	High variability between different CPOE systems. CPOE systems often failed to detect and prevent important medication errors

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Upperman et al., 2005 Journal of Pediatric Surgery	Retrospective review and prospective evaluation	All clinical units in a tertiary care children's hospital in the USA	CPOE	Adverse drug event (ADE) rate Harmful ADE	CPOE did not affect overall ADE rate. CPOE decreased harmful ADEs (0.05/1000 doses to 0.03/1000 doses P = .05).
van Rosse et al., 2009 Pediatrics	Systematic Review 12 observational studies included	Inpatient paediatric care and neonatal, paediatric or adult intensive care settings	CPOE	Medication prescription errors Adverse drug events Mortality	CPOE significantly decreased the risk of medication prescription errors (RR: 0.08; 95% CI: 0.01–0.77). Non-significant decrease in adverse drug events (RR: 0.65; 95% CI 0.40–1.08). Mortality rates were not significantly influenced by CPOE (RR: 1.02; 95% CI: 0.52– 1.94).
Wang et al., 2007 Pediatrics	Prospective review of medication documentation and voluntary reporting system	16 938 medication orders for children at an academic community hospital in the USA	CPOE compared with pharmacist	Medication errors Adverse drug events	Clinical pharmacists effectively intercepted inpatient prescribing errors but not medication administration errors. The addition of CPOE is unlikely to reduce administration errors.

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Walsh et al., 2006 Pediatrics	Retrospective review of randomly selected admissions	6916 medication orders in a children's hospital in the USA	CPOE	Frequency and type of medication errors attributable to CPOE	20/104 (19%) medication errors were attributable to CPOE Types of computer-related errors: duplicate medication orders drop-down menu selection errors keypad entry error order set errors 4 preventable adverse drug events that were not prevented by CPOE.
Weir, Staggers, & Phansalkar, 2009 International Journal of Medical Informatics	Systematic review of 46 publications	Studies were included if they directly compared CPOE with non-CPOE system, were implemented in a clinical setting and reported clinically relevant outcomes.	CPOE		Study quality varied widely

2. Electronic Medication Administration Record (eMAR) n=7

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Coleman et al., 2013 International Journal for Quality in Health Care	Interrupted time series analysis	University teaching hospital in the UK	eMaR	Percentage of missed medication doses	A visual indicator for overdue doses was not associated with significant decreases in the rates of missed doses A clinical dashboard derived from the eMAR data reduced missed medication doses.
Culler et al., 2011 Computers, Informatics, Nursing	Qualitative study using interviews	Convenience sample of nurses working on either a medical or surgical ward or ICU at 2 paediatric hospitals	eMaR	Self-reported barriers to implementation	72% of respondents identified excessive time for logging into the system as a barrier Nurses' satisfaction increased increases in patient safety were realised
Guo et al., 2011 Applied Clinical Informatics	Heuristic evaluation 4 independent evaluators and verification with clinical staff	1 organisation with 3 hospital sites in the USA	eMaR	Independent usability problem Severity score for each problem Which usability principles (heuristic) were violated for each problem	60 unique usability problems

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Moreland et al., 2012 Computers, Informatics, Nursing	Longitudinal comparative survey	Nurses in a tertiary-care medical center in the USA	eMaR	Nursing Satisfaction with eMAR instrument	eMAR system was perceived to improve workload, teamwork, ease of documentation, drug information accuracy, and patient safety
Munzner, Welch & Richardson, 2012 Journal of Pharmacy Practice and Research	Retrospective review	Inpatient wards at a tertiary hospital in Australia	Comparison of eMAR with voluntary incident reports	Rate of medication omissions	No difference in omission rates overall eMAR supported documentation of rationale for the omission
Redley & Botti, 2013 Journal of Clinical Nursing	Retrospective review of medication-related incident reports	Two acute care hospitals in Australia.		Reported medication errors	Paper based: omission wrong dose wrong frequency wrong documentation eMAR: wrong documentation omission
Warrick et al., 2011 Intensive Care Medicine	Prospective audit before and after implementation	Paediatric Intensive Care	eMaR	Prescribing errors Omitted doses	Non-significant reduction in prescribing errors (8.8%; 95% CI 4.4-13.2 to 4.6%; 95% CI 2.0-7.2) significant decrease in omissions (8.1%; 95% CI 5.8-10.4 to 1.4%; 95% CI 0-2.8%)

3. Bar code medication administration system (BCMA) n=14

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
DeYoung, Vanderkooi & Barletta, 2009 American Journal of Health System Pharmacy	Observation before and after implementation	Adult intensive care patents in a community teaching hospital in USA	A total of 1465 medication administrations observed	Number of medication errors identified per number of medications administered	Wrong time medication error rate reduced from 18.8% to 7.5% ($p < 0.001$). No significant change in other medication error types
Fowler, Sohler & Zarillo, 2009 MEDSURG Nursing	Before and after implementation survey	Convenience sample of all 68 nurses working on a surgical unit in a community hospital in USA	BCMA	Medication Administration System – Nurses Assessment of Satisfaction (MAS-NAS) scale.	Increase in nurses satisfaction scores related to improvement in patient safety. Decrease in satisfaction related to the increase in time required for administration of medications.
Helmons, Wargel & Daniels, 2009 American Journal of Health System Pharmacy	Prospective, before and after implementation observational study	Medical and surgical ward and intensive care units in an academic hospital in the USA	BCMA	Medication error rate	increase in wrong-time errors no change in total number of errors improved adherence with patient identification increased nursing staff distractions
Holden et al. 2013 Cognition, Technology & Work	Before and after implementation Cognitive systems engineering Observation Interview	Academic, tertiary care Children's Hospital in the USA	BCMA	Impact of BCMA on nurses' problem solving	New ways of solving old problems New problems which may or may not be solved Nurses often use potentially risky workarounds

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Hurley et al., 2007 Journal of Nursing Administration	Before and after implementation survey. Post implementation interviews	Nursing staff in one academic medical center in the USA	BCMA	Medication Administration System-Nurses Assessment of Satisfaction (MAS-NAS) Scale	Total and sub scale MAS-NAS scores improved by 0.8 to 1.1
Morriss et al., 2009 The Journal of Pediatrics	Prospective observational cohort study.	All patients within a neonatal unit over 50 week time period	Daily structured audit of each patient's medical records	Medication error rate Potential Adverse Drug Event (ADE) rate	Increase in medication error rate from 69.5/1000 doses to 79.7/1000 117% increase in wrong time errors. Potential ADE decreased from 15.1/1000 doses to 4.4/1000 doses
Paoletti et al., 2007 American Journal of Health-System Pharmacy	Before and after implementation observation including control group	Two cardiac telemetry units and a general ward in a hospital in the USA.	BCMA	Number of medication administration errors	24% - 35% reduction of medication administration errors. 54% reduction if wrong time errors excluded
Poon et al., 2008 Journal of Nursing Administration	Time-motion study using direct observation before and after implementation	Tertiary care hospital in the USA	BCMA	Proportion of time that nurses spent on medication-administration-related activities	Proportion of time unchanged pre-BCMA: 26.9% post-BCMA: 24.9% (P = .16) Increase in direct care time:26% - 30%

