Exploring medication errors and doctors' and nurses' perceptions of them in the Paediatric Intensive Care Unit (PICU)

By

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STUDENT DECLARATION FORM

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ABSTRACT

Despite the introduction of numerous strategies to improve medication safety, error rates over the last 5 years have not reduced. Moreover, some errors are being repeated. This suggests that staff may not learn from their errors or individual learning is not being shared across the PICU.

The aim of this study was to gain a more accurate understanding of medication error (ME) occurrence in one large Paediatric Intensive Care Unit (PICU) and to explore the paediatric intensive care (PIC) team's perceptions of MEs and how they perceive that they learn from them.

An exploratory study using a parallel convergent mixed methods approach was chosen using both qualitative and quantitative methods involving focus groups, interviews, content analysis of reflective learning tools and observations of nurses administering medication on the PICU.

The focus groups and interviews generated three overlapping core categories, which were linked by a meta-category, the reality of practice, which provides a means of synthesising the range of participants' perceptions and practices. The three core categories were: perceived culture on PICU, factors affecting ME reporting and learning from MEs. Interruptions and distractions were observed to increase violations of policy and protocol. Three MEs were observed out of 59 medication administration episodes; none of these errors were reported formally, suggesting that MEs remain underreported. The content analysis of the reflective learning tool highlighted a lack of detailed, self-analysis and reflection following an error to demonstrate learning.

Since there is still underreporting of MEs, clearer definition and ongoing guidance of what constitutes a ME may have the potential to improve reporting practices. Individual learning and shared learning does not automatically take place following a ME on the PICU. The current reflective learning tool does not facilitate useful reflection on the error and is unlikely to promote learning across the unit. More detail is needed about when to ask staff involved with a medication error to complete tools to aid learning from MEs. Staff engagement should be sought at all levels to promote learning. Staff need to see the relevance of any new safety processes that are implemented; this could be achieved through positive feedback.

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ABBREVIATIONS

ANP	Advanced nurse practitioners
DH	Department of Health
ECMO	Extra corporeal membrane oxygenation
ICU	Intensive care unit
ME	Medication error
MEs	Medication errors
MAE	Medication administration error
MAEs	Medication administration errors
NPSA	National Patient Safety Agency
NAO	National Audit Office
NCCMERP	National Co-ordinating Council for Medication Error Reporting and Prevention
NHS	National Health Service
NRLS	National Reporting and Learning Service
UK	United Kingdom
US	United States
WHO	World Health Organisation

CHAPTER 1: INTRODUCTION

1.1 Background and significance

Patient safety by reducing error is a key priority for major health services around the world and continues to be a major challenge (Kohn et al., 1999; WHO, 2005; NCCMERP, 2005, NHS England, 2014). In 2000, the UK government put forward a report called an “Organisation with a Memory” stating that in the past there had been little systematic learning form adverse events. The Chief Medical Officer identified three problems within the NHS that impeded learning from error: blame culture, which inhibits reporting; inattention to near misses; and insufficient individual self-appraisal when involved with an error. Whilst patient safety has always been at the forefront for health professionals, in the last decade MEs have become an increasing concern, having been identified as the single most ‘*preventable*’ cause of patient harm (NAO, 2005).

1.2 The scale of the problem

The National Patient Safety Agency (NPSA) have calculated that ME is estimated to cost the NHS more than 750 million pounds a year in preventable harm, from prolonged hospital stays, legal claims and readmissions to hospital, although the vast majority of MEs, result in no harm to patients (NPSA, 2007). However, research has shown that MEs are under estimated and remain underreported (Wilde and Bradley, 2005; Vincent, 2006; Sari et al., 2007; Armitage et al., 2010).

1.3 Medication errors

MEs can occur at each stage of the cycle from prescribing, transcription, dispensing to administration. This means that all health care professionals, including doctors, nurses and pharmacists should be involved in an approach to preventing the problem of MEs (Williams, 2007). Reason (1997) states that MEs stem from 'human errors' and 'latent failures' within the organisation and the administrative processes and systems. It is widely acknowledged now that MEs occur when human errors and system factors interact with this cycle, so rather than just focusing on the individual, the conditions within the organisation and clinical practice are important causes of error (Armitage et al., 2010). As these types of errors are deemed to be preventable, there is the opportunity to learn from any failures and respond in order to prevent them in the future (Chuang et al., 2007).

1.4 Definition

MEs that are stopped before harm can occur are known as near misses, close calls or a potential adverse medication events (VHA, 2006). In order to understand MEs and to add context to the literature discussed in this review, it is necessary to define the term ME. Definitions of MEs vary across the literature (Brady et al., 2009). A study by Yu et al. (2005) searched 160 medication safety websites, finding 119 different definitions, using different terminology, with 33 of these sites giving reference to more than one definition per site. This plethora of definitions does not allow for a quick and easy classification of MEs (Allen and Barker, 1990; Franklin et al., 2005; Ghaleb and Wong, 2006; Valentin et al., 2009).

Lisby et al. (2010) concluded from a systematic review of the literature that the wide ranges of error rates reflect the differing definitions of error and the methods of data collection used in different settings. As this study was based in an NHS hospital the most up to date definition of a ME and patient safety incident, currently adopted by the NHS England and the NRLS were used as reference points:

> 'Medication errors are any Patient Safety Incident where there has been an error in the process of prescribing, preparing, dispensing, administering, monitoring or providing advice on medicines.'
>
> A patient safety incident' (PSI) is, 'any unintended or unexpected incident, which could have or did lead to harm for one or more patients receiving NHS care.' (NHS England, 2014:2)

In summary, the multiple definitions, terms and meanings can hamper the understanding and comparison of the literature around MEs. This leads to different approaches to interpreting or detecting MEs and as such requires close scrutiny when reviewing the literature.

1.5 Critical care: The PICU environment, culture and perspective

In paediatrics the potential for errors to cause harm is three times more likely compared to adults, with children under four being at particular risk (Bates et al., 1995; Kaushall et al., 2004; NPSA, 2007). Anderson and Ellis (1999) advise that there are numerous reasons that put children at higher risk of MEs. The majority of medication doses in paediatric intensive care (PICU) are calculated by a child's age, individual body weight (kilograms) or body surface area as well as their clinical condition. There is a large variance in weight and body area within

the paediatric population. In PICU, the weights of paediatric patients may change dramatically over a short period of time requiring frequent recalculation of medication doses (Chua et al. 2009). Also, off-label usage [medication prescribed for other than their intended use] of medications leads to adult formulations being diluted or reformulated for children's use (Budetti, 2003). Chua et al. (2009) advise that children have limited response capabilities and communication skills, to warn carers about the side effects they may experience from medication errors. On PICU there is also a reduced patient ability to communicate due to unconsciousness and these children, especially neonates, do not have the internal reserves to buffer MEs when compared to adults (Sullivan & Buchino, 2004; Dickinson et al., 2012.)

Critically ill patients are prescribed twice as many medications as patients outside the intensive care unit, putting them at a higher risk of a ME (Moyen et al., 2008). Studies on adult ICU's have shown that on average, patients experience 1.7 errors per day (Donchin et al.,1995), whilst nearly all ICU patients suffer a potentially life threatening error at some point in their stay (Provonost et al., 2005).

1.6 Reporting of medication errors

It has been suggested that 96% of the 1.7 errors per ICU patient day are never officially reported (Wild and Bradley, 2005). A further study has shown that routine incident-reporting systems may report as few as 5% of medication errors compared to those detected by case review notes (Sari et al., 2007). Barriers to reporting MEs include shame, fear of litigation, lengthy reporting systems, fear of punishment and an unsupportive culture on the ward or in the organisation (Wolf et al., 2000; Evans et al., 2006; Armitage et al., 2010). Armitage et al.

(2010) expands on this further, advising that resourceful staff used to multi-tasking, may normalise interruptions and organisational weakness, therefore not seeing the need to report critical incidents or near misses. Johnson (2007) advises that incident reporting does not always take into account the contributory factors, questioning whether frontline staff believes such factors are inescapable when working in demanding situations, or whether staff have a lack of knowledge on error causation. Armitage et al. (2010) concluded that incident reporting needs to capture a range of contributory factors to facilitate learning and put supportive actions in place.

1.7 Nurse perspective

As nurses administer the bulk of the medications on PICU, it is therefore vitally important that we understand how PICU nurses perceive MEs, look at the accuracy and quality of their report rates and their perceptions of learning from medication errors.

1.8 Medical perspective

Prescribing errors account for 26% of errors in critical care (Thomas & Panchagnula, 2008), although Taylor et al. (2004) advise of the high level of underreporting of errors by doctors. Prescribing errors are frequently (75% of the time) detected by the pharmacist or nurse before administration to the patient (Sullivan and Bochino, 2004).

1.9 Error prevention

The majority of literature up to now has focused on descriptive reports of incidence rates and identifying factors that promote and improve safety medication in health care organisations (Hoff et al., 2004; Chang and Mark, 2011). An organisation with a memory (DH, 2000) concluded that there had

been insufficient research on how we learn from failure in health care in the UK. Similarly, Hoff et al. (2004) advised the need to gain further insight into the mechanisms for reducing errors and that there was a lack of theoretical foundation. More recent reports have concluded that healthcare still has a lot to learn, with regard to patient safety, implying that the last 10 years represents a "lost decade" (Wynia and Classen, 2011). The focus of research on identifying personal or organisational predictors of MEs, aimed at prevention of errors occurring, has led to a gap between awareness of MEs and the knowledge of how to manage and learn from errors when they do occur (Chang and Mark, 2011).

1.10 The study site

On the PICU, where this study took place, despite the introduction of numerous strategies to improve medication safety over the past five years, ME rates had not reduced; moreover the same errors continue to be repeated. In addition to this, the error reporting from both the medical and nursing staff does not contain enough detail to establish the causative factors relating to the medication error. This suggests that staff may not be learning from their errors or that individual learning experiences are not being shared cross the unit. It is hoped that by gaining an insight into the process and culture of MEs on this PICU, that problems specifically associated within this setting will be highlighted to enable meaningful feedback to be given to the management and staff so as to target interventions to improve safety and prevent errors. The following literature review will look to identify the relevant research around how doctors and nurses working on a PICU perceive MEs, the management of these errors and how they learn from them.

CHAPTER 2: THE LITERATURE REVIEW

2.1 Introduction

This literature review is based on the approach described by Polit and Hungler (1997). The research question underpinning this review is 'how do doctors and nurses working on a PICU perceive MEs, the management of these errors and how they learn from them?'

2.2 Data sources

The databases searched were CINAHL, Medline, PychINFO and Pubmed and the search included articles from 1990 – 2015 so as to include the literature 10 years pre and post publication of 'An Organisation with a Memory'. The following key words were used; Medication error* (ME), perception*, understanding, critical thinking, attitude, learn*, management, pediatric, paediatric, neonatal, and critical care.

2.2.1 Inclusion criteria

Studies included in the review were those that identified how doctors or nurses perceived MEs in relation to the management of errors and learning from them. The aim was to obtain high quality evidence of the characteristics of how doctors and nurses actually learn from MEs, particularly in relation to the PICU. However, the search returned very few articles that were specific to PICU, with some generalisability to pediatrics, as opposed to just within the remits of PICU. Therefore the inclusion criteria were broadened to include studies which at least identified the learning and management of MEs, within a hospital setting.

2.2.2 Exclusion criteria

The following criteria were used to exclude studies from the review:

- Studies or reviews not performed in a hospital setting.
- Studies involving the psychiatric setting
- Studies purely measuring incidence rates
- ME studies based on health technology improvements
- Studies involving only measurement of safety and quality indicators
- Studies measuring incidence rates pre and post intervention strategies that did not include learning or management of MEs.

In the papers identified, a general content analytic approach was used to review the abstracts and articles for pertinent information, according to the inclusion and exclusion criteria. Additionally, a manual search of the reference lists of the articles selected in the review was conducted. All duplicates between databases or papers that could not be obtained were excluded. Only original studies published in English were considered for inclusion as there was no facility for translation. The Critical Appraisal Skills Program (CASP) Tool relevant to the methodology used in the paper was used to critically appraise and assess the trustworthiness and relevance of the papers included in the review. A total of 21 studies met the inclusion criteria, these form the basis of this literature review (see Diagram 1).

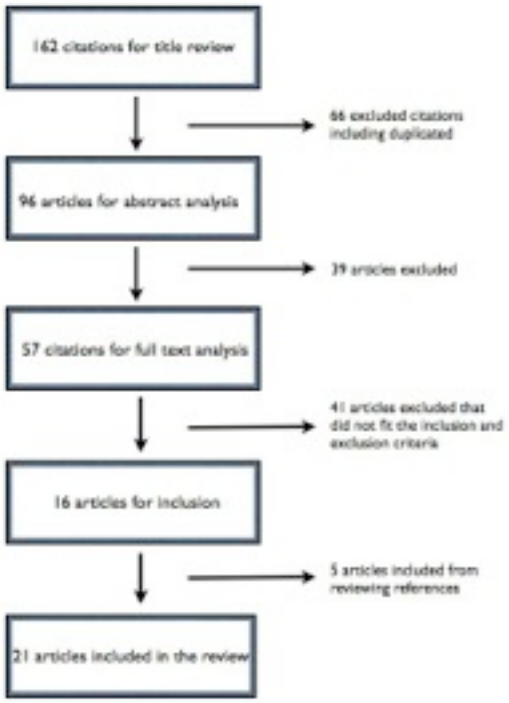

Diagram 1 Results of database search

2.3 Learning from medication errors

This review will be presented under learning from MEs from a medical perspective, from a nursing perspective and from an organisational perspective. Research has identified that a positive learning climate leads to reduced rates of error (Edmondson, 2004). Whilst studies advocate that the attributions of a learning climate include detecting and handling errors, communicating about errors and sharing knowledge (Chang and Mark, 2011). It is not always clear how these interventions should be absorbed into the everyday practices of a ward. Moreover, some studies have presumed that learning is something that just develops naturally and does not need nurturing (Vashdi et al., 2007). Popper and Lipshitz (2000) proposed that without the necessary practices in place, the learning potential of the team is lost. Hence their definition of learning

below is used as a guide, as whilst it has relevance to the context of learning from preventable adverse events in the healthcare setting it also considers the setting - the 'ward' and the 'information relevant' to the staff:

> "Institutionalised structural and procedural arrangements, and informal systematic practices, which allow the ward systematically to collect, analyse, store, disseminate and use information relevant to its performance and its members" (Popper & Lipshitz, 2000)

Therefore, this review will critically analyse the literature on how doctors and nurses perceive learning and management from MEs. This will be done by examining their perceptions of the formal and informal practices that are in place on the wards in hospitals and their relevance to learning and management of MEs.

2.4 A medical perspective of medication errors

There still remains little research evidence demonstrating how doctors respond to errors and how they engage with the formal reporting of errors (Kroll et al., 2008). Whilst prescribing mistakes are inevitable because of the complex nature of medicine, time pressures and clinical decision making, little is known of how doctors can learn better from their mistakes (Wu et al., 1991). Learning from errors can be complex. Many barriers to learning were identified in this literature review, these barriers include awareness of making a ME, reflection following a ME, taking responsibility for a ME and discussing MEs with senior medical staff. These will now be discussed in more detail.