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Poon et al., 2010 New England Journal of Medicine	Prospective before and after implementation study	Academic medical center	BCMA	Transcription error rate Timing administration error rate Non-timing administration error rate	Transcription errors reduced from 6.1% to 0. Non-timing administration errors reduced from 11.5% to 6.8% Timing administration errors reduced from 16.7% to 12.2%
Sakowski et al., 2005 American Journal of Health System Pharmacy	Retrospective audit Staff interviews	25 Adult inpatient units in 6 community hospitals	Review of warning and error reports from BCMA	Medication errors prevented	0.4% - 1.9% medication administration errors were prevented 1.7% to 6.8% medication error messages overridden Most related to timing errors
Sakowski, Newman, & Dozier, 2008 American Journal of Health System Pharmacy	Review of scenarios based on BCMA error logs	Adult inpatient units in 6 community hospitals		Calculated severity score for each medication administration error (MAE)	Majority of BCMA identified MAE were benign 91% - minimal or no clinical effect 8% - potentially moderate adverse effects 1% - potentially severe or life-threatening adverse event

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Topps et al., 2005 Nursing Administration Quarterly	Before and after implementation survey	Multidisciplinary healthcare staff at a Children's Hospital in the USA	BCMA	Bar-Coding Medication System Survey (self developed)	Staff perceived that it took more time to administer the medication using the barcode system. Staff felt medication errors were not reduced as much as they had anticipated
van Onzenoort et al., 2008 American Journal of Health System Pharmacy	Retrospective review of electronic medication administration records Staff interviews	University Hospital in the Netherlands	BCMA	Frequency of barcode verification (% of available bar coded administrations) Factors influencing the frequency of bar-code verification by nurses	55% compliance with bar-code verification scanning Main factors: difficulty in scanning bar codes lack of awareness of bar codes computer delays shortage of time
Young, Slebodnik & Sands, 2010 Journal of Patient Safety	Systematic Review Clinical trials or observational (cohort and case control) studies	Studies on efficacy of bar code technology on medication errors at patient point of care		Reduction in medication administration error (MAE) rate	BCMA did not consistently decrease the overall incidence of MAE

4. Smart intravenous pump technology n=6

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Fields & Peterman, 2005 Nursing Administration Quarterly	Review of randomly selected Continuous Quality Improvement (CQI) data event logs Direct observation	Inpatient settings in 3 hospitals in the USA.	SMART pump	Number of alerts Nursing compliance with programming	506 alerts over 6 months 12% of alerts resulted in reprogramming and avoidance of infusion error 98% to 100% nursing compliance
Hertzel & Sousa, 2009 Journal of Infusion Nursing	Literature review	Studies which evaluated the effectiveness of the use of smart pumps for preventing medication errors		Medication error rate	Lack of compliance with use of smart pumps were the main causes of medication errors in included studies.
Husch et al., 2005 Quality and Safety in Health Care	Prospective	Tertiary care academic medical center in the USA	SMART pump	Types, frequency, and severity of medication errors associated with IV pumps	285/426 (70%) of medications observed infusing through a smart pump, had an error. 37 wrong rate errors were unlikely to be prevented by smart pumps because mis-programmed doses would not have exceeded routine dose limits
McAlearney et al., 2007 Journal of Patient Safety	Descriptive qualitative Focus groups	Nursing staff from an academic medical center and community hospitals in the USA		Improved understanding about the use of smart pumps in clinical practice	4 themes emerged: General perceptions Challenges encountered Interventions to overcome challenges Learning to use smart pumps

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Ohashi et al. 2014 Drug Safety	Systematic review Descriptive observational, randomised controlled trials and before–after comparison studies	Adult and children	SMART pumps	Medication error Potential benefits and risks of smart pumps.	Smart pumps reduce but do not eliminate programming errors Contributory factors: Lack of compliance with using smart pumps Overriding soft alerts Using the wrong drug library
Rothschild et al., 2005 Critical Care Medicine	Prospective, randomised time-series trial	Cardiac surgery ward in an academic tertiary care hospital in the USA	Self developed data collection forms Hospital incident reports Computerised adverse drug event surveillance Smart pump event logs	Comparison of serious medication errors with and without smart pump decision support	No statistically significant difference in medication error between the intervention and control group Low user compliance

5. Double checking medication administration n=13

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Alsulami, Conroy & Choonara, 2012 Archives of Disease in Childhood	Systematic review 3 quantitative studies: RCT, Cross over, Retrospective review 2 mixed studies 9 Qualitative studies 2 systematic reviews	Adults and children	Double checking of medication or dose calculation	Medication administration error Medication dispensing error Nurses perception of double check	There is insufficient evidence to either support or refute the practice of double checking the administration of medicines
Alsulami, Choonara & Conroy, 2014 Journal of advanced Nursing	Prospective, observational study	Neonatal and paediatric inpatients in a children's hospital		Adherence with double checking Number, type and frequency of medication administration error	30% adherence with double check of dose calculation 80% adherence with double check of patient identification 127 errors = 6.4% error rate per drug administration (when practice violations are excluded)
Armitage, 2008 Journal of Evaluation in Clinical Practice	Retrospective content analysis of reported incidents and interviews with healthcare professionals	Teaching hospital in the UK		Contributory factors in medication errors	Four aspects of double checking which contribute to error: deference to authority reduction of responsibility auto-processing lack of time and potential solutions.

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Conroy, Davar & Jones, 2012 Nursing Children & Young People	Questionnaire survey	105 children's nurses and pharmacists from 69 hospitals in the UK		Nature of medication administration checking policy	Hospitals had different policies for different drugs and for neonates and children. It was more common to double check intravenous than oral medications
Davis et al., 2005 Collegian	Qualitative Descriptive Focus group content analysis	Paediatric nurses from a tertiary children's hospital in Australia		Nurses' attitudes and opinions toward medication administration policy	Issues related to adhering to medication policy: Access to information Time constraints Differences between policy and practice Professional conflict
Davis et al., 2010 Quality & Safety in Health Care	Questionnaire survey	Paediatric nurses from a tertiary children's hospital in Australia		Participant response to medication administration vignettes	Nurses recognised that double checking policy safeguards patients and should direct decision-making
Dickinson, et al., 2010 Journal of Clinical Nursing	Qualitative Descriptive study Thematic analysis of focus group data	Paediatric nurses from a tertiary children's hospital in New Zealand		Nurses understanding of double check process and procedure	Independent double check is recognised as best practice. There is a lack of clarity regarding what independent double check means in practice

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Gill et al., 2012 Journal for Specialists in Pediatric Nursing,	Mixed-method design incorporating questionnaire and focus groups	Paediatric nurses from a tertiary children's hospital in Australia		Nurses compliance with medication administration policy Reasons for non-compliance.	Noncompliance was widespread Key factors influencing compliance were ward culture, type of drug, familiarity with patient and drug, and workload
Hodgkinson et al., 2006 International Journal of Evidence-Based Healthcare	Systematic review Systematic review Intervention studies Observational studies	Persons aged 65 years and over in acute, subacute and residential care settings,	Strategies to identify and manage medication incidents	Incidence of medication errors associated with the prescribing, dispensing and administration of medicines.	Studies examining the types and causes of medication errors occurring in older adults (≥65 years) are limited. Results from general population are relevant. Often it was impossible to accurately determine the effectiveness of the specified intervention.
Jarman, Jacobs & Zielinski, 2002 International Journal of Nursing Practice	Qualitative Descriptive design Questionnaire plus quantitative data from incident reports	Adult inpatient units in an Australian Hospital	Single check compared with double check	Medication error rate	No significant difference in error rates with single checking process compared with a double checking process.
Kruse et al., 1992 Australian Clinical Review	Crossover trial Medication chart audit	3 Elderly Care wards in one hospital in Australia	Single check compared with double check lower with double checking compared with	Medication error rate	There was a reduction in errors with double checking (2.12 vs 2.98 errors per 1000 medications administered)

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Manias, Aiken & Dunning, 2005 Journal of Clinical Nursing,	Qualitative Descriptive design Data collected from observation and interviews	Nurse graduates from a teaching hospital in Australia		Adherence to medication administration protocols Impact of ward environment on adherence to protocols	Adherence to protocols occurred if they were perceived not to impede with other nursing activities. 7 themes: availability and use of protocols scrutinizing patients' identity double-checking certain medications writing incident reports following specific policies timing the administration of medications safe storage of medications
Ross, Wallace & Paton, 2000 Archives of Disease in Childhood	Quantitative Retrospective Longitudinal Descriptive design Review of medication error incident reports	Paediatric teaching hospital in UK		Medication error rate	Double checking by pharmacy resulted in reduction of medication dispensing errors

6. Interventions to reduce interruptions during medication preparation and administration n=9

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Biron, Loiselle & Lavoie-Tremblay, 2009 Worldviews on Evidence-Based Nursing	Literature review	Original studies of nurses and frequency of work interruption		1. Interruption rates. 2. Characteristics of interruptions. 3. Contribution of work interruptions to medication administration errors	Average of 6.7 interruptions per hour Mostly initiated by nurses Some evidence of interruptions associated with medication administration errors Variable quality of included studies
Biron, Lavoie-Tremblay & Loiselle, 2009 Journal of Nursing Scholarship	Descriptive observational study of 102 medication administration rounds	One medical ward		Characteristics of work interruptions related to source, secondary task, location, management strategies, and duration	6.3 interruptions per hour of medication administration Nurses most common source of interruption Direct patient care was most frequent secondary task undertaken Interruptions lasted an average of 90 secs
Conrad et al., 2010 Journal of Nursing Care Quality	Quality improvement pilot project report.	One ward of a community hospital in the USA	Medication room redesign, standardised medication process and double check	Number of nurse interruptions and distractions during medication administration. Number of medication errors	Reduction in interruptions from a median of 4 to a median of 1 interruption per medication administration Voluntary reported medication errors decreased by 22%

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Freeman et al. 2013 Journal of Nursing Care Quality	Quality improvement report	Cardiothoracic surgical telemetry unit in an academic medical center in the USA	Implementation of safety bundle interventions Observation Retrospective review of voluntarily reported medication incidents	Number of interruptions Number of medication error reports	Interruptions reduced by 2.11 per medication administration. Decreased number of reported medication errors (28 incidents over a 3-month period)
Hopkinson & Jennings, 2013 Research in Nursing & Health	Integrative literature review Majority of the studies were based on non-experimental designs	31 articles examining interruptions to nurses work in acute care settings.		Impact of interruptions	Large variability in quality and methodology of studies Limited evidence that interruptions cause clinical errors
Pape, 2003 MEDSURG Nursing	Observational study with a control and 2 intervention groups	One ward in an acute care hospital in the USA	Focused protocol Medsafe protocol	Number of interruptions and distractions identified by the Medication Administration Distraction Observation Sheet (MADOS)	Reduction in the number of distractions from 484 in the control group to 180 with the focused protocol and 64 with the Medsafe protocol.

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Raban, & Westbrook, 2013 British Medical Journal Quality & Safety	Systematic review Observation Intervention and non-intervention groups Before and after intervention	Any clinical setting		Interruption rates Medication administration error (MAE) rates.	weak evidence of the effectiveness of interventions to significantly reduce interruption rates very limited evidence of effectiveness of interventions to reduce MAE rates
Relihan et al., 2010 Quality and Safety in Health Care	Before and after intervention observational study of nurses undertaking medication rounds	An acute medical admission unit of a teaching hospital	Bundle implemented: staff education checklist red vest signage patient information leaflets	Rate of interruptions and distractions (number of interruptions/hour) identified by the Medication Administration Distraction Observation Sheet (MADOS)	The interruption/ distraction rate post intervention was 0.43 times that of the pre intervention rate.
Westbrook et al., 2010 Archives of Internal Medicine	Observational study Observation and chart review	Nurses preparing and administering medications in 6 wards at 2 teaching hospitals in Australia		Procedural failures and interruptions Clinical errors	Each interruption was associated with a 12.1% increase in procedural failures and a 12.7% increase in clinical errors

7. Medication safety education programmes n=5

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Dennison, 2007 Journal of Continuing Education in Nursing	Pre-test post-test	20 nurses in a 12-bed coronary care unit in USA	Medication safety education programme consisting of 2 computer modules; Medication Error Reduction Training and Intravenous Infusion of High-Alert Medications	Safety climate survey Medication Safety Knowledge Assessment Tool Nurses behaviour measured as adherence with 4 recommended infusion practices Number of infusion pump alerts Reported medication errors	Statistically significant change in knowledge regarding medication errors No change in: Safety climate scores, Nurses infusion pump medication safety behaviours, Number of infusion pump alerts Number of reported errors
Greengold et al. 2003 Archives of Internal Medicine	Randomised controlled trial	2 hospitals in the USA	Dedicated trained medication nurses compared with nurses responsible for holistic care including medication administration	Observation of medication errors	No statistical difference between intervention and control group (15.7% vs 14.9% P<.84).

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Harkanen et al. 2016 Nurse Education Today	Systematic review with meta-analysis	14 Intervention studies 5/14 = moderate or high quality rating	Traditional classroom training Simulation e-learning Slide show presentation Interactive CD-ROM programme, Posters Pamphlets	Meta-analysis pooled effect size	Meta-analysis favoured the interventions with a pooled effect size of 1.06.
Hodgkinson et al. 2006 International Journal of Evidence-Based Healthcare	Systematic review including randomised controlled trials non-randomised controlled trials longitudinal studies cohort or case–control studies descriptive studies	Older persons (aged 65 years and older) in the acute, subacute or residential care settings	CPOE and CDSS Individual medication supply systems Clinical pharmacists Double checking Medication Administration Review and Safety committee	Medication errors	The evidence for the effectiveness of intervention strategies to reduce the incidence of medication errors is weak
Niemann et al. 2015 Journal of Clinical Nursing	Observation Stepped implementation of 3 interventions	Paediatric ward in a university hospital in Germany	Handout Training course Reference book	Number of medication errors	Total number of errors decreased from 527/581 (91%) to 116/441 (26%) after combined interventions

8. Voluntary Incident reporting n=7

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Anderson et al. 2006 International Journal of Medical Informatics	Simulation model to explore organisational change	Data for the model was based on a large USA voluntary reporting system		Actions taken as a result of error analysis	96% of actions = individual intervention such as education 4% = system changes such as technological improvement
Baker, 1997 Image: Journal of Nursing Scholarship	Qualitative ethno methodological study	One hospital in Australia		Thematic analysis of documents governing nurses' medication practice, observation field notes and interview data	Nurses redefined medication error based on a shared set of tacit rules.
Bayazidi et al. 2012 Journal of Caring Sciences	Descriptive Self report survey	Teaching hospital in Iran		Medication error reporting rate Barriers and facilitators to reporting medication error	Discrepancy between errors made and errors reported. Barriers: blaming individuals instead of the system consequences of reporting errors fear of reprimand and punishment