2.4.1 Awareness

Doctors first need to be made aware that they have made an error. A qualitative single site study based in an Australian teaching hospital by Nichols et al. (2008) interviewed 26 staff (15 doctors; six interns, four resident medical officers and five registrars) using semi structured interviews, to determine the contributory causes of MEs. They found that ten of the doctors interviewed, did not know they had caused a ME until approached by the research team; the doctors related this to being asked to see patients after hours by senior doctors who were not in their primary team. There seems to be some agreement about this lack of awareness in similar studies in the UK and the USA (Dean, 2002; Fischer et al., 2006; Kroll et al., 2008). This inherent lack of feedback inhibits learning, the exception being the most serious of errors, which are identified because of their outcome (Dean, 2002). The study by Nichols et al. (2008) aimed to address learning from error by looking at the contributory causes of ME. However, a weakness of the study is that the majority of doctors interviewed were junior, and the views of more senior doctors and consultants were not included. As communication barriers between doctors were clearly identified as an issue, the inclusion of senior doctor accounts could have provided a more in-depth perspective. Participants were recruited by convenience sampling, whereas purposive sampling may have increased the likelihood of gaining a more varied sample of the team. In addition, as previously discussed the medication process involves many different people and prescribing errors are often discovered by the pharmacist or nurse later in the process (Dornan et al., 2009). The actual interviews were between 1 and 60 days following the error, as such, some of the interviews may have been

conducted with staff before senior doctors could speak to the more junior doctors regarding the error, due to shift patterns. Thus these 10 doctors who were not aware of having made an error, may have discovered this later on. However, previous research has suggested that interviews should be held as close to the error actually occurring to aid recall of what happened (Dean, 2000).

The EQUIP study (Dornan et al., 2009) was an in-depth investigation into causes of prescribing errors by foundation year doctors (FY1) concentrating on the interplay between their educational backgrounds and factors in their practice environments. This mixed methods study in the UK, utilised a large empirical evaluation of prescribing errors, followed by in-depth qualitative interviews, exploring the causes of the errors using a critical incident approach. Following this, telephone interviews with leaders of the undergraduate program's in which the FY1 trainees had been educated were conducted. The study included data collection from 19 trusts in the North West of England. In contrast to the Nichols et al. (2008) study, Dornan et al (2009) used purposeful sampling, which has been shown to be more robust (Wood and Ross-Kerr, 2006) in ensuring maximum variability of doctors interviewed. Dornan et al. (2009) found doctors rely heavily on nursing and pharmacy staff to identify and correct their errors, and possibly do not take as much care, because of this perceived 'safety net'. Whilst Dean (2002) emphasises this is one of the strengths of the system in picking up errors, it also inhibits the medical staff from learning. Indeed, doctors have reported that they would learn better from errors they have made themselves, although open discussion of other people's errors is also conducive to learning (Fischer et al., 2006). These studies

highlight that the lack of communication, poor reporting of errors and poor feedback to those involved, does not facilitate doctors to learn from their own errors, because they are not made aware of them.

2.4.2 Reflection

A prospective qualitative single site study in the UK by Dean (2002) utilised pharmacists to identify and interview doctors about their perceptions of the causation of their prescribing errors, when involved in a potentially serious ME. This study found that the medical staff did not reflect upon prescribing errors unless prompted to do so. This conflicts with findings from Fischer et al.'s (2006) study in the US in which nearly all 58 trainee doctors reported using reflection as the normal learning process following being involved in an error. Whilst the UK study included consultants, specialist registrars, senior and junior house officers (a more varied selection of participants), comparison between the two studies suggests a different approach to learning styles. NHS trusts are expected to provide feedback following an error and to allow time for reflection and learning (DH, 2013). Indeed, reflection is now part of the new medical curriculum (DH, 2008). However, medical supervisors acknowledge there are limited opportunities for reflection and no protected time for one to one supervision (Brown et al., 2007). Ideally, some individuals will develop through experiencing an error, observing the consequences and considering how to do it better next time (Dean, 2002). Dean (2002) suggest that the cost of time required for reflection is small compared to the financial and personal costs of MEs.

Kroll et al. (2008) carried out a qualitative study, using semi-structured telephone interviews, to look at the experiences and perceptions of MEs

amongst junior doctors in the UK. These 38 doctors worked in 10 different UK hospitals, who had all graduated from the same medical school and therefore had similarities in training. Kroll et al. (2008) report that the learning opportunities from MEs amongst doctors are lost as a consequence of 'informal reporting.' This conflicts with an earlier study that found that discussing errors with colleagues informally facilitated effective learning and accountability (Wu et al., 1991). However, the methodological approaches used in these two studies were very different. Wu et al. (1991) undertook a quantitative study using internally validated questionnaires to learn how medical errors made by house officers relate to subsequent changes in practice. Participants were approached on three different internal medical training programs, but no further details of sampling were provided. Random selection is a critical element for this type of questionnaire research in that generalisation is a primary goal (Edmonds and Kennedy, 2013.) The Wu et al. (1991) study had a response rate of 45%, indicating some response bias. The study by Kroll et al. (2008) used a computer generated random sample, 38 doctors were approached from a pool of 317 doctors and all consented to participate and be interviewed by telephone. The study by Wu et al. (1991) indicated that whilst only 54% of house officers discussed their mistakes with supervising physicians, 88% of house officers discussed their mistakes with colleagues. They advocate that learning could be improved by encouraging house officers to take responsibility and then discuss their mistakes with physicians in a supervisory role (Wu et al., 1991). Kroll et al (2008) attempted to identify the form in which supervisory feedback should be given. Interestingly, their study did not recommend supportive reassurance following an error, although they clearly indicated that blame is an inhibitor to learning as well. Instead, they recommended the need for specific, constructive

feedback, with training and protected time to do this. As previously discussed, NHS trusts are now expected to provide feedback and time for reflection and learning following a ME (DH, 2013).

Formal reporting of MEs by doctors is selective, although doctors may be angry or indignant when their colleagues have made an error, they do not usually report their colleagues (Kroll et al., 2008). This is not new. A previous study has described this as a 'conspiracy of tolerance', where young doctors learn to be non-accountable for their mistakes starting in medical school (Lester and Tritter, 2001). Fischer et al. (2006) report that doctors adopt this culture of not reporting colleagues in medical school, where their own individual ethic may have been superseded, changing how they would have responded before medical training. In addition, there is the fear of criticising senior colleagues (Wu et al., 1991). Historically, medical hierarchies have been shown to be integral to the way in which error is managed (Irvine, 1997; Tritter, 2001; Walton, 2006), but how this is actually played out on a daily basis in response to a ME and how doctors learn from errors is not clear. However, it does seem apparent from the literature that norms exist, such as discouraging the reporting of errors that inhibit learning. Kroll et al. (2008) propose the need to assess the impact of reflective learning, but no literature to date was found on how this had an impact on how doctors learn from MEs.

2.4.3 Responsibility

Fisher et al.'s (2006) qualitative study in the US used semi-structured telephone interviews to identify the major factors and areas of tension in doctors' learning from MEs. The interview schedule of seven questions was developed following a literature review; to identify how doctors' disclose and reflect as part of the

learner's cognitive and behavioral response to MEs. This study also highlighted the need for the learner to take responsibility as this was shown to be an important step in learning from a ME; defending a mistake is a barrier to an individual learning from it. Other studies have reported that doctors who accept responsibility for an error report constructive changes in practice (Wu et al., 1991; Kroll et al. 2008). Taking responsibility may be selective, as the majority of doctors have said that they learn best and take responsibility from errors that have a good outcome (Dean, 2002; Fisher et al., 2006; Kroll et al., 2008). In contrast, in cases of severe harm, the responsibility may have been denied and attributed to the patient's condition (DH, 2000). However, the longevity of learning from errors with the worst outcomes is questionable, as people become lax and fall back into bad habits (Fischer et al., 2006). Kroll et al. (2008) highlight that further opportunities for taking responsibility can be missed within the team by an inappropriate response from senior colleagues such as, "it's not a matter of life or death" (Kroll et al., 2008: p986). In this context it has been described as normalising as reassurance from senior colleagues impedes further discussion and therefore learning opportunities are missed (Brown et al., 2007).

2.4.4 Discussing with senior doctors

A senior doctor's personality and response to a more junior doctor's ME has been reported to affect the opportunity to learn, if chastisement has taken place (Fisher et al., 2006). Indeed, some doctors' report being forced to handle difficult situations and receiving ineffective supervision from staff not trained to give it (National Survey of Trainee Doctors, 2006). However, the DH (2008) maintains that clinical supervision is key to learning from errors. Kroll et al.

(2008) advocate the need and usefulness of discussion with more senior doctors to obtain specific and constructive feedback. Wu et al. (1991) reported that when doctors seek advice from their senior colleagues and are encouraged to discuss their mistakes, 98% reported at least one constructive change in practice and only 18% reported one or more defensive changes. Furthermore, clinical supervision has led to the detection of near misses, which then allows further discussion and learning (Engel et al., 2006).

Kroll et al. (2008) describe “the learning moment” when the most learning occurs, when the error was discussed, feedback was constructive and supportive, even if there was chastisement, as long as it was structured. This has long been a recommendation of the General Medical Council (GMC, 1993). In contrast, humiliation by a senior doctor can lead to doctors never understanding their own errors (Kroll et al., 2008). Burack et al. (1999) have previously suggested that the increased awareness of MEs, causes ‘desensitisation’ preventing learning. In line with supervision, doctors have reported that formal teaching, involving small group discussions, focused on real errors, presented by senior doctors who have been involved with MEs provides important support and learning (Fischer et al., 2006).

2.4.5 Conclusion

A lack of reporting and communication of MEs to the doctors involved in prescribing errors, does not allow doctors to learn from their own errors, because they are not made aware of them. Informal reporting of MEs amongst colleagues is common, but this may limit learning from errors, especially when doctors are not able to reflect and receive constructive feedback from senior colleagues and interpret this and make changes in practice to improve safety.

2.5 Nurses' perspectives on medication errors

Previous research has suggested that a ward with a positive learning climate can effectively use their safety information systems to evaluate and reduce MEs (Edmondson, 1996; Hoffman and Mark, 2006; DH, 2000; Chuang and Mark, 2011). However, despite this, there has been little research around the learning climate in nursing and the mechanisms involved to improve safety around MEs (Chuang and Mark, 2011).

2.5.1 Learning climate in nursing

A quantitative cross sectional study by Chang and Mark (2011) looked at how the learning climate moderates the relationship between error producing conditions and MEs occurring. This study used unvalidated questionnaires to provide a snapshot of the frequency and characteristics of 279 nurses in 146 hospitals across the United States. It partly focused on the learning climate in nursing in terms of willingness to reveal errors, degree of open communication around errors and the extent to which nurses actually identify the causation of errors. It also examined how the learning climate affected the skill mix within the team. It concluded that when the learning climate was good, the number of MEs was not dependent on the number of staff or the skill mix of the team. Argote et al. (2000) concluded that in a positive learning climate, where learning from errors is encouraged, nurses will share their learning experiences. However, learning will only occur if the nurse actually perceives this process of learning is effective in the first place, which then increases the likelihood of passing this learning onto other nurses. Additionally, nurses are often responsible for supervising other nurses to share their clinical skills, so over time knowledge of error management may be transferred across the unit, so that group learning

will take place (Chuang et al., 2007). Within nursing, informal linkages between staff (such as an individual's personal relationship with colleagues) may also affect how nurses learn from errors, especially when needing advice regarding improving practice (Chang et al., 2007). A weakness in the design of this study by Chuang and Mark (2011) was that the data collection relied on medication administration error's (MAEs) identified through incident reports alone, as such, the results may not be generalisable, as a true representation of the causative factors of all MEs (Flynn et al., 2002). Another limitation of this study is the lack of formal measurement around the role of leadership within the nursing context. From an organisation learning model context, leadership is key to successfully creating a positive learning climate (Edmondson, 2004). The role of leadership within this study was not measured and as such the study may rely too heavily on the accounts of more junior nurses. Future work could include the role of leadership, as it would be interesting to see how the nurse manager's role influences the creation of a positive learning climate.

2.5.2 Team learning and nursing

Research around adopting a team learning approach to reducing MAE's is not new (Edmondson, 2004). Previous studies have shown that there are fewer errors, when the team engages in a cyclic learning process of data collection to discover errors, analyse, reflect and implement changes (Tucker and Edmondson, 2003). Whilst Edmondson (2004) advises that data collection is a prerequisite for team learning to take place and without it the reflective process would be incomplete and happen less often. West (1996) states that gathering information is not enough, advising that further reflection is needed in order for teams to learn. West (1996) attempted to define team learning, putting forward

that the way in which group members reflect and adapt to new processes, will be related to the environment in which an individual is working. However, Edmondson (2004) outlines that reflection alone may be insufficient; it does not provide evidence on how the team has actually learned and the team must also introduce changes in the way that they perform their job. Whilst Edmondson's (2004) study favors the superiority of using the full cycle of learning, in reality, this practice may lead to 'patchy learning' where the steps of this cycle are used separately and unsystematically leading to a lack of shared knowledge and little change in practice (Drach-Zahavy and Pud, 2010). Research has shown that team structure, productivity and perceptions of power relations can shape collective learning (Edmondson, 2004).

2.5.3 Learning mechanisms

Drach-Zahavy and Pud (2010) conducted a cross-sectional sequential mixed method study using observations and interviews, to identify and test the effectiveness of learning mechanisms applied by nursing staff as a means of limiting MAE's. This study was conducted in three large hospitals in Israel, across 33 wards, with 173 nurses participating. This study explores learning mechanisms from a descriptive and theoretical point of view with the aim to make a practical contribution to team learning. This is a novel approach, because how errors are discussed and reflected on and who is actually involved in this process - inside or outside of the team - has not previously been specified (Wilson et al., 2007). As previously discussed, if the appropriate learning mechanisms are not in place, the teams' learning potential may be lost (Popper and Lipshitz , 2000).

Drach-Zahavy and Pud (2010) suggested that learning mechanisms are designed at team level, that these differ between teams and that, some of these mechanisms are ‘effective’ at promoting learning with in the team, whilst others are ‘ineffective.' They identified four types of learning mechanisms namely ‘integrated', ‘nonintegrated’, ‘supervisory’ and ‘patchy'. Wilson et al. (2007) offer an explanation for this pointing out that the effectiveness of team learning mechanisms is dependent on who operates them. Drach-Zahavy and Pud (2010) concluded that effective mechanisms are those that facilitate systematic gathering of information, rather than concentrating on singular medication errors. They also recommended that effective team learning mechanisms are those that engage and utilise all nurses on the ward with the learning process (integrated learning), rather than attributing learning to risk management or ward managers (nonintegrated learning). Whilst they observed bedside nurses to gain data on medication administration, they based their interviews solely on discussions with the head nurses. This would seem at odds with their findings, and not considering the bedside nurses’ voices and may have impacted on their findings.

2.5.4 Integrated or nonintegrated learning

Popper and Lipshitz (2000) had previously classified learning mechanisms as ‘integrated’ and ‘nonintegrated’. Advocating that for a learning mechanism to be integrated, the same people will be responsible for generating and applying the lessons learned, that is, the inclusion of all staff involved in a ME in a team meeting. In contrast, when a risk management unit collects and analyses data and implements changes in practice, this would be classified as nonintegrated (Drach-Zahavy and Pud, 2010). Nurses administer the bulk of medications and

are therefore well placed to recognise problems within the medication process (Tucker et al., 2002). Evidence suggests that when staff participate in the learning process, there is less resistance to integrated learning mechanisms and better acceptance (Edmondson, 2004). Additionally, there is the need to develop a positive safety culture at unit level, because while system level mechanisms have shown to be effective in improving medication safety, in the face of a poor local safety culture, these may be ineffective (Abstoss et al., 2011).