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Evans et al. 2006 Quality & Safety in Health Care	Descriptive Anonymous survey	Doctors and nurses from diverse clinical settings in 6 South Australian hospitals		Knowledge and use of the current reporting system Barriers to incident reporting	98% of respondents were aware that their hospital had an incident reporting system Nurses were more likely than doctors to have submitted an incident report The most frequently stated barrier to reporting for doctors and nurses was lack of feedback
Hand & Barber, 2000 International Journal of Pharmacy Practice	Descriptive Semi-structured interviews	Nurses from a teaching hospital in the United Kingdom		Nurses' attitudes and beliefs about medication system errors	Not all errors are reported Fear of disciplinary action stopped nurses reporting an error if no harm occurred
Mayo & Duncan, 2004 Journal of Nursing Care Quality	Descriptive Self report survey	983 RNs from 16 Southern California acute care hospitals		Modified Gladstone instrument to measure nurses perceptions of medication error	The top 3 ranked perceived causes of drug errors were: Legibility of doctors handwriting Nurses are distracted Nurses are tired and exhausted. 80% of respondents reported that errors were not reported due to fear of the reaction of the nurse manager

Author / Year Journal	Design & Method	Population	Intervention	Outcome measure	Result Summary
Yung et al. 2016 Journal of Nursing Management	Descriptive Self report survey	306 nurses from a teaching hospital in Taiwan		Attitudes and perceived barriers to reporting medication administration errors	19.0% of errors were reported in the hospital incident system major perceived barrier was fear of the consequences of reporting

APPENDIX B CHARGE NURSE INFORMATION AND CONSENT

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Practice

CHARGE NURSE INFORMATION AND CONSENT

Dear

I am currently undertaking a Doctor of Nursing degree at the University of Technology, Sydney. I am conducting an action research study on Improving Medication Practice. You are invited to learn more about this research study with a view to gaining your permission for nurses in your ward to undertake activities to improve medication safety on the ward.

What is the purpose of the study?

Medication errors are acknowledged as the leading cause of preventable adverse events in healthcare. However, the majority of strategies identified for improving medication safety are not being used in practice. While many of the barriers to successful implementation of evidence and practice improvement have been identified, we know less about what are the most effective ways to translate research into practice. One potential way of achieving sustainable evidence based practice change in healthcare is by enabling healthcare professionals to transform individual and team practices and workplace culture, using a facilitated process known as transformational practice development.

The purpose of this research is, therefore, twofold, to discover what the particular medication safety improvements might be and then how best to implement them to sustain practice change.

What happens in the study?

If you agree to your ward participating, I would require you to forward an electronic information pack to all nurses in your ward involved in the process of medication delivery to hospitalized children and allow me to discuss the study at any regular staff meetings. Nurses within your ward will have the ability to choose if and how they wish to participate in the study; willing to be part of a focus group or interview, willing to have their medication practice observed, and/or willing to be part of an action research group. After the nurses have read the study information sheet and considered whether and how to participate in the study, they will either contact me by telephone to discuss further, or complete the consent form provided and return via internal mail in the attached envelope.

I will use action research (AR) methods to facilitate a group of between 6 and 8 nurses to critically review their individual and team medication practice, develop and implement change initiatives and evaluate the outcomes. As a group, we will determine, how often and for how long we need to meet, however it can be anticipated that this may be monthly for approximately 60 minutes duration. Similarly, we will determine the number and length of each action cycle but the total time for the action research project is anticipated as lasting 18 months - 2 years. Nurses will require to be given time during their normal working hours to participate in the study. An initial preparatory day to introduce action research and practice development will be conducted. Included in this preparatory stage of the research project will be a values clarification exercise and subsequent development of a shared vision for practice.

Following this, the first step in an action research cycle is to ensure we have a common understanding of the problem. Although the topic has already been identified as medication safety, as a group, we will need to define the specific problem we wish to focus on. This step will include ensuring that the perspectives of key stakeholders are identified and taken into account.

Step two, will be to start collecting evidence on the identified problem. One source of evidence we will likely explore is current practice and context. This may be achieved through review of workforce and quality data, participant observation (action group members will observe nurses who have provided consent for their practice to be observed), and staff focus group or individual interview (action group members will conduct focus groups/individual interviews with nurses who have consented to take part in a focus group/individual interview). Within this step, we will also likely undertake a literature review. A critique of both practice and the literature is fundamental to understanding the issues and is required to enable the group to develop effective action plans (step 3) including implementation (step 4). Steps 5 and 6 involve repeated data collection and critical reflection on the changes to practice which were implemented, with the aim of determining further action cycles.

It is not possible to predict the exact nature of this initial action cycle or subsequent action cycles due to the participatory approach to the research. To facilitate participation and engagement, activities will be integrated within the ward quality plan following Auckland District Health Board audit and quality processes. For activities which are defined as research, according to the Auckland District Health Board Policy, appropriate approvals will be sought via the ADHB research office.

How is privacy protected?

All information discovered will be used for the purposes of this research study only. To ensure ongoing confidentiality, the transcriber will be required to sign a confidentially statement and all identifying information will be removed from the transcript data.

All raw study data will be kept in a secure place, including electronic data which will be password protected, and will be kept for a minimum of ten years (including a minimum of five years following publication of results). If any children's health data is collected, this will be stored for ten years after the youngest participant has turned sixteen years of age.

No material which could personally identify an individual or the area in which they work will be used in any of the reports on this study.

The observers, as staff members, are obliged to report errors observed, through the usual ward processes. The observer shall only intervene to prevent medication administration taking place, if a mistake is observed during the study, which places a patient at risk of harm.

Opportunity to consider invitation

I am inviting you to consider allowing an action research study on improving medication practice to be conducted on your ward. This project provides an opportunity for you and your staff to work with me to improve medication safety in your ward. If you have any questions regarding this study, please feel free to contact me. If you wish, a copy of the study protocol is available. You will be given 2 weeks to consider whether your ward can participate in the study.

Participant Concerns:

The Clinical Director and Nurse Advisor of Starship Children's Health have given permission for this study to be carried out. Any concerns regarding the nature of this project should be notified in the first instance to the researcher, Elaine McCall (0212428041; emccall@adhb.govt.nz), or her primary academic supervisor, Professor Jackie Crisp (+6123821784; jackie.crisp@uts.edu.au).

This study has received ethical approval from the Upper South B Regional Ethics Committee, ethics reference number URB/11/07/023.

Thank you for taking the time to read about, and consider your ward taking part in this study.

Clinicians on my ward can participate in the Improving Medication Practice action research study YES / NO

Name:

Signature: Date:

Project explained by:
Elaine McCall, Clinical Nurse Consultant, Starship Children's Health
Phone (09) 3074949 xtn. 25225 or 021 242 8041.

Signature: Date:

Primary Investigator:
Elaine McCall
Nurse Consultant
Starship Children's Health
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Supervisor:
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University of Technology, Sydney
+61295144849
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Notes:1. A copy of the consent letter to be retained by Charge Nurse

APPENDIX C NURSING STAFF INFORMATION

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Practice

NURSING STAFF INFORMATION

I am currently undertaking a Doctor of Nursing degree at the University of Technology, Sydney and I am inviting you to join an action research study on improving medication practice. This project provides an opportunity for you to work with me to improve medication safety in your ward. Please read this information sheet and decide if you wish to participate.

What is the purpose of the study?

Medication errors are acknowledged as the leading cause of preventable adverse events in healthcare. However, many strategies identified for improving medication safety are not being used in practice. While many of the barriers to successful implementation of evidence and practice improvement have been identified, we know less about what are the most effective ways to translate research into practice. One potential way of achieving sustainable evidence based practice change in healthcare is by enabling healthcare professionals to transform individual and team practices and workplace culture, using a facilitated process known as transformational practice development.

The purpose of this research is, therefore, twofold, to discover what the particular medication safety improvements might be and then how best to implement them to sustain practice change.

How was a person chosen to be asked to be part of the study?

The ward Charge Nurse Manager has agreed that this study can be undertaken in this ward and has forwarded you this information pack on my behalf.

Can I join the study?

Any nurse who is working in this ward and is involved in the medication delivery process can participate in the study.

What happens in the study?

As a nurse within the ward, you can choose if and how you wish to participate in the study; as part of a focus group or individual interview, willing to have your medication practice observed, and/or as part of an action research group. After you have read this study information sheet and considered whether and how you would like to participate in the study, you can either contact me by telephone to discuss further or complete the consent form provided and return via internal mail.

I will use action research methods to facilitate a group of between 6 and 8 nurses to critically review their individual and team medication practice, develop and implement change initiatives and evaluate the outcomes. As a group, we will determine, how often and for how long we need to meet, however it can be anticipated that this may be monthly

for approximately 60 minutes duration. Similarly, we will determine the number and length of each action cycle but the total time for the action research project is anticipated as lasting 18 months - 2 years. You will be given time during your normal working hours to participate in the study. An initial preparatory day to introduce action research and practice development will be conducted. Included in this preparatory stage of the research project will be a values clarification exercise and subsequent development of a shared vision for practice.

Following this, the first step in an action research cycle is to ensure we have a common understanding of the problem. Although the topic has already been identified as medication safety, as a group, we will need to define the specific problem we wish to focus on. This step will include ensuring that the perspectives of key stakeholders are identified and taken into account.

Step two, will be to start collecting evidence on the identified problem. One source of evidence we will likely explore is current practice and context. This may be achieved through review of workforce and quality data, participant observation (action group members will observe nurses who have provided consent for their practice to be observed), and staff focus group or individual interview (action group members will conduct focus groups/individual interviews with nurses who have consented to take part in a focus group/individual interview). Within this step, we will also likely undertake a literature review. A critique of both practice and the literature is fundamental to understanding the issues and is required to enable us as a group, to develop effective action plans (step 3) including implementation (step 4). Steps 5 and 6 involve repeated data collection and critical reflection on the changes to practice which were implemented, with the aim of determining further action cycles.

It is not possible to predict the exact nature of this initial action cycle or subsequent action cycles as the group will develop these. To facilitate participation and engagement, activities will be integrated within the ward quality plan following Auckland District Health Board audit and quality processes. For activities which are defined as research, according to the Auckland District Health Board Policy, appropriate approvals will be sought via the ADHB research office.

What are the discomforts and risks?

Within the medication action group, there may be actual/ implied criticism of clinical practice which may cause some discomfort. However, it is not the intention of this study on improving medication practice to explore personally sensitive information therefore it is unlikely to be distressful.

The risk for nurses willing to have their practice observed is that possibly someone may try to guess which coded observation relates to a particular nurse. As the intent is to observe the practice and not the person, all potentially identifying data related to names, days and shift times will not be included. Consistent with guidelines for the ethical conduct of research, the observers, as staff members, are obliged to report errors observed through the usual ward processes. The observer shall only intervene to prevent medication administration taking place, if a mistake is observed during the study, which places a patient at risk of harm.

What are the benefits?

The potential benefit for you is through reflecting on and developing your own practice. In taking part, you will be assisting with the extension of knowledge regarding medication safety for hospitalised children and clinical practice improvement. The study could benefit patients by supporting nurses to achieve best practice in medication safety and a reduction in medication errors.

How is my privacy protected?

All information discovered will be used for the purposes of this research study only. No material which could personally identify an individual or the area in which they work will be used in any of the reports on this study. In addition to submission of the doctoral thesis, and submission for publication in academic and professional journals, a summary of the findings will be sent to the Starship Children's Health Service senior management team and the Auckland District Health Board Research Review Committee & Maori Research Review Committee (including participant ethnicity data). As a participant you may request your own personal copy of the research summary.

All participants are guaranteed confidentiality by the researcher. To ensure ongoing confidentiality, the transcriber will be required to sign a confidentially statement and all identifying information will be removed from the transcript data. Due to the interactive nature of action groups, you will be aware of each other's identities. I will emphasize the importance of confidentiality and seek group agreement to respect each other's confidentiality. I cannot guarantee absolutely that participants will maintain each other's confidentiality.

You may withdraw from the study at any time up until the final report is written, without consequences, and without giving a reason, and this will in no way affect your employment or career progression. However, due to the complexity of data collection, it may not be possible to identify your individual contribution to the data and therefore data provided up to the point of your withdrawal from the study may not be able to be withheld.

All raw study data will be kept for a minimum of ten years (including a minimum of five years following publication of results). If any children's health data is collected, this will be stored for ten years after the youngest participant has turned sixteen years of age. All data will be kept in a secure place, including electronic data which will be password protected.

Opportunity to consider invitation

You will be given a month to consider if and how you would like to participate in the study. If you would like to participate in the study either complete the consent form provided and return via internal mail in the attached envelope OR contact Elaine McCall using the telephone or email contact details below. If you choose not to participate you do not have to give a reason and this will in no way affect your employment or career progression. I will respect your decision and not seek to persuade you otherwise.

Participant Concerns:

The Clinical Director and Nurse Advisor of Starship Children's Health have given permission for this study to be carried out. Any concerns regarding the nature of this project should be notified in the first instance to the researcher Elaine McCall, or her academic supervisors, Jackie Crisp or Valerie Wilson using the contact details below. If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact your professional organisation.

This study has received ethical approval from the Upper South B Regional Ethics Committee, ethics reference number URB/11/07/023.

Thank you for making the time to read about, and consider taking part in this study.

Primary Investigator:
Elaine McCall
Nurse Consultant
Starship Children's Health
0212428041emccall@adhb.govt.nz

Supervisor:
Jackie Crisp
Professor of Child & Adolescent Nursing
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Field Supervisor:
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annette.dickinson@aut.ac.nz

Supervisor:
Valerie Wilson
Professor of Nursing Research
& Practice Development
University of Technology, Sydney
+61295144849 val.wilson@uts.edu.au

APPENDIX D NURSING STAFF CONSENT FORM

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Safety

NURSING STAFF CONSENT FORM

I have read and I understand the information sheet dated 12/7/2011 for participants taking part in the Improving Medication Practice action research study.
I understand that I have been asked to participate in this project because I am part of a healthcare team which regularly administers medications to children in hospital.

I have had the opportunity to use whanau support or a friend to help me ask questions and understand the study. I have been given the opportunity to discuss this study with the researcher and I am satisfied with the answers I have been given. I am aware that I can contact Elaine McCall (0212428041; emccall@adhb.govt.nz), or her primary academic supervisor, Professor Jackie Crisp (+6123821784; jackie.crisp@uts.edu.au) if I have any concerns about the research.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw my participation from this research study at any time and this will in no way affect my employment or career progression. However, I understand that due to the complexity of data collection, it may not be possible to identify my individual contribution to the data and therefore data provided up to the point of my withdrawal from the study may not be able to be withheld.