2.5.5 Supervisory learning

Drach-Zahavy and Pud (2010) propose 'supervisory learning' as a type of learning mechanism, that may develop in wards. This is more complex, in that it is integrated (it operates at ward level), but nonintegrated in that the ward manager has responsibility for the cycle of learning. They describe this as 'imposing' learning on nurses. In contrast, a study by Karga et al (2011) conducted across five hospitals in Greece, used an externally modified questionnaire to investigate the emotional responses of nurses and the perceived senior staff response to errors and how these are associated with constructive or defensive changes in nursing practice. Karga et al (2011) highlighted the importance of senior staff responding positively to an error, where this correlated well with constructive changes in practice; advocating the need to support staff to overcome their initial negative feelings, by managing them in a constructive way that led them to focus on correcting error producing behaviors. Karga et al (2011) also reported that defensive changes were more likely if the nurse felt unfairly treated and that the nurse was then less likely to take responsibility for the error. There is some evidence to suggest that when

responsibility of learning is given to the ward manager, the nurses will shift attention to the actions being supervised, cutting corners elsewhere where they are not (Edmondson, 2004), therefore true learning and changes may not take place. Furthermore, supervisory learning can emphasise power differences and limit team learning (Edmondson, 2004). Whereas when team leaders encourage staff to speak openly and freely, learning rates increase (Pisano et al., 2001).

2.5.6 Nurses' emotional response to errors

Relatively few researchers have actually used nurse's own voices to conceptualise the problem of MEs (Stetina et al., 2005). A qualitative study by Treiber and Jones (2010) investigated the perceived causes of MAE's to better understand how nurses deal with them. They used nurses' accounts of error to explain how they learnt from errors. They performed an interpretive analysis of written accounts made by 158 nurses who had been involved with a MAE. Embedded within these accounts was a 'lessons learned' theme which reflected how nurses developed their own personal rules as a result of an error. However, there were a number of processes that the nurse needed to pass through to reach the point of learning. Initially the accounts could be separated into either justifications or excuses. The concept of justifications and excuses stems from work carried out by Scott and Lyman (1968) in which they developed and used these statements to explain untoward behavior and bridge the gap between actions and expectations. They claimed that a justification in an account was where the person accepts responsibility for their action but denies the act was wrong. Whereas with an excuse, the person accepts the action was wrong but denies full responsibility. Treiber and Jones (2010) concluded that a 'blame

effusion' must take place in order to survive an error, more simply, nurses will make excuses and justifications to make sense of the events and allow them to continue to work after a mistake. This study reported that the lessons learned were individualistic in nature, thus adding to the understanding of personal behaviors following an error.

Similarly, Rassin et al. (2005) conducted a qualitative single site study in Israel using in-depth interviews with 20 nurses to examine the influence of MAEs on the mental state of the 'erring' nurse. They too identified from the participants the theme of 'personal lessons' learnt. However, more worryingly they found that errors can have a severe emotional effect on nurses, such as fear, guilt, shame and even mental ill health lasting for months, suggesting symptoms likened to post traumatic stress disorder. Previous studies have found similar findings of blame and guilt (Scott et al., 2009; Wolf, 2005; Wu et al., 1991), which can then lead to underreporting of errors. This study by Rassin et al. (2005) concluded that risk management relies solely on reporting, with the presumption that this is a form of error prevention that is linked to learning from errors. In reality this suggests that the first step of learning is reporting the error, but if nurses are not supported, feelings of guilt and shame that may develop will inhibit this. This highlights the importance of emotional support to aid learning individually and at the organisational level.

2.5.7 Work environment and ward learning

Initially, research looked at the nurse's perspective of MAEs, by concentrating on their personal characteristics such as experience or knowledge of medication (Chang and Mark, 2011). Further studies have also looked at nurses' perceptions of how the work environment (e.g., such as interruptions,

distractions and workload) can contribute towards MAEs (Tucker et al., 2002, Donchin and Seagull, 2002). Whilst this research has highlighted the importance of the personal characteristics of nurses, and the environment that they work, in preventing errors, there is very little research on how the ward level learning is managed in relation to the learning practices used following an error (Drach-Zahavy and Pud, 2014).

The US report 'To err is human' (Kohn, 1999:p94) highlighted that the work environment within health organisations is 'anything but conducive to recognising and learning from errors'. Where organisation learning theory outlines that organisations do not seek to change things, unless there is an obvious 'mismatch' between the routines currently used and the environmental conditions on the ward (Levitt and March 1988). A weakness of organisational learning, is that early warning signs from 'smaller failures' are not always identified as worthy of analysis and learning, and it is only when catastrophic failures become known, that early weaknesses are noted (Cannon and Edmondson, 2005).

A mixed method study by Drach-Zahavy and Pud (2014) used surveys, observations and self-questionnaires in four hospitals, across 76 wards in Israel, including 360 nurses, to look at how ward level practices are used to learn from MAEs. This study tested the effectiveness of the four different learning types identified in their previous study (Drach-Zahavy and Pud, 2010). They found that ward-situated learning practices are important in reducing MAEs, the study highlighted that personal, organisational and technological factors will limit MAEs. However, the only learning practice associated with reducing MAEs was 'supervisory learning.' This contrasts with their earlier

findings, which concluded that for MAEs to reduce, learning needed to be ‘integrated,' rather than attributing learning to the head nurse. Whereas their later research found that integrated learning practices was associated with increased MAEs, their findings that ‘nonintegrated’ and ‘patchy’ learning were not associated with MAEs was found to be consistent with their earlier work. They concluded that head nurses can facilitate learning from errors, by ‘management walk-arounds’, thereby imparting a clear message to nurses of the importance of medication safety and encouraging learning on the ward. However, the argument that demanding greater vigilance does not always result in greater safety improvements means there is the need to understand and improve human performance within the medication process (Moyen et al., 2008).

2.5.8 Conclusion

A positive learning climate in nursing affects the willingness to reveal errors, communicate openly and identify causation of errors. Team learning goes beyond the traditional cycle of learning early evidence suggests that ward level learning requires senior nurses to respond positively, with constructive support to negate the feelings of guilt and shame that may inhibit nurses’ learning.

2.6 Organisational learning

The interest in organisational learning in relation to healthcare in the UK has increased since the DH’s ‘An organisation with a memory’ published in 2000 (Chang et al., 2007) that followed the US key paper to ‘Err is Human’ (Kohn, 1999). Most organisational learning theories stem from Argyris and Schon’s (1978) book on the process of organisational learning, which looks at how the cognitive and interpersonal factors of learning behavior lead to effective

organisational learning. Effective learning occurs when an organisation is able to retain and transfer its knowledge, ideally spreading it out within all the divisions of the organisation (Dutton and Thomas, 1984). Thus, ideally within healthcare, learning from MEs should be shared and retained across the different wards.

Tamuz et al. (2004) undertook a single site qualitative study in the US at one teaching hospital using semi-structured interviews with 86 staff, which included 36 pharmacists, 36 nurses and physicians and 14 key hospital administrators to examine how the definition and classification of MEs affects a hospitals ability to learn from its experience. The effect of the definition of MEs and reporting of them has previously been discussed. However this study also found that the classification of MEs can enhance or impede organisational routines, when analysing data and learning from it. A classification scheme that is meaningful to managers and front line workers will highlight those events that need to be studied (Ginsburg et al., 2009). There appears to be a lack of research relating to how managers or staff categorise MEs with respect to learning from errors. Tamuz et al. (2004) indicated that without these formal classifications in place, MEs can be 'defined away' and as such reduce an organisation's opportunity to learn from it. A weakness of the study by Tamuz et al. (2004) was that the findings were based on a preliminary analysis of the interview data and a systematic analysis of the data was not reported.

A qualitative study by Ginsburg et al. (2009) in the US based in five different hospitals aimed to clarify what types of errors should be the focus of learning by exploring how staff understand and categorise errors. This study used ten focus groups with 6-8 staff, with a total of 74 participants. They conducted two focus

groups in each organisation; one with patient safety officers, patient care managers and pharmacy managers and the second focus group with front-line nurses and allied health professionals. They identified that staff do not adhere to the standard definitions and classifications adopted by their healthcare organisation, but instead rely on the degree of harm, the rarity of an event and their own perceived judgment of an actual error having taken place. Ginsburg et al. (2009) advocated that organisations need to work hard to maximise learning from minor near misses that are defined away, highlighting that staff find current taxonomies of errors too wordy and complex.

Chang et al. (2007) proposed a multilevel theoretical model of learning from failure, which aimed to address the gap between awareness of preventable adverse events and the knowledge that relates to how we respond and learn effectively. Using theories of organisational learning and organisational behavior they proposed that to improve patient safety in health care, organisations required consideration of the individual, group and organisation experience, in how they translate and transfer knowledge and learn to prevent errors in the future. Whilst individual learning can contribute to the group or organisational learning, institutionalised norms of the group and organisational level will also affect individuals' attention, thinking and actions (Crossan et al., 1999). Crossan et al. (1999) describe this as a circular process, although they highlight that 'institutionalised' practices will always be favored, unless there are unfavorable outcomes. Chang et al.'s (2007) model of learning led them to suggest that managers at group level need to encourage open communication and information sharing to create a positive culture of safety. Furthermore, organisations should ensure that team units have people supporting their

learning practices, with a diverse amount of knowledge and experience, such as full time pharmacists. Within this model they advocated the need for appointing formal safety leaders, within the organisation. In the UK, it has now become common practice within larger hospitals, including the hospital where this study took place, to have a 'medication safety officer' to maximise reporting and learning from errors.

2.6.1 Conclusion

Effective organisational learning aids the transfer and retention of knowledge gained from MEs, where there is a clear definition and guidance for reporting MEs. The literature suggests that organisational learning is complex and multilevel in nature, where individual, team, and organisational learning influence and affect each other. As such the importance of leadership in promoting open communication and information sharing has been highlighted.

CHAPTER 3: METHODS

3.1 Introduction

An exploratory study using a parallel convergent mixed methods approach was chosen to answer the research questions and is illustrated in diagram 2. (Creswell et al., 2011). This method used both qualitative and quantitative methods involving focus groups, interviews, content analysis of reflective learning tools and observations of nurse administering medication on the PICU.

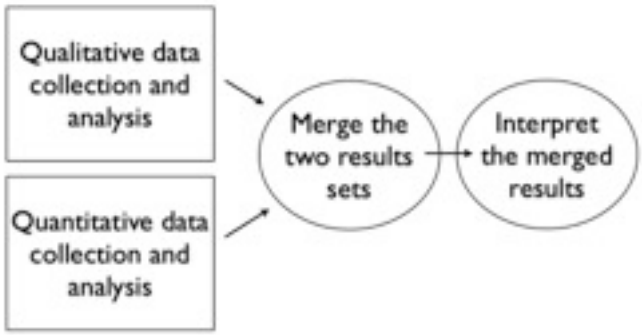

Diagram 2 Exploratory convergent mixed methods study (Creswell et al. 2011.)

3.2 Aims and objectives of the study

The aim of this study was to gain a more accurate understanding of ME occurrence in one large Paediatric Intensive Care Unit (PICU) and to explore the paediatric intensive care (PIC) team's perceptions of MEs and how they perceive that they learn from them. The intent of this study was to gain an insight into the processes and culture of MEs on this PICU, identify problems specifically associated within this PICU setting, enable meaningful feedback to

the management and staff and target interventions to improve safety and prevent errors.

The specific research objectives were to:

1) Examine how self-reported MAE rates by PICU nurses compare to those observed in practice.

2) Explore how doctors and nurses who work in the PICU perceive MEs, the management of errors and how they learn from them.

3) Examine the quality of the ME reflective learning tools submitted in the PICU.

Table 2 Relation of objectives to data collection methods

Research objective	Focus groups and interview	Observations	Content analysis of reflective learning tools
1)		X	
2)	X		
3)			X

3.3 The study setting

This study took place in a 23 bed paediatric intensive care unit, based in a large specialist children's hospital in the North West of England. It cares for children up to 16 years old from all specialties including cardiac surgery, neurology and neurosurgery, burns, trauma, infections and oncology. The unit accepts over 1000 admissions per year and is one of the largest PICUs in Europe. The unit provides all forms of therapy including haemofiltration, nitric oxide, high

frequency oscillation and cardiac extra corporeal membrane oxygenation (ECMO); providing care for level four intensive care children. The unit is predominantly open plan with eight single rooms, as illustrated in diagram 3 below.

The nursing team consists of over 160 nurses including a ward manager, eight nurse managers, a nurse consultant, three advanced nurse practitioners, a senior nursing research fellow, a clinical educator, an audit nurse and a lecturer-practitioner who runs the specialist PICU course. Other members of the PICU team include ten consultant intensivists, three specialist physiotherapists and PICU pharmacists. There is a team of 16-20 middle grade doctors; some of these are on six month rotation (paediatrics and anaesthetics) and some are training in the speciality work on PICU. The nurse to patient ratio on PICU is 1:1 for invasively ventilated children, but can be 2:1 in children who are very ill.

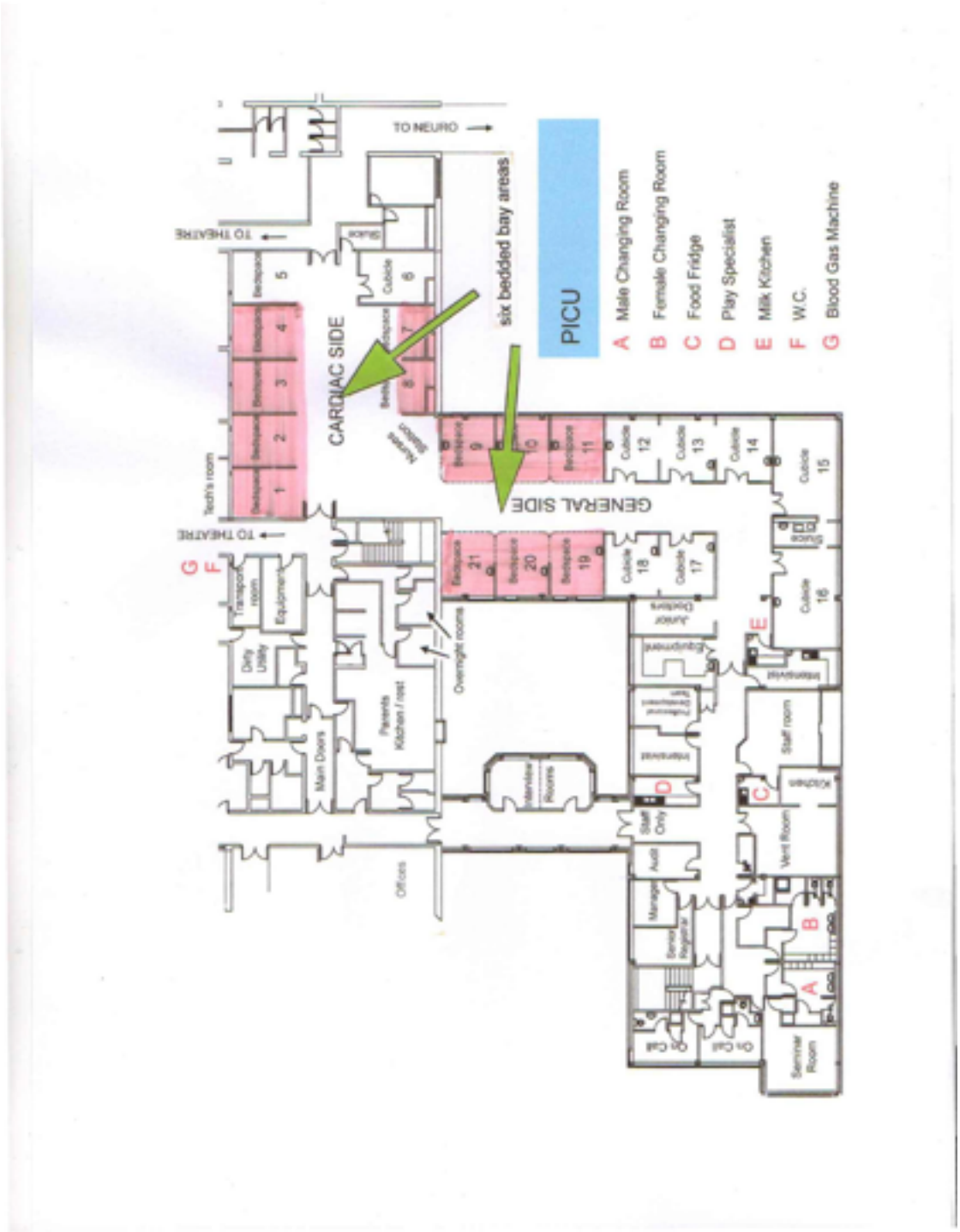

Diagram 3 Floor plan of PICU

3.4 The study design and theoretical framework

It has long been acknowledged that there is a gap between awareness of MEs and the knowledge required about how to respond to them effectively (Chuang et al., 2007.) The literature review highlighted the gap in the literature in how learning takes place following a ME in PICU. Quantitative research alone does not always answer the complex questions about the facts, measurable behaviors and cause and effect (Holloway and Wheeler, 2002). Qualitative research methods were chosen to explore the behaviors, experiences, feelings and perspectives of the participants involved in the medication process on the PICU study site. The mixed method approach was chosen for this study as it allows a focus on real-life contextual understandings, with multilevel perspectives and cultural influences (Creswell et al., 2011).