I understand that the researcher will keep confidential, information that is obtained in connection with this study which can be identified with me. The researcher will ask all group participants to agree to respect the confidentiality of other participants and emphasize the importance of doing so; however, they cannot guarantee absolutely that participants will maintain each other's confidentiality.

I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

Please indicate how you are willing to participate in the study:

I agree to have my medication practice observed	YES/NO
I agree to participate in a focus group on medication safety	YES/NO
I agree to the focus group being audio-taped	YES/NO
I agree to participate in an individual interview on medication safety	YES/NO
I agree to my interview being audio-taped	YES/NO
I agree to participate in an action research group on medication safety	YES/NO
I wish to receive a summary copy of the results	YES/NO

I _____(full name) hereby consent to take part in the Improving Medication Practice action research study, as indicated above, being conducted by Elaine McCall, as part of the Doctor of Nursing degree at the University of Technology, Sydney.

Signature: Date:

Project explained by:

Elaine McCall, Clinical Nurse Consultant, Starship Children's Health

Signature: Date:

Notes:1. A copy of the consent form to be retained by participant

APPENDIX E WARD PROFILE QUESTIONNAIRE

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Practice

WARD PROFILE QUESTIONNAIRE

Nursing staff:

Total:	FTE.....	Headcount.....
% full time:	FTE.....	Headcount .....
Level of Practice:	FTE: Four	Headcount: Four .....
	Three	Three .....
	Two.....	Two .....
	One.....	One .....
	EN.....	EN .....

% female.....

% nursing staff turnover for 2012 .....

% average sick leave 2012

Designated nurse positions.....

.....

What is the skill mix for each shift?

Weekday am..... pm..... night.....

Weekend am..... pm..... night.....

Patient demographics:

Average age.....

% female.....

Average length of stay.....

Top 5 diagnostic groups .....

.....

Contextual data:

Number of consultant teams?

Average admissions per weekday..... weekend day.....

Average discharges per weekday ..... weekend day.....

APPENDIX F STAFF CONTEXT AND CULTURE SURVEY

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Practice

STAFF CONTEXT AND CULTURE SURVEY

This survey is part of the ward …. Medication Safety Team efforts to better address medication safety for our patients. All ward staff are receiving this survey which will take about 15-20 minutes to complete. All information provided will be kept confidential and used for the purposes of this project only. No material which could personally identify an individual will be used in any of the reports on this project.

We invite you to participate in this survey in order that we can gain a better understanding of the ward context and culture with particular regard to medication practice. The information from this survey will be themed by the medication safety team and feedback will be shared with the wider ward team to help develop interventions to improve medication safety.

Please complete your survey and return it WITHIN THE NEXT 10 DAYS. When you have completed your survey, please put it into the enclosed self-addressed envelope and return via internal mail.

If you have any questions, please contact Elaine McCall, on extension 25225 or emccall@adhb.govt.nz.

Thank you in advance for your participation in this important improvement effort.

Medication Safety

How much do you agree or disagree with the following statements? Circle the appropriate number.

		Strongly Disagree			Strongly Agree
1.	The culture of ward 24A makes it easy to learn from the medication mistakes of others	1	2	3	4
2.	Medication errors are handled appropriately in ward 24A.	1	2	3	4
3.	The management/ leadership in ward 24A listens to me and cares about my medication safety concerns.	1	2	3	4
4.	The physicians in ward 24A listen to me and care about my medication safety concerns	1	2	3	4
5.	Starship leadership is facilitating us to be a medication safety-centred ward	1	2	3	4
6.	My suggestions about medication safety would be acted upon if I expressed them to the ward 24A nursing leader	1	2	3	4
7.	The management/leadership of ward 24A does not knowingly compromise medication safety concerns for the sake of productivity	1	2	3	4
8.	I am encouraged by my colleagues in ward 24A to report any medication safety concerns I may have.	1	2	3	4
9.	I know the proper channels to direct questions regarding medication safety in ward 24A	1	2	3	4
10	If a member of my immediate family were to be a patient in ward 24A (not my patient) I would have no concern at all about possible medication errors	1	2	3	4
11	Ward 24A is doing more for medication safety now than it was 1 year ago	1	2	3	4
12	Medication safety in ward 24A is approached as a process of care issue and not a personal blame issue.	1	2	3	4
13	The health care providers in ward 24A take responsibility for patient medication safety	1	2	3	4
14	In ward 24A we have clearly defined rules and guidelines for medication safety	1	2	3	4
15	Medication safety is constantly reinforced as a priority in ward 24A.	1	2	3	4
16	In ward 24A we have defined protocols about reporting and discussing medication mistakes that almost happened and could have harmed a patient but did not	1	2	3	4

Conditions of Work Effectiveness Questionnaire – II

For each of the following statements, please circle the appropriate number:

How much of each kind of opportunity do you have in your present job?	**None**		**Some**		**A lot**
1. Challenging work	1	2	3	4	5
2. The chance to gain new skills and knowledge on the job	1	2	3	4	5
3. Tasks that use all of your own skills and knowledge	1	2	3	4	5

How much access to information do you have in your present job?	**No Knowledge**		**Some Knowledge**		**Know a lot**
1. The current state of the hospital	1	2	3	4	5
2. The values of top management	1	2	3	4	5
3. The goals of top management	1	2	3	4	5

How much access to support do you have in your present job?	**None**		**Some**		**A lot**
1. Specific information about the things you do well	1	2	3	4	5
2. Specific comments about things you could improve	1	2	3	4	5
3. Helpful hints or problem solving advice	1	2	3	4	5

How much access to resources do you have in your present job?	**None**		**Some**		**A lot**
1. Time available to do necessary paperwork	1	2	3	4	5
2. Time available to accomplish job requirements	1	2	3	4	5
3. Acquiring temporary help when needed	1	2	3	4	5

In my work setting/job:	**None**		**Some**		**A lot**
1. The rewards for innovation on the job are	1	2	3	4	5
2. The amount of flexibility in my job is	1	2	3	4	5
3. The amount of visibility of my work-related activities within the institution is	1	2	3	4	5

How much opportunity do you have for these activities in your present job?	**None**		**Some**		**A lot**
1. Collaborating on patient care with physicians	1	2	3	4	5
2. Being sought out by peers for help with problems	1	2	3	4	5
3. Being sought out by managers for help with problems	1	2	3	4	5
4. Seeking out ideas from professionals other than physicians e.g. physiotherapists, Occupational therapists, dieticians,	1	2	3	4	5

	Strongly Disagree				**Strongly Agree**
1. Overall, my current work environment empowers me to accomplish my work in an effective manner	1	2	3	4	5
2. Overall, I consider my workplace to be an empowering environment	1	2	3	4	5

The Context Assessment Index

How much do you agree or disagree with the following statements? Please put a cross in one box only.

		Strongly Agree	Agree	Disagree	Strongly Disagree
1.	Personal and professional boundaries between healthcare professionals are maintained				
2.	Decisions on care and management are clearly documented by all staff				
3.	A proactive approach to care is taken				
4.	All aspects of care/treatment are based on evidence of best practice				
5.	The nurse leader acts as a role model of good practice				
6.	Healthcare professionals provide opportunities for patients/families to participate in decisions about their own care				
7.	Education is a priority				
8.	There are good working relations between clinical and non-clinical staff				
9.	Staff receive feedback on the outcomes of complaints				
10.	Healthcare professionals in the multidisciplinary team have equal authority in decision making				
11.	Audit and/or research findings are used to develop practice				
12.	A staff performance review process is in the place which enables reflection on practice, goal setting and is regularly reviewed				
13.	Staff have explicit understanding of their own attitudes and beliefs towards the provision of care				
14.	Patients / families are encouraged to be active participants in their own care				
15.	There is high regard for patients privacy and dignity				
16.	Healthcare professionals and healthcare support workers understand each other's role				
17.	The management structure is democratic and inclusive				
18.	Appropriate information is accessible to patients / families				
19.	Healthcare professionals and patients / families work as partners providing individual patient care				
20.	Care is based on comprehensive assessment				
21.	Challenges to practice are supported and encouraged by nurse leaders and nurse managers				

		Strongly Agree	Agree	Disagree	Strongly Disagree
22.	Discussions are planned between healthcare professionals and patients				
23.	The development of staff expertise is viewed as a priority by nurse leaders				
24.	Staff use reflective processes (e.g. action learning, clinical supervision or reflective diaries) to evaluate and develop practice				
25.	Organisational management has high regard for staff autonomy				
26.	Staff welcome and accept cultural diversity				
27.	Evidenced-based knowledge on care is available to all staff				
28.	Patients / families have choice in assessing, planning and evaluating their care and treatment				
29.	Healthcare professionals have the opportunity to consult with specialists				
30.	Healthcare professionals feel empowered to develop practice				
31.	Clinical nurse leaders create an environment conducive to the development and sharing of ideas				
32.	Guidelines and protocols based on evidence of best practice (patient experience, clinical experience and research) are available				
33.	Patients are encouraged to participate in feedback on care, culture and systems				
34.	Resources are available to provide evidence-based care				
35.	The organisation is non-hierarchical				
36.	Healthcare professionals share common goals and objectives about patient care				
37.	Structured programmes of education are available to all healthcare professionals				

Background demographic information

What is your position on ward …:

Charge Nurse	Pharmacist	Consultant
Nurse Educator	Dietician	Registrar
Nurse Specialist	Child Health Therapist	House Officer
Staff Nurse	Level of practice _____	Other:
Enrolled Nurse	Level of practice _____	_____

Age
less than 25
25-29
30-34
35-39
40-44
45-49
50-54
55-59
greater than 60

Gender: Female / Male

Ethnicity:

How long have you worked on ward …?

Less than 2 months	3 to 5 years
2 to 11 months	6 to 10 years
1 to 2 years	11 years or more

How many hours per week do you usually work in ward …?

15 or fewer hours per week
16 to 24 hours per week
25 to 40 hours per week

Any other information that you would like to provide on medication safety practice on ward …?

Thank you for taking the time to complete your questionnaire. Please put into the self-addressed envelope and put in the internal mail. The medication safety team look forward to sharing the results with you.

APPENDIX G EXAMPLE OF CAI SCORING

	CAI question related to culture																
ID	1	3	7	9	12	15	16	18	21	23	24	28	31	33	34	36	Score (%)
001	4	3	3	3	3	3	3	3	2	3	3	3	3	2	3	2	72
002	3	3	2	2	4	4	4	3	2	3	2	3	2	4	4	4	77
003	4	3	3	3	0	3	3	3	2	3	3	2	3	4	2	3	69
004	3	3	4	3	4	4	4	3	3	3	3	4	4	3	4	4	88

	CAI questions related to leadership							
ID	2	6	10	17	22	27	29	Score (%)
001	2	3	2	2	3	3	3	64
002	3	3	3	2	3	3	3	71
003	2	3	2	3	2	3	3	64
004	3	3	3	3	3	4	3	79

	CAI questions related to evaluation													Score
ID	4	5	8	11	13	14	19	20	25	26	32	35	37	(%)
001	3	2	2	3	3	3	3	3	3	3	4	2	4	73
002	2	3	4	2	3	4	3	3	2	3	3	1	3	68
003	3	3	3	0	3	4	3	3	3	3	4	0	3	68
004	3	3	4	3	4	4	3	4	1	3	4	1	3	77

1. A score is calculated for each individual for each of the 3 dimensions.
   For example, respondent 1 scored the ward culture at 72%, leadership at 64% and evaluation at 73%.

2. An average score (team score) for each dimension is obtained
   For example, an average score for the ward culture, for the 4 responses given above = 76.5%.

3. An average score (context score) of all dimensions is obtained.

   For example, the context score for the above data is 72.5%.

APPENDIX H OBSERVATION OF PRACTICE: TOOL

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Safety

OBSERVATION OF MEDICATION PRACTICE

NAME: DATE:

Observation	Questions arising

APPENDIX I OBSERVATION OF PRACTICE: STAFF INFORMATION

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Practice

OBSERVATION OF MEDICATION PRACTICE

WARD STAFF INFORMATION

Why observe medication practice?

To:

- Look at "How things are done around here"
- Identify Contradictions
- To find out what works really well to facilitate high quality medication practice
- To identify what processes and systems can be reviewed so that improvements can be made to medication practice
- Improve patient safety

- To develop a culture of safe and effective medication practice we need to understand what the current practice and culture looks like now "how things are done around here". We all get so immersed in our daily practice that we are not necessarily aware of our practice or may make assumptions about the ways that we practice.
- Observing practice enables clinicians to become aware of what's actually happening in their area and raises our level of awareness about some of the things that we may take for granted, or make assumptions about. By using observation to look at practice around medications, we may compare how practice is aligned with best practice; checking, administration, documentation etc.
- Contradictions – Observing practice enables clinicians to identify the contradictions between what we espouse and what we do. Ward 24A staff have said that they value safe medication practice (values clarification and development of vision). Observation will allow us to identify if this is actually happening in practice. For example, a nursing team may say that they really value FCC and that they always involve children, young people and families in making decisions about their care. However, during observation it becomes apparent that the way they conduct their multidisciplinary ward rounds outside of the patient rooms actually excludes patients and family participation.
- Observing medication practice enables us to identify areas of excellence as well as areas for development.
- Observing medication practice creates the potential for better patient care - to improve patient safety.

How are observations used in practice?

Observations are one strategy to collect data to create a picture of what the ward practice and culture looks like at this point in time.

Theming data, reflection and critique & action planning

- The next step once the observation period is completed is for us to work with and understand all of the data - to look at what's emerging from the data, looking for commonalities, over lap

and contradictions and reflecting on what it means. What we think is really good and what are our concerns about the practice observed and being able to make sense of the information and how we can use it.

- Following analysis of the data collected, we will meet with the ward staff to provide feedback on themes identified, seek clarification of issues and gain feedback on how to support the continuation of things that have been identified as being done well and what areas they would like to improve.
- This will help us develop an action plan for quality improvement

APPENDIX J VALUES CLARIFICATION TOOL

Elaine McCall
Clinical Nurse Consultant
Starship Children's Health
Auckland District Health Board
Private Bag 92024

Improving Medication Safety

VALUES CLARIFICATION TOOL

I believe medication safety means:
I believe the purpose of medication safety is:
I believe this purpose can be achieved by:
I believe my role in medication safety is:
I believe the factors that enable safe medication practice are...
I believe the factors that inhibit safe medication practice are...
Other values and beliefs about medication safety I have are...

APPENDIX K PERMISSION TO USE CWEQ II

NURSING WORK EMPOWERMENT SCALES &
Request Form

I request permission to copy the Nursing Work Empowerment Scale as developed by Dr. G. Chandler and Dr. Heather K. Spence Laschinger. Upon completion of the research, I will provide Dr. Laschinger with a brief summary of the results, including information related to the use of the Nursing Work Empowerment Scale used in my study.