Whilst it is the intention of mixed methods research to integrate and combine qualitative and quantitative research, this can often lead to diverse philosophical positions and tensions (Greene, 2007). However, mixed methods research also represents an opportunity to challenge those tensions, giving precedence to the importance of the problem and research question, whilst valuing the positivist and constructivist approach (Morgan, 2007).

Whilst there is a growing acceptance of the use of mixed methods in research, there does not appear to be a set way of using a theoretical framework to guide inquiry (Evans et al., 2011). However, optimally all studies should draw upon one or more theoretical frameworks and mixed methods allow the opportunity for the integration of a variety of theoretical frameworks (Creswell et al., 2011). This study draws on the theoretical framework identified within the literature

review developed by Chuang et al.'s (2007) multi-model of learning from failure, which constitutes the theory of the research and will form the basis for the discussion. The framework was chosen as it aims to address how individuals, groups and organisations translate and transfer knowledge. The problem identified at the beginning of this study was that whilst individual learning may or may not take place following an error, errors were still being repeated and as such did not suggest shared learning was taking place. This theoretical framework was chosen as a best fit to explore this.

3.4.1 Focus groups

Focus groups (Kitzinger, 1984) were chosen as one of the methods, with the aim to use group interaction to explore doctors' and nurses' perceptions of MEs and how they learn from them on the PICU. The benefits of focus groups include the way they stimulate exchange of ideas, as individual opinions are formed and shaped through talking and arguing with colleagues about events and issues in everyday work life, focus groups tap into the ordinary social processes and everyday social interchange (Wilkinson, 1998). However, it would be naive to assume that focus groups produce data that are completely 'natural' as focus groups artificially set up a situation for the purposes of the study (Kitzinger, 1994). The focus groups allowed me to set up an environment in which the participants could discuss their views, listen to the views of others and reflect on what others were saying. Holloway and Weaver (2002) describe this as empowering participants to more easily express their views. This opportunity for discussion meant that focus groups were my preferred method of collecting data. Kitzinger (1994) refers to focus groups as being more naturalistic compared to semi-structured interviews. However, despite their

strengths there are some drawbacks to using focus groups including the researcher having difficulty managing the debate and less control of the process than in one to one interviews (Holloway and Weaver, 2002). One or two individuals may dominate the discussions, which may lead to group conformity or convergent answers (Carey and Smith, 1994). As such it cannot be assumed that there is conformity or group consensus between the members of the group, even if it appears so (Holloway and Wheeler, 2002), as some people may not be comfortable at expressing their views in front of other people (Polit and Hungler, 1997). It was acknowledged that nurses, doctors, pharmacists and managers would differ in their experiences of MEs and that there could be different levels of power in play between different professions and individuals. Krueger and Casey (2000) advise that focus groups are not suitable where a hierarchical relationship exists; for this reason the researcher arranged to conduct separate focus groups; one focus group for the nurses and one for the doctors, consultants and managers.

Focus groups require a topic guide (Kreuger, 1998). The topic guide was developed (Appendix 1) to guide discussion around MEs in general on the PICU, but not individual events that people had been involved with. The topic guide was designed to incorporate the main themes identified within Chang et al.'s (2007) theoretical framework of learning from failures. The questions were presented in a logical order to generate and guide discussion around the research aims and objectives. The researcher was aware that although the topic guide was a cue to guide my discussion with the participants, it was important to listen attentively, to determine the flow of the discussion and pick up areas of consensus or confrontation.

As part of the moderating focus group training, the researcher learnt to avoid using closed questions and not to ask double questions. The researcher was aware that as a band 5 PICU nurse not to make assumptions based on prior experiences and as such not to agree or disagree with the participants, but to remain neutral. New topic areas were opened with a broad question and then focused open specific questions were used to probe and explore in greater detail. The researcher was conscious not to focus on just one participant, to use visual stimuli to those participants who were not speaking and verbally encourage a response from them to join the discussion. The researcher was aware of the need to allow some time for silent thought, to allow the participants to interpret the questions being asked. The researcher used probing questions such as 'what do you mean by that?' and 'could you give me more detail?' to clarify and gain more detail. It was important to have a second researcher present at each focus group to take notes and allow the moderator to focus fully on the discussion (Holloway and Wheeler, 2002). The researcher made notes straight after the focus groups to record how the participants had interacted and any nonverbal cues that had been observed.

The scenarios were introduced at the beginning of the focus group and interviews (apart from the consultants and managers focus group) to engage the participants and encourage them to interact with each other early on (two types of scenarios for doctors and nurses, based on prescribing and administration errors respectively, see Appendix 2) The scenarios were developed and based on a previous study (Saradikar et al. 2010), which examined the attitude to reporting ME among differing health professionals. The

medication errors used in the scenarios were representative of a similar medication error that had occurred on the PICU, giving the advantage of adding a 'real life' focus to the discussion from the onset between the participants to stimulate and prompt discussion. A weakness of using the scenarios, may have been the over reliance of participants using memory, which may have limited the output and quality of data. Furthermore, it has been reported that there is often a difference between what people say they do and their actual practice (Langford and McDonagh, 2003). McCabe (2002) advises that focus groups cannot reflect real life scenarios, because they are conducted in places and times that are removed from where the actual experiences have occurred. Therefore, this may have impacted on the validity of the discussion. The scenarios facilitated data to be collected on participants opinions around actual reporting of MEs, participants were asked to complete a Likert scale on the likelihood of staff reporting an error based on four different types of MEs (Appendix 2). It allowed exploration of different views and highlighted any differences within the groups. The Likert scales were not 'personalised' to ascertain whether the actual participant would report it, but to gain an insight into the reporting culture on PICU as a whole.

Focus groups require a person to moderate them and a person to take notes. The role of the moderator should be flexibility, open-mindedness, skill in eliciting information and the ability to create an open and non-threatening environment (Holloway and Wheeler, 2002). The moderator should be able to stimulate and guide the discussion. However, Morgan (1997) advises in exploratory studies, to hold back on too much questioning, where perceptions are being examined, to

gain a true perspective and not allow the biases of the moderator to be expressed.

The environment for the setting of the focus group is important in order to set the right atmosphere, in that it should be relatively spacious, comfortable and allow participants to sit in a circle around a table if possible, as the circle arrangement encourages direct eye contact and the table acts as a protective barrier to encourage discussion (Kreuger, 1998). A pilot focus group was arranged with volunteers from the PICU, to allow the researcher to practice the role as moderator and guiding a group discussion. The session was recorded, which allowed the researcher to identify where probing questions or indeed silence would elicit more information.

Morgan (1988) suggests a sample size of four to twelve participants. A sampling framework was not used due to the low response rate to participate within the focus groups. The focus groups were scheduled to last one hour, dictated by the participants' own time and funding allocated for the nurses to attend. The researcher moderated the nurse focus group. One of the researchers academic supervisors (LT) took notes. (LT: a senior nurse on PICU) moderated the other focus group (nurse manager and consultants), where the researcher then took notes, because it was felt that this may have been problematic for the researcher in her role as a Band 5 nurse asking questions of her managers.

Before each focus group started, the topic was introduced, staff acknowledged reading the participant information sheets and then informed written consent was given. Ground rules were introduced as noted on the topic guide (Appendix

1), the tape recorder was introduced and turned on. All participants and researchers were invited to the focus groups and interviews without uniform, to remove any distinction in seniority (Kreuger, 1998).

3.4.2 Semi-structured interviews

Since it was expected that recruitment to the focus groups might be problematic because of time constraints, a fallback method was planned to collect data using semi-structured interviews. The focus group topic guide was used to introduce the scenarios and guide the interview discussion, but the sequence of questioning was not the same for each interview, as it depended on the participant and their responses. The benefit of semi-structured interviews may be that it gives more flexibility for the researcher to guide the questions (Holloway and Wheeler, 2002). However, the flexibility and consistency was balanced so that the accounts of the participants being interviewed could be compared (May, 1991). Double questions were avoided and interviewees were given time to answer and prompted when necessary to reduce anxiety (Sorrell and Redmond, 1995). Whilst the researcher was a colleague to those being interviewed and more likely to easily understand the cultural concepts of working on PICU, making assumptions was avoided, the researcher tried to act as the 'naive' interviewer to clarify meaning and avoid researcher relationship bias (Holloway and Wheeler, 2002). Another disadvantage of using interviews was the increased amount of data to transcribe and analyse.

3.4.3 Observation of nurses administering medication on PICU

Observation of the nurses administering medication on the PICU was undertaken to ascertain how reported medication administration rates by PICU

nurses compare to those observed in practice. As not all MEs are documented or reported, data were collected by observing nurses administering medication on the PICU, so as to establish a more accurate ME rate. Dean and Barber (2001) found that observational methods for studying MAE's are the most valid and reliable method, compared to chart review and reporting. The researcher planned to carry out a series of observations, lasting two hours each, during the mornings at peak medication administration time.

Observational methods are techniques to acquire direct data through observation of the phenomena and relate well to clinical practice (Polit and Hungler, 1998). Structured observations were chosen to record the structure of nurses' behaviors and characteristics whilst administering medication. A checklist in the form of a template was developed (Appendix 3), which was based on evidence identified in multiple studies by Braun safe infusion therapy to highlight the risks that can lead to a ME during administration (Friedman et al., 2007 Ferner et al., 2001; Parashuran et al., 2008; Cousins et al. 2003; Cohen et al., 2003). As such the observation template was developed to minimise researcher subjectivity, and the evidence suggested it covered each step where an error in the administration of medication could occur and hence be recorded. Limitations of structured observations that may affect external validity include behaviors and activities happening simultaneously so not all MEs may be recorded; the position of the observer obstructing the observation range; some infrequent behaviors may be missed; and in a busy environment, such as PICU, the researcher maybe distracted (Parahoo, 1997). In addition the Hawthorne (observer) effect is an unnatural reaction when being observed or assessed that has been reported as a threat to construct validity (Edmonds and

Kennedy, 2001). The researcher was aware that participants' awareness of being observed may have affected their practice and as such make the data collected artificial. However, it appeared that after a short time the participants forgot the researcher was there. This is line with research that identified that there is some Hawthorne effect in the initial stages, but this diminishes as the participants become used to being observed (Wood and Kerr, 2006).

During the observations it was also proposed that if any nurses were observed to have a near miss which was then corrected by the nurses, they would be asked to use the 'Think Aloud' method immediately afterwards (recorded into a hand held dictation machine) to describe how he or she detected the error and corrected it. Aiken et al. (2004) found that direct observations and the use of the 'Think Aloud' method optimised the data collected during medication administration. Ericsson and Simon (1998) describe this method as a direct expression of thinking and verbalising those thoughts that are normally inhibited. Aitken et al. (2004) reported that nurses' thinking processes extend beyond the rules and procedures, and the 'think aloud' method can be used to identify nurses' thought processes of professional expertise inherent in medication administration which goes beyond the technical use of the five rights for safe medication administration, in order to capture the cognitive processes that allow nurses to detect and correct errors (near misses). However, a weakness of this study is that adults may alter the course of their spontaneous thinking, so this activity may not be able to be performed objectively (Aitken et al., 2004).

Before each observation period, all nurses on duty in one of the six-bedded areas (Diagram 3) being observed for that shift were approached for verbal consent to be observed. The six-bedded areas were chosen to make observations as the researcher felt these would be the most unobtrusive areas, as a researcher to observe. Including the cubicles in the observations would limit the amount of medication administrations and put the nurse in the cubicle under too much scrutiny, making the situation artificial. All the staff knew the researcher in her role as a Band 5 nurse on the PICU, but the researcher made it clear that she was working as a researcher collecting data that shift. Many medication administrations were observed within the period, of both oral and intravenous medications. As part of the observations a reflective diary was also kept, to record field notes and make sense of the reality of practice being observed, whilst the quantitative data was being collected.

3.5 Target population

This study engaged nurses, doctors, pharmacists, consultants and managers (all staff involved in the medication process) working on the PICU. MEs can occur at each stage of the cycle from prescription to administration, highlighting that all these health professionals should be involved in an approach to preventing the problem of MEs (Williams, 2007).

3.5.1 Inclusion criteria

- Nurses on Band 5, 6 and 7 and who had been working for a minimum of 3 months on the PICU (as this allowed for completion of induction) and who had a PICU based intravenous therapy certificate
- Doctors and consultants working on the PICU

- Pharmacists working on the PICU

3.5.2 Exclusion criteria

- Locum and agency staff
- Nurses who did not have a PICU based intravenous therapy certificate

3.6 Sampling

The sampling strategies were pragmatically determined due to the constraints of the resources, accessibility and availability of the staff on this very busy PICU. An advantage of probability sampling is that it reduces the possibility of bias and ensures a more representative sample from the population, whereas a weakness of non-probability sampling is it may or may not accurately represent the population (Wood and Ross-Kerr, 2006). Therefore, although convenience sampling and purposive sampling (non-probability sampling techniques) are not the most robust sampling methods, they were chosen due to their practicality.

Sampling for the observations, focus groups and interviews was undertaken using convenience sampling as it was acknowledged that this approach was a pragmatic way of inviting people to participate in the study during the sessions. (Edmonds and Kennedy, 2013.) The heterogeneity of the sampling for the focus groups and interviews was purposive to include nurses, doctors and pharmacists. Professionals who were available and willing to participate were recruited to the study. A weakness of convenience sampling is that there is no way of estimating the potential bias of the sample selected, the researcher

remained objective by avoiding deliberate selection (Wood and Ross-Kerr, 2006).

The sample of reflective learning tools that had been generated as part of the usual practice on the PICU in response to a ME were all selected over a 12 month period of April 2012 to March 2013 [n=39], all the samples in this period were analysed in their entirety.

3.7 Recruitment

3.7.1 Recruitment of participants for focus groups and interviews

Recruitment for the focus groups and interviews was initially through posters placed around the PICU (Appendix 4). An emailed flyer was also sent to all staff on the unit (Appendix 4) and this email also included a Participation Information Sheet (Appendices 5,6,7 and 8). Participation was voluntary and relied on the willingness of participants with no coercion. Three possible dates for the focus groups were emailed to staff interested in taking part who met the inclusion criteria and the most convenient date was arranged. The interviews were arranged at the end of a shift, to suit the interviewee. All participants who attended the focus groups and interviews were asked to read through the participant information sheets, before giving informed consent (Appendix 9).

3.7.2 Recruitment of participants for observations of medication administration

Recruitment for the observations was initially through posters placed around the PICU and an emailed flyer to all staff on the unit (Appendix 10). Participation Information Sheets were attached to the email (Appendix 11). The lead

researcher and nurse researcher gave contact details to answer any questions regarding the study. On each proposed shift that observations were to take place, the nurses at the start of that shift were approached and given information sheets. Informed written consent was taken from all the nurses who were likely to be administering and checking medication within that two hour period.

3.8 Data analysis

3.8.1 Focus groups and semi-structured interviews

The researcher transcribed the focus groups and interviews, which helped in the familiarisation process with the data and allowed initial analysis to begin. All focus group recordings and study data were stored according to the UCLan and Alder hey NHS FT data protection requirements as per ethics approval.

The transcripts from the focus groups and interviews were subjected to a thematic content analysis using the guidelines proposed by Burnard (1991) to identify emerging themes. The method provided a step by step approach to coding and categorising the transcripts (Table 3). The researcher transcribed the audio-files and then made notes about general themes that were identified. The transcripts were imported into NVivo software computer program used for qualitative data analysis, as this software helped me to organise, sort and analyse the data.

Table 3 Burnard's framework (1991) for analysis of focus groups and interviews

1. Transcription of taped interviews
2. Transcriptions read and notes made about general themes.
3. Open coding - re-read transcripts and develop descriptive categories
4. Grouping of categories from step 3 under higher order headings
5. Repetitious categories and headings removed from the list
6. Independent categorisation by two colleagues and comparison of three lists
7. Transcripts re-read alongside final list of headings and categories
8. Sections of transcript coded according to the list of category headings
9. 'Cut or clip' (manually or electronically) highlighted transcript sections
10. 'Paste' sections of transcripts under corresponding categories and headings
11. Categorisations returned to interviewees to check appropriateness
12. Filing of category system with copies of original transcripts
13. Systematic writing up of results including direct quotes from transcripts
14. Discussion of findings alongside relevant literature and research

Initially, the researcher open-coded the transcripts to develop descriptive categories (for example, good practice and bad practice). These categories were then regrouped under higher order headings (for example, experience of MEs and reporting of MEs). Repetitious categories and headings such as 'emails' and 'contributory factors' were removed. The researcher then reviewed these categorisations with expert qualitative researchers (my supervisors). New categories such as barriers to reporting and culture on PICU were identified with the supervisors and a final list of headings and categories were made. The transcripts were then reread alongside these new headings and categories and

sections of the transcripts were then clipped electronically under the corresponding category to which they belonged. Appendix 12 shows the final audit trail on NVivo. Whilst NVivo was useful in sorting the data, the researcher found that the last stages of data synthesis, where she linked all the categories together to identify the mega category and core categories were easier to visualise by forming a table (Appendix 13) and drawing a large mind map. The researcher found that at this stage of synthesis her preference was to be more 'tactile' in the way she handled the data.

3.8.2 Content analysis of Reflective Learning Tools

Content analysis has been defined as a systematic, reproducible technique for condensing large amounts of text into fewer content categories using explicit rules of coding (Weber, 1990). Holsti's (1969) framework employs systematic techniques (see below) for making inferences about the characteristics of Messages within text in an objective manner. Holsti's framework was chosen as it allowed the researcher to sift through large volumes of data, which would have been too onerous to search out by other methods and too time consuming within the scopes of this study (Weber, 1990). The aim of the content analysis was to identify trends and patterns within the data (Table 4).

Table 4 Questions to guide content analysis (Holsti, 1969)

Questions to guide content analysis with my answers	
1) Which data are analysed?	The data to be analysed were the reflective learning tools
2) How are they defined?	Brief' entries or 'detailed' entries
3) What is the population from which they are drawn?	PICU doctors and nurses
4) What is the context relative to which the data are analysed?	The context was PICU
5) What are the boundaries of the analysis?	A 12 month period (April 2012 to March 2013)
6) What is the target of the inferences?	Identifying how staff understand and learn from MEs.

First, the researcher defined the reflective learning tools as either being 'brief' entries or 'detailed' entries about the incident, which was dependent on the volume of words and level of reflection and self-analysis of the individual completing the tool. The researcher also took note of the words that were mentioned frequently. The researcher was aware that each word must be considered within its context as some words such as 'distracted' may have multiple meanings. Within this study a category was defined as a group of words, such as 'emotional impact' with similar meanings (Holsti, 1969). Once the researcher had been working closely with the data from the reflective learning tools, she was able to develop three core categories (emotional impact, rationalising and external excuses) that accommodated all the data. The results for this content analysis were incorporated within the results from the focus groups and interviews following the core category 'Learning from MEs' as supplementary evidence on learning styles within the PICU

3.8.3 Data analysis of observations

The number and route of medications administered over a 24-hour period on PICU were recorded over ten nonconsecutive days to obtain the mean number of medications given per patient per day. Every morning, before patients were discharged from the PICU, the number of medications administered (oral, intravenous, continuous infusion and bolus) was counted over the previous 24-hour period on a tally chart for each patient. The number of patients on PICU was also recorded. The mean number of medications administered over a 24-hour period and the average number of patients on PICU was calculated (Appendix 14). This was then used as the denominator, to calculate an event rate with the MEs identified during the observations. The observation template used to record MEs and allowed the identification of areas for improving compliance with the medicine administration policy and protocols.

3.9 Ethical approval and issues

Ethical approval was obtained from the BuSH Ethics Committee at the University of Central Lancashire on 15 July 2013 (Reference number BuSH 187). The study was also approved the Alder Hey Research Review Committee and Development Department and the Clinical Lead Director and Nurse Manager of the PICU where the study was based (Appendix 15). This study did not need NHS research ethics approval (HRA) because the research only involved NHS staff, not patients (HRA, 2011). The study was registered as an audit [audit number 2498] with the Alder Hey NHS Foundation Trust.

It was decided that in the event of a near miss or possible ME, the nurse-researcher would intervene before a medication error was about to occur. If this

caused stress to the nurses involved, the researcher would stop observations at this point to support the nurse/ nurses to ensure patient safety. Any concerns would be reported to the nurse manager in charge for that shift. Similarly the observation would be stopped if following a near miss or ME the nurse was asked to use the Think Aloud technique, but was too distressed. On conclusion of each observation session, the researcher would make sure that all the nurses on that shift were comfortable with the observations before leaving the ward.

Participants taking part in the focus groups and interviews were invited to put forward their perceptions and were advised against discussing any one particular individual's experiences in detail that could offend or cause discomfort to themselves or other participants. At the end of each focus group, the researcher checked that none of the participants were distressed by any of the contents of the focus group, and offered to arrange further support if necessary. As part of the interviews, pharmacists were invited to attend. Due to the small number of pharmacists who work on PICU regularly, no **direct** reference was made to highlight that the data had been drawn from any discussion undertaken with the pharmacists. This confidentiality was assured before commencement of any interviews with the pharmacists at their personal request.

3.10 Maintaining confidentiality

As with any research or audit, the researcher had a duty to keep all data confidential and non-identifiable. Data were anonymised, all identifiers were removed and replaced by a code. No records of identifiers were retained. All audio recordings were destroyed following transcription. Manual data were stored in a locked file, in a locked office on the PICU at the NHS site. Electronic

data were stored on a secure drive of a password protected NHS computer only. Only an individual with a password could access the hospital's encrypted files on the Alder Hey server. All participants were informed that no publications would identify any of the participants. All data will be held for five years as per NHS trust policy and then destroyed.

3.11 Consent

The principle of respect for autonomy includes choice and free decision to consent (Holloway and Wheeler, 2002). Particular care was taken as the researcher was a nurse on the PICU, not to influence or coerce anybody to take part. A full explanation of the study and participation information sheet was given to staff who expressed an interest, generated from the initial emails sent. Following this written and informed consent took place (Appendices 8 and14).

3.12 Reliability and validity of the observations

Reliability refers to the consistency of the research tool used and the reproducibility of the results, whereas validity in quantitative research refers to the extent to which a tool measures what it is supposed to measure (Wood and Ross-Kerr, 2006). A validated tool for measuring MAE rates was not found from a review of the literature. Therefore a tool was developed, based on current evidence, on where error in the medication administration process normally occurs. This would have affected the validity of the observations and is often known as face validity, where the tool appears an appropriate way to answer the research question (Wood and Ross-Kerr, 2006). External validity around

sampling and data collection have previously been discussed in the study design section.

3.13 Trustworthiness - credibility, dependability, confirmability and transferability

Data quality is important in qualitative research, in that there should be confidence that the data represents the true phenomena under study. The criteria often used to assess the trustworthiness are credibility, dependability, confirmability and transferability (Lincoln and Guba, 1985). Various techniques may be employed to improve and document credibility, including prolonged engagement and persistent observation to achieve scope and depth. The constraints, costs and accessibility were limitations to the amount and time of each focus group and interview (Lincoln and Guba, 1985). Triangulation of the data, in this mixed methods design, aims to improve the credibility of the findings. Lincoln and Guba (1985) recommended peer debriefing, where the researcher is exposed to the searching questions of others who are experienced in qualitative research. Regular supervisory sessions allowed discussion of data interpretation issues and comments. The use of Burnard's (1991) framework acted as a guide to assist with credibility and dependability of the data. The confirmability or neutrality and objectivity of collecting data and analysing it has been mentioned within the study design, and the audit trail produced from using the NVivo data package (Appendix 12) serves as a tool of persuasion that the data is worthy of confidence (Polit and Hungler, 1997).

In summary, the reliability of the data was established by comparing responses from two focus groups and six interviews, the trustworthiness of inferences was ensured by multiple coding, and audit trail and peer review. In Lincoln and

Guba's (1985) framework, transferability relates to the sampling and design and as such, the researcher cannot specify the external validity, but should provide the contextual thick description necessary so that someone interested in making a transfer can contemplate the possibility.

3.14 Reflexivity

Researchers are the main tool of research and must reflect on their own actions, feelings and conflicts that are experienced during the research and as such it is ongoing throughout the data collection, analysis, interpretation and writing up (Holloway and Wheeler, 2002). Reference has been made throughout the study methods, where the researcher has taken a self-critical position to enhance the rigor of the research. As a Band 5 staff nurse on the PICU, the researcher continually reflected on her own values and preconceptions of working on PICU to minimise the effect on the research process, as prior knowledge cannot be separated from the mind (Steedman, 1991; Denzin, 1994), reflexive research should take account of the researcher involvement. It is important here to distinguish between the methodological reflexivity and introspective reflexivity, where it is impossible for the researcher to remain outside and as such the presence of the researcher in whatever form will have some kind of effect (Denzin, 1994). During the interviews and focus groups, normally the interviewers aim to establish a good relationship with the participants to gain a deeper insight into the subject matter. Within this study, the researcher already worked along side the participants in a professional PICU nurse role. As part of the research process the researcher wrote down her own preconceived ideas before undertaking the research. As such, the researcher was aware of her own pre-conceived ideas, in which she needed to

question continually how **her** interpretation of the data, led to the findings. The data analysis of the focus groups and interviews involved independent catagorisation by two colleagues (Supervisor and Director of Studies), one of whom, also worked on the PICU. This allowed a deeper questioning of the thought process of the researcher, during the analysis stage. The numerous quotes provided within the results section and the audit trail taken from the NVivo analysis, provided reassurance about the reproducibility of the findings. The researcher initially open coded **all** the data, the researcher utilised quotes from **all** the participants, ensuring that she did not quote from one participant more than the other, which could have lead to researcher bias. As part of the research process, the researcher kept a reflexive journal to record details, which included how the researcher may have influenced the results of each interview, focus group and the observations.[Such as using leading questions] Whilst the additional information recorded in this journal was used to enrich the findings of the study, it also was intended, to allow the reader of the study to assess any concerns regarding the interpretations of the findings (Roller and Lurkas, 2015). Reflexivity is an essential process when undertaking any study, however each study is unique, thus requiring the individual researcher to determine how best to proceed. As part of this study, there were times when the researcher identified areas of potential role conflict, that made her feel anxious, or even annoyed. By writing a reflective journal, the researcher was able to identify these areas, where there may be a lack of neutrality, which otherwise would have lead to further research bias.

3.15 Conclusion

The methodology has attempted to address the issues and limitations identified within the literature review of previous research. Creswell et al.'s framework (2011) guided the methodology and the results reported conform to GRAMMS guidelines for the reporting of mixed methods studies (O'Cathain et al., 2007). This guidance is designed to assess and improve quality in how researchers' report research of this type.

CHAPTER 4: FINDINGS

This chapter will present the results and has been structured into six sections (Table 5), corresponding to the different methods used for data collection for clarity. In total 17 staff participated in focus groups or interviews, 39 reflective learning tools were analysed and 59 medication administration episodes were observed over 12 hours (Table 5).

Table 5 Breakdown of participants and data collection

Findings	Method of data collection	Data source
Section 4.1	Likert scale following scenario's	Nurse focus group and Interviews (participants detailed below)
Section 4.2	Observations (n=6) (duration two hours each)	59 medication administration episodes in total
Section 4.3	Content analysis of reflective learning tools	39 completed reflective learning tools in total
Section 4.4 **Section 4.5** **Section 4.6** (Each section represents a core category)	Nurse focus group	Junior staff nurse (n=2) Senior staff nurse (n=2)
	Nurse manager and consultant focus group	Nurse manager (n=2) Consultant (n=4)
	Interview 1	Registrar (n=1)
	Interview 2	Registrar (n=1) ANP (n=1)
	Interview 3	Registrar (n=1)
	Interview 4	ANP (n=1)
	Interview 5	Band 6 nurse (n=1)
	Interview 6	Pharmacist (n=2)

This chapter will first describe the findings from the scenarios that were used to commence the nurse focus group and interview discussions (section 4.1). This chapter will then present the results of the observations (section 4.2) and finally the content analysis of the reflective learning tools (section 4.3). The main part of this chapter (sections 4.4, 4.5, 4.6) presents the findings from the thematic analysis of the data within both the focus groups and interviews that generated the core categories. Three overlapping core categories are presented (Diagram 4), which gives an overview of their relationships, to each other. The meta-category - 'reality of practice' - is the central concept that provides a means of synthesising the range of participants' perceptions and practices.

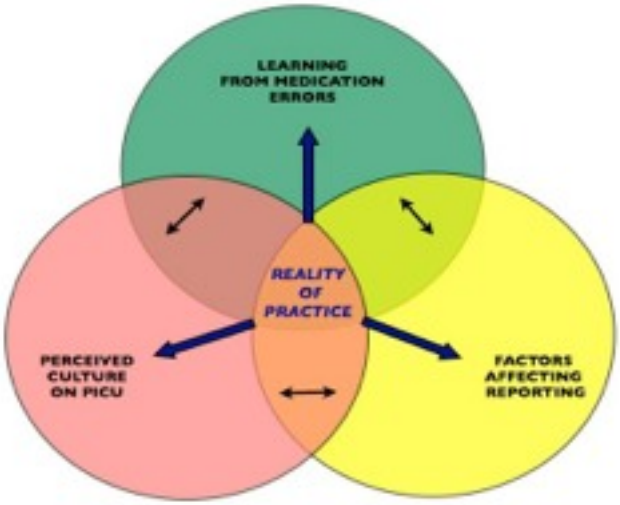

Diagram 4: Model of the 'Reality of practice' and its association with MEs

Diagram five further illustrates the structure of the core categories and sub categories to provide the reader with clarity about these categories (p.57.)

Direct anonymised quotes from the data have been used throughout the chapter. Where quotes have been used in the text to illustrate a particular point, an abbreviation is used to distinguish the setting and type of health professional speaking (Table 6).

Table 6 Descriptor abbreviations for direct quotes in focus groups and interviews.

Abbreviation	Descriptor
Reg	Medical registrar
Cons	Consultant Intensivist
JSN	Band 5 Junior PICU staff nurse pre paediatric intensive care course
SSN	Band 5 Senior PICU staff nurse post paediatric intensive care course
B6	Band 6 nurse PICU (sister or charge nurse)
AHP	Allied health professional
P	Participant
Int	Interview
MFG	Manager and consultant focus group
NFG	Nurse focus group
NM	Nurse manager
ANP	Advanced nurse practitioner

Diagram 5. Overview of the meta category, core categories and sub-categories from focus groups and interview analysis

4.1 Scenarios – staff perceptions of MEs and error reporting

Four different ME scenarios were presented to participants at the beginning of the interviews and focus groups (Appendix 2). As part of the scenarios staff were asked to talk through each scenario and discuss which scenarios would be reported (complete a critical incident form). Following the discussion participants were asked to grade the scenarios using a Likert scale, 1-5 (1, not report to 5, definitely report) in likelihood to report a medication error, based on the severity of the scenario. Likert scales were completed by 12 participants.