Questionnaires Requested:
Conditions of Work Effectiveness-II (includes JAS-II and ORS-II): Yes

Please complete the following information:

Date: 7/4/2013
Name: Elaine McCall
Title: Engagement in Medication Safety: The Path to Transforming Practice (Improving Medication Safety)
University/Organization: I am a doctoral candidate at the University of Technology, Sydney and employed at (and undertaking the study in the clinical setting) of Starship Children's Hospital, Auckland New Zealand
Address: Paediatric Intensive Care Unit level 2
Starship Children's Hospital Private Bag 92024 Auckland. New Zealand
Phone: +642102236343
E-mail: Elaine.A.McCall@student.uts.edu.au

Description of Study: I am facilitating Practice Development with staff nurses in one paediatric ward to improve medication safety within an action research study. Fundamental to Practice Development is the empowerment of nursing staff to become innovators of practice improvement through ownership of change. I would like to use the Nursing Work Empowerment Scale to assess the current level of staff nurses empowerment at the beginning of the study and again at the conclusion of the study cycles to reassess for improvement.

Permission is hereby granted to copy and use the Nursing Work Empowerment Scale.

Date: April 12, 2013

Dr. Heather K. Spence Laschinger, Professor
School of Nursing, University of Western Ontario
London, Ontario, Canada N6A 5C1
Tel: 519-661-2111 ext.86567 Fax: 519-661-3410
E-mail: hkl@uwo.ca

APPENDIX L PERMISSION TO USE CAI

Apr 8

McCormack, Brendan <bg.mccormack@ulster.ac.uk>

HI Elaine

Very happy for you to use the CAI. Good luck with your study

Best Regards

BRENDAN

Professor Brendan McCormack,

Director Institute of Nursing & Health Research,

Head Person-centred Practice Research Centre
University of Ulster
Shore Road
Newtownabbey
Co. Antrim
Northern Ireland
email: bg.mccormack@ulster.ac.uk
Office: 0044(0) 28 701 24094
Fax: 0044(0) 28 701 24951

From: Elaine McCall <Elaine.A.McCall@student.uts.edu.au>
Date: Sunday, 7 April 2013 08:16
To: "McCormack, Brendan" <bg.mccormack@ulster.ac.uk>
Subject: permission to use CAI

Professor McCormack

I am currently enrolled in the Doctor of Nursing programme at UTS with Jackie Crisp and Val Wilson as my supervisors. I am using Practice Development to improve medication safety within an Action Research study. I am seeking permission to use the Context Assessment Index at the beginning of the study to assess current context and potential areas for change and also reassessment of the context at the conclusion of the study to look for any improvement.

Regards

Elaine McCall

APPENDIX M NZ HEALTH & DISIBILITY ETHICS APPROVAL

Health and Disability Ethics Committees

Upper South B Regional Ethics Committee
c/- Ministry of Health
6 Hazeldean Road, Level 1 Montgomery Watson Building
Addington, Christchurch
Phone: (03) 974 2305
Email: uppersouthb_ethicscommittee@moh.govt.nz

24 August 2011

Ms Elaine McCall
Auckland District Health Board
Paediatric Intensive Care Unit
Starship Children's Health
Private Bag 92 024
Auckland

Dear Ms McCall

Re: Ethics ref: **URB/11/07/023** (please quote in all correspondence)
Study title: Engagement in medication safety: The path to transforming practice
Investigators: Ms Elaine McCall, Professor Jackie Crisp, Professor Valerie Wilson, Dr Annette Dickinson

This study was given ethical approval by the Upper South B Regional Ethics Committee on [insert date]. A list of members of the Committee is attached.

Approved Documents

- Study Protocol v1.0 date 30 May 2011
- Nursing Staff Information sheet v1.1 dated 12 July 2011
- Nursing Staff Consent form v1.1 dated 12 July 2011
- Charge Nurse Information Sheet and Consent Form v1.1 dated 12 July 2011
- Transcriber Confidentiality Agreement v1.0 dated 30 May 2011

This approval is valid until 31 December 2013, provided that Annual Progress Reports are submitted (see below).

Amendments and Protocol Deviations

All significant amendments to this proposal must receive prior approval from the Committee. Significant amendments include (but are not limited to) changes to:

- the researcher responsible for the conduct of the study at a study site
- the addition of an extra study site
- the design or duration of the study

Health and Disability Ethics Committees

Upper South B Regional Ethics Committee
c/- Ministry of Health
6 Hazeldean Road, Level 1 Montgomery Watson Building
Addington, Christchurch
Phone: (03) 974 2305
Email: uppersouthb_ethicscommittee@moh.govt.nz

— the method of recruitment
— information sheets and informed consent procedures.

Significant deviations from the approved protocol must be reported to the Committee as soon as possible.

Annual Progress Reports and Final Reports
The first Annual Progress Report for this study is due to the Committee by 31 August 2012. The Annual Report Form that should be used is available at www.ethicscommittees.health.govt.nz. Please note that if you do not provide a progress report by this date, ethical approval may be withdrawn.

A Final Report is also required at the conclusion of the study. The Final Report Form is also available at www.ethicscommittees.health.govt.nz.

Statement of compliance
The committee is constituted in accordance with its Terms of Reference. It complies with the *Operational Standard for Ethics Committees* and the principles of international good clinical practice.

The committee is approved by the Health Research Council's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990.

We wish you all the best with your study.

Yours sincerely

Mrs Diana Whipp
Administrator Upper South B Regional Ethics Committee
Email: uppersouthb_ethicscommittee@moh.govt.nz

APPENDIX N UTS ETHICS RATIFICATION

From: Ethics Secretariat <Research.Ethics@uts.edu.au>

To: Prof Jackie Crisp <Jackie.Crisp@uts.edu.au>

Cc: Ethics Secretariat <Research.Ethics@uts.edu.au>; Elaine McCall <Elaine.A.McCall@student.uts.edu.au>

Sent: Tuesday, 25 October 2011 4:56 PM

Subject: Eth: HREC Clearance Letter - UTS HREC 2011-384R

Dear Jackie and Elaine,

Re: "Engagement In Medication Safety: The Path To Transforming Practice" [External Ratification: Upper South B Regional Ethics Committee, New Zealand Human Research Ethics Committee HREC approval - URB/11/07/023 - August 2011 until 31st December 2013]

At its meeting held on 18/10/2011, the UTS Human Research Ethics Committee reviewed your application and I am pleased to inform you that your external ethics clearance has been ratified.

Your UTS clearance number is UTS HREC REF NO. 2011-384R

You should consider this your official letter of approval. If you require a hardcopy please contact the Research Ethics Officer (Research.Ethics@uts.edu.au).

Please note that the ethical conduct of research is an on-going process. The National Statement on Ethical Conduct in Research Involving Humans requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report. You must also provide evidence of continued approval from the Human Research Ethics Committee you originally received approval from.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

If you have any queries about your ethics clearance, or require any amendments to your research in the future, please do not hesitate to contact the Ethics Secretariat at the Research and Innovation Office, on 02 9514 9772.

Yours sincerely,

Professor Marion Haas

Chairperson

UTS Human Research Ethics Committee

C/- Research & Innovation Office
University of Technology, Sydney
Level 14, Tower Building
Broadway NSW 2007
Ph: 02 9514 9772
Fax: 02 9514 1244
Web: http://www.research.uts.edu.au/policies/restricted/ethics

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