Table 7: Staff likelihood of reporting the ME

	1 Would not report	2	3	4	5 Definitely report
Scenario A	9/12 (75%)	1/12 (8%)	2/12 (16%)	0	0
Scenario B	0	0	0	3/12 (25%)	9/12 (75%)
Scenario C	0	0	0	0	12/12 (100%)
Scenario D	0	0	0	0	12/12 (100%)

The results (Table 7) indicated that if the ME was detected prior to administration to the patient (Scenario A) 75% (n=9) thought that the error would not be reported on the PICU. If the medication had been administered to the patient (Scenario B) 75% (n=9) thought that the error would have been reported. In Scenarios C and D, both of which resulted in harm to the patient, there was a clear indication that these MEs would be reported by all. Scenario

B, where the ME resulted in no harm to the patient, led to the most discussion. Although 75% (n=9) of the participants said that in scenario B the ME would have been reported, three (doctors and advanced nurse practitioners [ANPs]) scored four (Likert scale) reflecting some doubt, of whether this type of medication error would be reported on this PICU. One registrar explained:

> *'You would hope that it would be, but it is probably not' (Int1,Reg).*

Some participants felt that because the medication was heparin (classed as a high risk medication) the ME would be reported, whereas other medications, might be a *'little further down the scale towards a two or a one [Likert scale]' (Int2,Reg).* A heparin error was talked of as a 'never event' making it:

> *'Far more likely to be reported. If you asked me the same question about morphine, then maybe not' (Int2, ANP).*

All the nurses in the focus group agreed that in scenario B, the ME would be '*definitely*' reported because:

> *'…It is a safety issue then isn't it? The patient has actually received the medication' (NFG, P3, SSN).*

The scenarios were used to set the scene within the nurse focus group and the ANP, pharmacist and medical interviews to open the discussion around MEs. The findings that are presented in section 4.4 emerged from the content analysis of the transcripts of all the focus groups and interviews; they also draw on the discussion from the scenarios, where appropriate.

4.2 Observations of medication administration on PICU

Observations of nurses administering medication were undertaken for a total of 12 hours in January 2014, across six shifts including both day and night shifts. The number of patients on the PICU during each period of observation was recorded in Table 8 (Appendix 14). From this, the mean number of patients on the PICU during each observation period was calculated as 19 (so with 21 funded beds that is a 90% occupancy rate). A mean of 30.6 oral/Intravenous (IV) medications were administered per patient per day.

Any MEs, near misses, or violations observed were recorded on an observation template (Appendix 3). An event rate of actual MEs was calculated as shown below (Table 9). In total, 59 medication episodes were observed, consisting of oral medications, n=29, IV medications, n=33.

Table 9 Incidence of MEs during observation period

Observations	No of MEs observed	No of medications administered	Incidence of MEs
PICU	3	59	5.1 Per 100 medication administered

Three errors were observed over 12 hours of observations during the month of January 2014. During this month 10 actual medication error were reported via the hospital reporting system (not including the three errors observed.). This equates to 10 errors reported over a 744 hour period. If the number of medication errors actually observed were extrapolated to give an estimation of the number of drugs which potentially could be observed over a month period

this would result in a calculation of 186 medication errors in that monthly period. This would then give a guide of 5.4% of medcation errors are currently reported on the PICU. This is line with previous research mentioned in the literature review, that only 5% of medication errors are currently reported.

Three errors occurred during the observation periods. *(Notes in italics are taken from reflective diary during observations, to give further insight)*:

Error 1: An IV morphine infusion was made up incorrectly, resulting in an under-dose of medication. *(The analgesia had been reviewed on the morning ward round at 0800hours and re-prescribed at a higher rate, 0.2mls/hr increased to 0.3mls/hr, which equated to 4micrograms/kg/hr being changed to 6micrograms/kg/hr. Shortly after the first staff nurse for this patient was reassigned to another patient. The analgesia increase was not handed over to the new member of staff, who was temporarily taking this patient until the late shift nurse (assistant nurse practitioner who do not administer medication) came on to take over. This patient was due to be discharged from the ward, having had three different staff nurses that shift).*

The two staff nurses (this was not their patient) checking the morphine nurse controlled analgesia (NCA) did not notice the prescription change. The error was picked up by the team leader, when the patient became increasingly unsettled with tachycardia, indicating pain. *(This Band 6 nurse on duty, did not want to use the 'think aloud' method and record her thought process in finding the ME, but said she knew instinctively because she attended the doctors ward round and knew about the planned increase in analgesia. The Band 6 was*

checking that the patient was ready for discharge, when she noticed the error. The two nurses who had changed the morphine NCA, also declined recording their thought process, through the 'think aloud' method. However, on review of the observation charts, the patient had been tachycardic for some time, indicating the need for increased analgesia.)

Errors 2 and 3: A transcription error on the medication chart the previous night resulted in an administration error (two errors). A new prescription booklet was transcribed over a night shift. Oral Potassium Chloride was prescribed instead of oral Potassium Citrate. The day nurse, during the observation period, noticed the error because she had looked after the patient the previous day. The wrong medication had been given once. Due to a low doctor: patient ratio that shift, a doctor was not able to review the patient immediately, leading to an additional omission error, as the medication was then administered late. *(The staff nurse who noticed this error, was reluctant to report the ME officially. When I asked her why, she said the Band 6 team leader on that day, said it was 'too much paper work'. The nurse also confided that she had been involved in a ME a few weeks earlier, she felt publicly blamed for it and was therefore, reluctant to report MEs in the future).*

These three errors that occurred during the observation of nurses administering medication were not identified through the formal hospital electronic reporting system for MEs or the paper form additionally used on PICU.

Across these 59 medication administration episodes, 19 interruptions were observed, but none during the three errors. Violations and deviation from

protocols for medication administrations were observed to increase with distractions and interruptions. *(Some of these distractions could not be prevented, such as those encountered by the Haemofiltration (HF) nurses. During observations a patient on HF, was due to have their infusions changed. The HF system alarmed twice (fluid bag was changed and filter changed). Patients on HF normally have two nurses (HF nurse and a bedside nurse), however, due to low nurse numbers on the shift observed the second nurse was an unqualified assistant nurse practitioner (who cannot administer or check medication) as such the HF nurse had to change the patients infusions. It was observed during these distractions the infusion pumps were only reprogrammed, checked and started by one nurse, rather than two according to protocol. It is noted here, that there were many examples of nurses being interrupted by other staff and parents, who did control the interruptions, stating they were checking medications. However, during the observations, consultant intensivists, doctors and physiotherapists, freely interrupted nurses, where the researcher perceived that the nurses were clearly checking medications, or programming infusion pumps. In one particular observation, one nurse was interrupted four times, by three different members of staff and a parent of a different patient (two for social reasons and two for professional reasons). It was observed in this particular case that the bedside nurse did not check if the infusion pumps was programmed correctly whilst changing inotropes.*

From the data collected using the observation templates during the observations a number of areas were identified for improving compliance with administration policy and protocols:

- **In 86%** of occasions where medications were administered to patients - staff were not visibly seen to check identification bands or patient names on prescriptions booklets.
- **In 7%** of medications administered intravenously, staff did not check the correct route i.e. peripheral/central venous line
- **In 15%** of medications administered intravenously, staff did not check compatibility with other medications in the IV line being used.
- **In 16%** of medications administered as a continuous infusion, staff did not check the correct infusion pump rate programed.

4.3 Results of the content analysis of reflective learning tools

The content analysis of the reflective learning tools reported here enhances the understanding around the 'reality of practice' in how the current process of 'learning from MEs' takes place on PICU. The following six questions were asked to address the content of the reflective learning tools: 1) Which data are analysed? 2) How are they defined? 3) What is the population from which they are drawn? 4) What is the context relative to which the data are analysed? 5) What are the boundaries of the analysis?
6) What is the target of the inferences?

Thirty-nine tools were completed over a 12-month period (n=29 nurses; n=10 doctors). The completed tools were classified into two groups; 'brief' reflections (n = 19, 51%) and 'detailed' reflections (n = 20, 48%); simply by the amount written and depth of self-analysis. Within the completed tools, ineligible handwriting hampered some of the analysis. Two themes were identified:

4.3.1 Emotional impact of the error and coping

Nurses were more likely to describe quite negative feelings, reporting feeling *'devastated,' 'upset,' 'physically sick,' 'stupid,' 'awful,' 'mortified,' 'deeply shocked'* and *'disappointed.'* The emotions expressed were similar regardless of whether the medication error was classed as minor or more serious to the patient.

Doctors more often described the error in an unemotional and objective manner, externalising their feelings, for example using the term *'failure'* concerning an action which led to an error: *'failure to know the correct dose,' and 'failure to read notes',* and were aware that *'this may have potentially affected patient safety.'*

In trying to cope with the error staff often tried to rationalise their actions which had led to the ME, such as *'high workload,' 'new shift pattern,' 'tired,' 'distracted,' 'other staff may be able to shut out the noise,' 'busy patient,' '[poor] staffing levels'*.

4.3.2 Rationalising and external excuses

Staff often blamed themselves - *'I failed to properly check the medication dose,'* - and then appeared to look externally to find an excuse or rationalise the error such as *'the prescription chart was unusual for PICU,' or 'the patient had newly arrived and their gestational age may not have been known.'*

Staff articulated how they had learned individually from the error and how they planned in the future to *'personally be more thorough,' 'ensure I calculate*

dosage independently' and 'remain focused.' Only one reflection referred to learning from the error as a team, suggesting sharing learning from the error across the unit as *'changes need to be made, other staff not to interrupt when medications are being checked or administered.'*

4.4 Perceived culture on PICU

The category 'Perceived culture on PICU' focuses on the causative factors that were identified as contributing to medication errors on the PICU. The category is composed of five subcategories: 'human error'; 'external distractions'; 'communication' of MEs across the PICU; the 'operating theatre culture versus the PICU culture,' 'challenging senior nursing staff' and 'routinisation.' The 'reality of practice' is evident throughout the data and is representative of how the staff perceive the realities of working in PICU and how this may contribute to MEs.

4.4.1 Human error

This sub category refers to the participants' acknowledgement of how lapses in concentration may contribute to MEs and their understanding of the factors involved. The doctors, ANPs and nurses acknowledged that whilst MEs are inevitable, learning needed to occur, one registrar explained:

> *'So errors happen, there won't be a unit where there are no errors, all humans error, so if error happens and you learn from it, which I think we have learned, that is a very good thing.' (Int3,Reg.)*

This acknowledgement was evident throughout the discussions about people making errors, and was used as an underpinning rationale for having several

levels of checking in place as a means of trying to mitigate MEs. One ANP summed this up by saying:

> *'I think on the whole individuals recognise their place in that checking process, there is always times when it falls down' (Int4, ANP).*

Whilst the nurses recognised that all *'all human beings can make mistakes'*, the term *'human error'* was used loosely and with little overt understanding of the factors involved, such as situational awareness about MEs. Issues such as being distracted, which then may have led to a slip, lapse in concentration or a mistake, were not always fully acknowledged; the tendency was to see errors as being inevitable:

> *'That is how MEs work though, that is how it happens, when you go "50:50, yeah, yeah" and you just, its human error isn't it? So I think you are always going to get the human error element.' (NFG,P3,SSN.)*

Participants recognised the need to be aware of their own potential for 'human error' and the potential for error in staff whom they relied on as a safety mechanism, as one of the JSN…. explained:

> *'Pharmacy are brilliant, but there was one the other day and because pharmacy had checked it.[identified by green pen on the chart then people assumed it was correct].....it was wrong and pharmacy had checked it wrong, but it was like...pharmacy had checked it, but they are human as well!' (NFG,P4,JSN.)*

‘Human error’ was used as a generic explanation for many errors and often used to shift the focus from an individual and to depersonalise the error as one consultant described:

> *‘I think a thing people used to say, “I was tired because I worked the night, the unit is busy, I was distracted.” Is it not people reluctant to say, “oh dear I just made a mistake,” which I think is a really difficult thing to say’ (MFG,P1,Con).*

This generic terminology ‘I was distracted, tired’ was something the managers described was often evident in the reflective medication error learning tools. It appeared to the managers that people were unable to think why they had made a mistake and felt the need to use an excuse, as the following excerpt shows:

> *‘That is what I was saying about the nurses [reflective learning] tools you can almost see they are trying to think of an excuse about why they made the mistake……. that they are trying to fill the page with.’ (MFG,P5,NM.)*

The ‘reality of practice’ is that nurses complete the tools and may identify *‘I was tired’* as a causative factor, but the managers who see this terminology frequently used, frame it as an excuse. However, some participants explained that they had made mistakes and admitted they did not recognise why the mistake had happened, as one of the consultants explained:

> *‘I just don’t know what happened, you know it is obviously wrong, but I don’t know how I got it wrong’ (MFG,P3,Cons).*

Some doctors distinguished between internal distractions, external distractions and the PICU environment:

'So that [the internal distraction] won't go off if you just give them a quiet room. So I don't know how we get about that distraction…… sometimes a distraction is a physical person coming and disturbing you [external distraction], but in some people and certainly I think this has happened with me, the distraction was because I was thinking of something else [internal distraction]' (MFG,P3,Cons).

However, after involvement in a ME, some participants had a heightened awareness of the need to be *'much more focused'* and reduce distractions, as one band 6 nurse recalled:

'I remember I made a medication error very early in my career and I have never forgotten it.' (Int5, B6N.)

4.4.2 External distractions

'External distractions' such as interruptions were part of the 'realities of practice' and were one of the main causes of MEs on PICU. External distractions were reported as causes of MEs by managers, doctors and nurses during prescribing and administration of medications. One of the consultants provided a typical response:

'I don't know why nurses make mistakes but when I have looked at why doctors make mistakes it is because of all the distractions around them' (MFG,P3,Cons).

Doctors reported that nurses distracted them when they were prescribing:

'When you are being chased around to prescribe something which actually needed time to think about one thing, rather than being distracted by

requests for non-urgent things like slightly low potassium which is not a medical emergency' (Int2,P1,Reg).

The ANPs reported that no matter what you were doing, there was a culture within PICU of staff interrupting you, and this led to being distracted when you were prescribing. One of the ANPs explained:

*'There definitely **isn't** a culture of not disturbing medical staff or ANP's when they are prescribing, because people just come and disturb you, no matter what you are doing. It's very unusual that somebody actually stops for a second and thinks, oh, you are prescribing.' (Int4,ANP.)*

The nurses also reported that interruption and distractions when they were preparing and administering medicines were common and came from doctors and families, for example:

'Like the doctors interrupting you when they come to the bed space and being able to say "Hang on a minute, I am just checking medications" because quite often you are drawing up your infusions …….and you are talking and oh yes this is this ……and you are getting interrupted and you are getting distracted.' (NFG,P3,SSN.)

The nurses noted that a *'change in culture'* was needed to improve safety around MEs so that interruptions could be stopped. All participants said that distractions increased the likelihood of making a ME. However, the majority did not feel that they were able to change this aspect of the PICU culture, as on a busy PICU:

'I don't think you can eliminate every distraction' (MFG,P5,NM)

Only the more senior doctors and consultants thought that whilst it would be impossible to eliminate all distractions they could be controlled, rather than using distractions *'as an excuse'* as the following quotation makes clear:

> *'You can control distractions, so say when the parent are talking to you, you say "Okay just one second I just need to finish this and then you get my full attention" and ditto with the nurses, I quite often say to the nurses 'Do you need this medication now?' and they will say, 'Oh, no. Okay' (MFG,P1,Cons).*

The nursing staff appeared to find it more difficult to control distractions within the environment as they often multitasked as one of the nurses described:

> *'Do your infusions and … support the family and do this and the doctor comes in, asks questions and everything else. You then focus on your patient or focus on the family, because families interrupt and it is difficult to say "Look, I will answer your questions, but I really need to do these medications first…"'(NFG,P3,SSN).*

Some senior nursing staff [clinical nurse managers], who did not regularly take patients, identified most distractions as being staff related and did not perceive interruptions from parents as a problem, as *'parents don't interrupt very often' (Int5,B6).*

Doctors identified that junior nurses were less confident with medication administration and were more likely to interrupt the doctors and request support. One doctor described how junior nurses may not have the situational awareness of what else is happening on PICU and are more likely to interrupt,

causing the doctor to become distracted when they should be focused on the patient they are with at the time. This problem of being interrupted was a common theme with the doctors.

> *'Unless it's something life threatening, I just say to people, "Just let me finish this," I think we have to stop people..... I think we have got to, reinforce the message that the safety isn't just at the nursing side, it's across the board.' (Int4, ANP.) [ANP's prescribe medication on PICU, as they work as a doctor on the medical rota]*

This ANP felt that nurses should approach their team leaders rather than go directly to an ANP or a doctor, although this would be dependent on staffing levels and other factors. There were specific times that the doctors identified where interruptions and the increased likelihood of being distracted occurred such as when they were *'admitting a patient.' (Int3,Reg.)* One of the registrars noted particular issues for new trainees [doctors] starting on PICU and who are inexperienced and under pressure, explaining that:

> *'Somebody comes in for another medication [prescription for another patient] and thinks, "I'll have to do it" and he is not actually thinking safely.' (Int3, Reg.)*

4.4.3 Communication

Nurses, doctors and pharmacists recognised that communication following a ME did not always follow a standardised procedure or include everybody involved. At the monthly critical incident meeting MEs are discussed, system improvements identified and, although free to attend, time pressures mean bedside nursing staff rarely attend, as one of the AHPs explained:

'It is a very select group [senior PICU team] the critical incident meeting and I am not sure, I know the person who runs it does do some kind of summary, but does everyone see that?' (Int5,P2, AHP.)

Other health professionals (e.g. pharmacists and doctors), noted the absence of bedside nurses at these meetings and identified the need for *'better engagement'* and *'empowerment'* to *'understand the process'*.

One doctor felt that there just was insufficient input by nurses on the unit and they thought the nurses should be encouraged to go if staffing was adequate. They noted that there was not sufficient investment in *'nursing input'* which was '*wrong.' (Int3,Reg.)*

Communication amongst staff about MEs took various forms. The managers talked about how communication channels may break down amongst the managers and that management following a ME was not always consistent or clear. In that there was no clear method of documentation about whether *'someone did something at the time' (MFG,P1,Cons).* The nurse managers acknowledged the need to have some form of documentation in place following a ME, so that they could see and record that some form of '*conversation about the error has taken place' (MFG,P5,NM)* and the process to dealing with a ME had begun, by the manager on at the time of the error. It was acknowledged that due to PICU staff working shifts, they are usually spoken to when they next come into work after the ME; this could be up to a week later and by a different manager to the one on who had been on shift when the error had occurred.

Managers talked about the most important thing being *'to tell the person directly'* and *'put it into the system' (MFG,P1,Cons).*

There was a consensus amongst the medical consultants that verbal communication following a ME was an important part of the learning process, as one consultant described:

> *'It is much more likely that it be something that stays in that persons head, one, because it has been done and two, because it has been told at the time, makes it much more personable.' (MFG,P1,Cons.)*

Doctors talked of reflecting verbally with their colleagues and discussing a ME with, for example, their supervisor so that it *'becomes one of my objectives to focus on all the time' (Int3,Reg).* Whilst doctors articulated the importance of talking directly with colleagues following an error, the nurse managers described a more negative form of communication, *'gossiping'* which they felt was embedded in the nursing culture where the focus was on '*actually finding out who did it and not actually learning from it' (MFG,P4,NM).*

Despite medication calculations and errors being a topic covered in mandatory training days, nurses discussed the importance of challenging other staff, such as *'is that the right dose?'* and not being *'frightened to challenge, even if someone senior,'* but acknowledged this might lead to *'people taking offense'* and noting that:

> *'Nobody is going to learn about what I am thinking unless I have explained it adequately or they have understood what I have said.' (Int5,ANP.)*

Participants felt communication was an area that could be improved around MEs through improved reporting and documentation. Reporting with paper forms led to a delay in managers dealing with the ME a *'few days after the incident.' (MFG,P5,NM.)* Verbal communication and feedback to all staff was important, so that learning could take place and so that they could *'communicate effectively… actually follow up as a result of the error.' (Int6,P2,AHP.)* There was general acknowledgement that the process of learning following an error would take place for the individuals involved, but this process did not automatically *'share that learning.' (MFG,P5,NM)* across the unit.

4.4.4 Operating theatre culture versus PICU culture

Communication around patients being admitted from theatre to PICU was perceived as an increased risk. This risk was seen to arise as medication prescribing and administration is done mainly by the anaesthetist in the operating theatre. There were many situations where the participants perceived an increased risk of a ME such as when a patient is transferred from the operating theatre to PICU. In this PICU a large proportion (just under half) of patients are surgical (mainly cardiac surgical).

A large number of medications and dosing errors were attributed to patients coming back from theatre, with medications made up in specific operating theatre concentrations by the anaesthetists. The doctors described these nonstandard prescriptions as *'as a little bit risky' (Int2P1,Reg)* and sometimes they were *'wrong,'* as one consultant noted:

'The patient came from theatre with a different prescription than what we would use, it was completely wrong.' (MFG,P3,Cons.)

The doctors talked of how their PICU experience and their situational awareness of increased risk of ME with patients coming from theatre made them more vigilant, especially between the times of 3pm and 8pm when most postoperative patients are admitted into PICU. The nurses also recognised that the *'operating theatre culture'* meant that the set [PICU] protocols were not followed, as this band six nurse explained:

' You know they may turn up from theatre and they have got a tray full of syringes with liquid in ... no labels' (Int5,B6).

This senior nurse had attempted to question the anaesthetist regarding following hospital protocol. The negative response he received demonstrated a power imbalance between the nurses and consultant anaesthetist, highlighting a traditional hierarchical attitude.

4.4.5 Challenging senior nursing staff

Whilst nurses generally felt supported by senior nursing staff to report a ME, they expressed concerns regarding the senior nurses' support of new safety processes implemented on the unit to prevent MEs. One example was the *'The infusion round'* which was brought in by the nurse consultant to stop infusions being made up at night when staff were potentially fatigued. This involved a nurse, usually the team leader, going round each patient in turn to check and change all the intravenous infusions for each patient, each morning, with the bedside nurse]. Initially when this process was introduced, it was intended to be done in the afternoon, but as this time on PICU was busy, especially with

patients returning from theatre, the process was moved to the morning. The plan was to start the infusion round following the medical morning handover (after 9.30 - 10am), so that any infusions, which were planned to stop, would not need replacing, therefore reduce waste and costs and supporting staff to change all infusions in daytime hours. The 'reality of practice' is that such processes when introduced, can take time to embed into practice and the nursing staff explained that new processes could cause additional problems:

> *'You are expected to do it [make up your infusions] at a time that might not be convenient to you, [the time is] not always suitable, especially when you are in a cubicle and the trolley emerges from nowhere..... I am doing my patient assessment.....other medical teams are coming around, and you like to hear what is going on and then I am expected to do all my infusions' (NFG,P2,JSN).*

Senior nursing staff, viewed this new intervention as a process that had to be completed before lunch time breaks began, which then led to it being done earlier and earlier in the shift, until it was starting just after nursing staff handover and before the doctors' handover. Senior nursing staff felt that this was because of *'inadequate nurse staffing,'* which meant lunch breaks had to be started earlier, and therefore the infusion round had to be started earlier. Some nurses suggested that such safety interventions could affect their normal nursing routine around the care of the patient and could cause problems. In certain cases, some staff felt able to communicate this problem to senior nursing staff: *'I said "no" and we did it afterwards [after the medical ward round]' (NFG,P4,JSN).*

Junior nursing staff, especially when new to PICU, did not feel at ease challenging more senior staff and described feeling pressurised to do what the senior staff told them:

> *'When you are new, when you have got a senior person trying to rush you and hurry you, when you are just starting out doing IV's...you are under that pressure and it is a nervous thing, I have got to get this done and they are quicker.... I think that is a culture thing on here [PICU]' (NFG,P1,SSN).*

4.4.6 Routinisation

Interventions such as the 'infusion round' introduced onto the PICU took time to embed into the PICU culture and it was noted by the nurse managers that staff *'do not like change' (MFG,P5,NM)*. The reality of the busy PICU affected many interventions and meant they were often adapted. The reason and importance behind the introduction of this intervention was forgotten, the 'routinisation' of this intervention in the 'reality of practice,' led to it being adapted and the relevance of the intervention fades.

> *'It worked really well for three months and we had no medication errors ... it was great and now it has all gone and you think, why?' (Int6,B6.)*

Initially the infusion pump and programming errors had diminished. When an intervention is introduced such as the infusion round, other unintended benefits may occur, such as discharging patients that overshadow the initial purpose of the intervention as mentioned by this manager:

> *'We actually changed the time of it to the morning because we thought we are virtually following the ward round, you can get the medications that are*

being crossed off, make sure the patients are ready for discharge and get all the medications done for discharge,' (MFG,P5,NM).

The nurses perceived the pharmacists as a positive presence on the PICU. The nurses perceived that like everyone else on PICU, the pharmacists were human and subject to error. The nurses reported that checking by the pharmacists may, at times, have become routinised and the checks that the pharmacists made, were being used in place of other safety checks, with a possible over-reliance on these checks.

'People see green pen [check by pharmacist] and think it is okay and they don't need to check the prescription.' (NFG,P1,SSN.)

The evidence around 'routinisation' in the discussions repeatedly came from the nurses, who talked about how they were at the end of the process with medication administration.

4.5 Factors affecting ME reporting

The second core category was generated from participants' descriptions of reporting MEs and the barriers on PICU that they perceived inhibited them from reporting them. The doctors and nurses had different approaches to reporting. Reporting is an important step in the process of shared learning, the 'realities of practice' are represented here as 'inconsistencies and misconceptions,' 'nurse compliance with and perceived barriers to reporting,' doctors noncompliance and perceived barriers to reporting' and 'nurses noncompliance with protocols'.

4.5.1 Inconsistencies and misconceptions

This subcategory examines issues related to inconsistent reporting and misconceptions that arise due to the use of personal definitions of 'ME' and how this affects the decision process of reporting. This was particularly evident when looking at MEs classed as near misses, as reported in the scenarios. Doctors and nurses stated that errors detected before administration *wo*uld not be reported as they would not be perceived as a ME. Furthermore, one of the consultants described how there was variation of what was defined as a ME and that it:

> *'Often varies between doctors, as what is regarded as serious, let alone between groups of colleagues' (MFG,P2,Cons).*

Participants perceived that staff did understand the relevance of a near miss, but it was a personal decision not to report. There was a general sense that MEs were more likely to be reported if there was a consequence to the patient, as one senior staff nurse explained:

> *'People fill forms in when things actually happen, but if it is a near miss, it is still an incident, but people do not fill the forms' (NFG,P1,SSN).*

Nurses felt that the checking process *'you know the five points prior to giving and administering medications' (NFG,P3,SSN)* was in place to pick up near misses and rectify them before reaching the patient. Similarly, if a doctor incorrectly prescribed a medication and the nurse picked it up during their checks, they would ask the doctor to change the prescription at the bedside, one of the registrars asked: *'does it warrant being reported?' (Int3,Reg.)*

4.5.2 Nurses' compliance with and perceived barriers to reporting

There was the perception amongst nursing staff, that *'critical incident reporting is nurse led'* and that it was rare for a doctor to *'instigate a report' (NFG,P3,SSN).* Pharmacists reported that '*inherently nurses have a different way to reacting to finding out that they have made an error to doctors.'* Nursing staff appear *'mortified*' and it *'sits heavily on their shoulders'*, whereas doctors appear to *'shrug their shoulders' (Int6,P2,AHP).* The importance of reporting MEs was clear to nurses:

> *'People learn from it and you want to learn from it yourself and you can benefit from other people's mistakes.' (NFG,P2,JSN.)*

Nurses felt there were many barriers which inhibit them from reporting which included issues relating to workload and time, on occasions when they are very busy in the shift they would have to stay at the end of the shift to complete an error report in their own time. Instead, nurses prioritised other tasks, such as *'documentation'* and *'handover'* which were often completed in the nurses *'own time.'* too *(NFG,P4,JSN).* Pharmacists too, acknowledged that were barriers for pharmacists and nurses in physically finding the time to sit down and fill out a ME report, unless you were prepared to stay late, which not all people will do.

Nurses perceived that feeling like they were *'being punished'* or *'being blamed' (Int5,B6)* would inhibit nurses from reporting MEs. Blame also had repercussions on how staff felt when they reported errors which involved other people, as one AHP explained:

'I felt really bad..... I know if I do an incident form, we will set it in motion for the nurse and follow it with the nurse and consequences of that, whereas the doctors, I don't think they even know about it.' (Int6,P2,AHP.)

The AHPs and the consultants talked about how nurses are dealt with very differently [perceived as more harshly] following a ME compared to doctors and that this could act as a barrier for nurses reporting MEs, in that *'there are more repercussions for the nurse' (Int6,P1,AHP).* One of the medical consultants explained that:

'Nursing is so more hierarchical than medicine...because of the consequences for their career.' (MFG,P2,Cons.)

These consequences refer to that the frequent outcome for the nurse involved in an error was to suspend their ability to administer IV medications. This then affects their work and the patients they get allocated. In contrast to the impact on a nurse's career, only one doctor raised the issue of the possible consequences of a ME on their career. One consultant mentioned that he may caution a doctor involved with a ME and that the parents may report the doctor to the General Medical Council, which could have serious repercussions for that doctor.

4.5.3 Doctors' noncompliance with and perceived barriers to reporting

Doctors perceived that nurses were responsible for reporting MEs. When a doctor did report a ME, it was because there was a real or potential consequence to the patient. There was the belief that it was the job of the nurses to report any MEs, including prescribing errors.

'I think we are looking after a lot more patients than the nurse by the bedside is... I perceive that the nurse has somewhat a little bit more time to put the form in than I do.' (MFG,P6,Cons.)

Doctors reported that nurses are in the '*best position to notice' (MFG,P1,AHP)* and report an error. Although doctors [and ANPs] independently prescribe medication, the analysis revealed that nurses are seen as a safety net.

'The nurses are almost the prescriber's second checker aren't they? If they are the ones picking up the errors, that is why they're reporting them.' (MFG,P5,NM.)

Doctors talked of the time it takes time to report MEs and prioritised their patients' care above this stating:

'I think that the reporting system...creates more work.... It is not very easy to report. The current system....(MFG,P3,Cons).

The *'endless paperwork'* was seen as a hindrance on top of their workload and not very *'realistic'* as the form was *'laborious' (Int2,P1,Reg).* The time burden of paperwork was compounded by the 'l*ogistics,' 'Where is the form?' 'Where do I fill it out?' You never hear about it' (Int3,Reg).*

This noncompliance with reporting may be instilled in doctors during hospital induction, as one participant revealed that their experience during their induction did not inspire them to report a ME:

' It was a brief session, it basically highlighted, it was quite complicated for you to report something on the internet.' (Int1,Reg.)

Doctors also perceived that reporting a ME would be seen as *'a failure'* and this would *'inhibit a lot of trainee's and consultants from reporting' (MFG,P2,Cons).* Some doctors felt that even if they were peripheral to the error, there was a risk of being blamed. However one doctor talked about how it was not always about being blamed for a ME by managers, but rather about being made to acknowledge accountability and take responsibility that something had gone wrong, rather than just being blamed. Doctors also reported hesitation around reporting their colleagues for fear of the consequences:

> *'I think sometimes you hesitate to report almost in a way, afraid of getting your colleague into trouble' (Int2,P2,ANP).*

Some participants talked of how reporting a ME may be dependent on the consequence or harm to the patient. Certainly within the scenarios the likelihood of reporting was dependent on the 'perceived' harm to the patient, for example:

> *'[If] it was discovered was the child was unresponsive or something and then in that situation the doctors probably would.' (NFG,P4,JSN.)*

However, the following account described an actual error where the patient did not come to any harm, but where a similar error [involving this medication] in the past, had led to the death of a child in this hospital:

> *'I was in the middle of something and somebody came over and said "By the way your child over their just got roc'd [muscle relaxed with a Rocuronium bolus] on CPAP " …. [a ventilation mode where the child was spontaneously breathing and no machine breaths are delivered], so I put a*

rate [breath rate and changed ventilation mode to give them breaths while the medication wore off]...I left the rate on, went and wrote it on the prescription, but I think..... I don't know, honestly I don't think it even crossed my mind to report it...' (Int1,Reg.)

Due to the nature of this ME, it was reported by the nurse. However, during the interview the doctor gave no indication that she was aware of this error having been reported. Whilst the potential for harm to this patient as described in the account was high, this did not prompt the doctor to report the error, or check if safety processes would be put in place to prevent the error occurring again.

The core category of noncompliance and compliance concerning reporting of MEs has highlighted the difference and similarities between nurses and doctors. As part of the medication process and nurses administrating medication, there was also the different notion of nurses' noncompliance of following protocols, which generated its own subcategory.

4.5.4 Nurses' noncompliance with protocols

The nurse managers observed that nurses did not always follow hospital policy especially in relation to two nurses independently check medication during administration. One nurse manager explained:

'From a nursing point of view, it is often just missing out a part of the policy, like two nurses checking the medications and dosing, it should be done, they know it should be done, yet they make that conscious decision, that they are not or, unconscious decision, whichever not to follow policy' (MFG,P5,NM).

Despite stating that it was *'better if you do it independently' (NFG,P1,SSN),* some nurses talked about how rushing and time pressures meant that they did not always independently double check medications; this was especially so with medications administered at the beginning or the end of the shift because *'that person wants to get home'.* Nurses acknowledged that some nurses, felt that their shift ended when the next shift nurse arrived, often rushing hand over, to finish work early. Nurse managers also identified that the allocated (and paid for) half hour handover time should be used more effectively to increase patient safety.

4.6 Learning from MEs

It was clear that part of 'learning from MEs' on PICU was about the 'engagement of staff in the learning process'. Staff described 'training about MEs,' either as part of their professional training or the general induction training to the hospital and the PICU. Further probing revealed that participants had differing perceptions of how learning experiences affected the 'reality of practice' on PICU which led to discussions of 'learning styles', 'dissemination and fragmented learning,' 'management of MEs' and 'changes in practice.'

4.6.1 The engagement of staff in the learning process

Initial engagement of staff around MEs on this PICU usually occurs within their training and mandatory study days although there are the other opportunities to engage staff in the learning process around MEs. The word 'engage' was used prolifically within the discussions. Nurse managers perceived difficulties in everyday practice to actively engage staff and improve learning from errors saying:

'All we can do is put things in place to allow people to learn from it, if they choose not to, then there is nothing you can do about it.' (MFG,P5,NM.)

The nurse managers felt that staff who had been involved in numerous MEs, ideally should be involved in setting up and putting interventions in place, feeling that:

'You learn most when you set up the process to prevent an error from happening.' (MFG,P5,NM.)

Doctors felt that the nurses should be more engaged in attending the weekly clinical multidisciplinary team meeting, not just those that discussed critical incidents. Explanations such as *'not enough staff'* were deemed to be unacceptable and the doctors felt that more *'nursing representation'* was needed *(Int3,Reg).* The doctors suggested that in an *'ideal world'* staff would be rotating into these weekly meetings as often as possible although the 'reality of practice' means that nurse staffing levels rarely allow this to happen. The nurse managers wanted staff to become more engaged in the learning process, but it was not always clear to them how they could improve this. Lack of engagement was seen by some participants as the root of the problem in failure to learn from error. One AHP explained that:

'If we do, as a unit want to improve as a unit, then we have to engage with the staff.' (Int6,P1,AHP.)

The pharmacists perceived that *'better engagement'* would improve reporting of errors and *'empower people'* but that whilst *'not allowing clinical time.....it doesn't mean anything to anybody.'* There was the perception that this was a

result of *'the leadership [hospital management] not following through.'* There was concern that:

> *'If MEs are one of our top priorities as a hospital, why are we not allocating any clinical nursing time for it?' (Int6,P2, AHP)*

4.6.2 Training about MEs

Staff discussed how they learned about medication safety. Doctors reported that learning about MEs during initial professional training was very vague and limited. *'Medical school? Not really, Induction? Again not really.' (Int2,P1,Reg.)*

In contrast, the nurses explained that medication administration was embedded within their training:*'When I was going through my nursing training, medication administration is part of the training, rather than being an added skill afterwards.' (Int2,P2,ANP.)* There was the perception that the general hospital induction was *'brief,'* with information aimed at everybody, rather than individuals who were specialising in different areas, with '*masses of useless information'* that '*hinders us from holding onto the important useful bits.' (Int1,Reg.)* Doctors felt that the separate induction for staff starting on PICU was much more useful, However, this registrar did distinguish between the anaesthetic registrars starting and the general paediatricians; the former do not receive the PICU induction:*'The anaesthetists doesn't get induction here, they get the trust induction and they get the anaesthetist induction, but when they put in here for a month, they don't get anything which I think that is why*

they find it hard...' (Int1,Reg.) Doctors who had more experience on PICU, felt this was less important, it was more likely, however, that pediatrician trainee's or A&E trainee's starting on the PICU were more of a *'danger.'* The risks with anaesthetist trainees were more likely to be related to '*big medication dosages....So the risk factors or error types would be different with the anaesthetist.' (Int3,Reg.)*

*D*octors identified the differences in training amongst the nurses who come to the PICU with varied backgrounds and training, from being newly qualified, with general ward experience, to those with experience of working on other PICU's. Nurses described training on medication safety as part of their professional training and training on mandatory study days regarding critical incident reporting. Nurses reported that they were not adequately trained to use the new trust computerised reporting system 'Ulysses' for reporting MEs. This may be, in part, because staff are still allowed to use the paper based reporting on PICU.

4.6.3 Learning styles

Participants gave accounts of the reflective learning tool used on the PICU. Within these discussions, participants characterised different 'learning styles' and described how the PICU culture and use of the reflective learning tool may nurture or prevent learning.

Nurse managers perceived that there was *'a clear difference'* in how nurses and doctors completed the current reflective learning tool (Appendix 16), where '*medics took complete responsibility'* and nurses made *'excuse[s], with* the wording used by nurses being too *'generic'* (MFG,P1,NM). The consensus was following completion of the tool there was insufficient *'forward focused'*

planning, so although this tool may be completed following a ME it may not contribute to the process of learning, as one AHP explained:

> *'It is very poor in the follow up and what you know do after the incident.' (Int6,P2,AHP.)*

The tool was also not always being used as intended by the staff who had made a ME as *'It is not actually a reflection... I think sometimes they are writing what they think you want them to say.'* It was being used '*inconsistently'* by the managers *(MFG,P5,NM).* There was some degree of consensus between the doctors, nurses and managers that the tool was not achieving what it sets out to do, for example *'we do it because we have to do it...not because we actually want to learn' (Int2,P1,Reg).* The tool was described as a *'box ticking exercise...That doesn't really achieve anything. (Int6,P2,AHP.)* The timing of completion of the tool was also important as staff felt they initially needed support following an error, before they begin the learning process. One doctor explained that giving the reflection learning tool straight away just *'reinforces....How very bad you feel'* and what you need is time to think and reflect on the error, to gain more out of the process *(Int3,Reg).*

The reflective learning tool, whilst aimed for the use of individuals, has the potential to share learning across the PICU team and the hospital. It appears that the process of shared learning may be inhibited at the beginning, if the current tool is not delivered effectively. However this 'reflective style of learning' was considered useful as *'most people are very reflective'* and reflection was seen as the *'most common learning experience'* with MEs. *(Int2,P2,ANP.)* One participant mentioned how the actual 'style of learning' such as a presentation,

may have more affect than a self-taught computer based course. This doctor felt that the training around MEs, delivered by the trust through an e-learning module on medication prescribing, did not have as much *'impact'* as if it had been an actual *'conversation' (Int3,Reg).* This doctor felt that learning was more 'effective' when it was part of an engaged discussion around common MEs in PICU. This perception of verbally discussing MEs was a common theme amongst the doctors in their approach to learning where they *'immediately share'* with other colleagues. When doctors talked about verbally reflecting and being *'transparent'* about MEs, they also talked about the importance of *'support'* from their colleagues explaining:

> *'We all talk to each other about it, which is a very useful way of reflecting, writing .... It doesn't add anything at all...' (Int1,Reg.)*

This style of reflecting verbally and learning was not raised in the nurses' discussions. Nurses implied that they learnt more on an individual basis, and the only 'shared learning' across the PICU (if there was any) was by an email indicating caution with a medication. However, nurses did understand the importance of shared learning, explaining:

> *'I think it is because people learn from it and you want to learn from it yourself and you can benefit from other people's mistakes.' (NFG,P2,JSN.)*

During the interviews and focus groups, all participants were shown a new intervention [learning tool to force reflection around particular areas] involving an anonymous [non-manager seen] short e-learning tool [questionnaire] to be completed by all staff involved in an error regardless of their role. (Appendix

17).There was strong evidence throughout the discussions that participants felt that this would be a useful tool, that they would want to complete. The doctors felt that this tool no longer felt like a tick box exercise, with spaces for free text which allowed you to fill it in, in your own words.

> *'You have got somewhere else to write....very frustrating when you don't' want to tick one of the options...you can really think about it...they are all relevant points.' (Int1,Reg.)*

Comments on the new learning tool were generally positive, but there was some negative response around the length of the tool [32 questions over 9 pages]. The ANP and doctors suggested *'condensing'* the tool (Int4,ANP). The consultants suggested that there was too much 'to read through,' *(MFG,P6, cons)* to understand and answer the questions. Whereas the nurses felt that the time taken to complete the tool was about right.

> *'You need to take it seriously, you've made an error' (NFG,P3,SSN).*

The tool takes approximately 20 minutes to complete and guides staff through the reflective learning process, helping the person completing the tool to identify contributory factors and increase situational awareness. The nurses did not show any preference to the tool being anonymous or manager-seen. The nurses felt that discussions with the managers following an error were very helpful and felt that an additional date to sit down and talk about the error, possibly a week or two later would be helpful in supporting the nurse.

The nurse managers were concerned about the new learning tool being completed anonymously. It was felt that this new tool would have to be used

alongside the existing procedures following a ME. It became apparent that the completion of the current reflective learning tool is used as a formal documentation of management or record that a discussion has taken place with the member of staff involved with a ME

> *'The medication error tool is about the only evidence that we have, that a discussion has taken place with someone after a ME..... It needs documenting.... So that we know what action has been taken' (MFG,P5,NM).*

The reflective learning tool had been instituted to aid individual learning from MEs, but the tool had become adapted and used as formal documentation in the management a ME on this PICU. The results of the content analysis of reflective learning tools has been incorporated into the 'learning styles' and allows the comparison of how doctors and nurses perceive the tool and the 'reality of practice' in how effectively it is used.

4.6.4 Dissemination and fragmented learning

'Dissemination and fragmented learning' evolved from the discussions around how participants perceived they became aware of errors on the PICU and suggested that the majority of feedback on MEs to the PICU nurses was by emails. The consultants discussed the 'reality of practice' in disseminating information on MEs on the PICU in order for shared learning to take place and increase safety. A summary report is compiled after every critical incident meeting, where medications and therapeutics forms a large part of the discussion. This summary is emailed to the managers, consultants and intermittently the nurses on the unit. The consultant involved in preparing this

summary acknowledged that they pick out the most significant errors, but there was no way of knowing if people read this report:

> *'If they all read it.....I am trying to pick out, the ones that I think that everybody should read.' (MFG,P6,Cons.)*

This process of summarising the MEs on the unit and then disseminating them by email to the staff, assumes that staff will read and understand the importance of learning from others mistakes. The data suggested that the managers were not confident that this actual process worked.

> *'I think that is what we always accept the person that makes the error, we think learns from it because they have made the error, but it is how we share that learning, so that everyone else doesn't make that error' (MFG,P5,NM).*

The discussions suggested a mixture of perceptions around the idea of disseminating through emails and the reliance of using emails as a vehicle to share learning across the PICU. Nurse managers felt that staff do not always learn from these emails if they did not feel directly involved with the ME noting a sense that if it did not involve them then *'…they don't bother reading the rest of it then' (MFG,P5,NM).* The overuse of emails was evident throughout the data. One AHP summarised some of the issues:

> *'Emails are difficult, because it is a great way of communication, but I think it is use and abuse, because then people are copied into things too easily' (Int5,P2,AHP).*

Emails were useful when used correctly as they provided *'some feedback'* and gave an *'incentive'* and '*actually made you want to put incident forms in'* although otherwise it was felt that incident forms just:

> *'Disappeared off into the ether and you have no idea if anyone does anything about it and I find it takes away the incentive to do it' (Int,Reg).*

There was further evidence to suggest that providing feedback to staff would engage them and bring them 'on board' to report future MEs. Nurses felt that there was an increase in emails being circulated, so that they were being made more aware of certain types of MEs on the PICU, however there was a consensus of a *'need to communicate a balance in the emails' (NFG,P4,JSN)*. The nurses felt that when an intervention has been put in place to prevent MEs, there is no feedback to say if the intervention has been successful. The nurses described the current emails as a form of negative feedback and that staff would feel more encouraged if successful interventions were fed back so that they could see the point.

During discussion around interventions and processes introduced onto the unit, participants talked about new processes being introduced which did not always embed themselves into the culture of PICU, for example: '*We introduce new processes, but we don't enforce it*' (MFG,P3,Cons). However, when processes were eventually embedded into the culture of PICU, staff described how 'routinisation' may lead to these processes becoming adapted to fit into other 'routines' of PICU or the 'reality of the PICU.' This further highlights the meta-theme of the reality of PICU practice.

4.6.5 Management of MEs

Generally nurses and doctors perceived that the managers and consultants were approachable and that staff were looked after and managed well. However, there were ideas about how this could be improved and some suggestions where this process may fall down. Whilst the difficulties and *'inconsistencies'* around management of MEs has previously been reported in the 'communication' sub category, the nurse managers also felt that the different styles of management by nurse managers also led to some MEs being dealt with *'straight away'* and others *'you look back and nothing has been done' (MFG,P5,NM).*

The MEs are reported by way of Ulysses [computer reporting] or paper reporting [green forms located on the wards], the nurse managers perceived that reporting by paper forms, compounded the problem of MEs being dealt with by management, as there was often a delay in these forms being then entered onto Ulysses and then being flagged to management.

The nurse managers and consultants talked about how offering support to the staff involved with a ME was important once all the checks had been put in place to maintain the safety of the patient following a ME. The doctors talked of '*having a responsibility to do good with our prescription' (MFG,P3,Cons)*, reflecting their understanding that a ME could have very serious consequences. The nurses talked of their perception of *'a positive experience with management' (NFG,P2,JSF)*, where staff felt they were given support just after a ME.

4.6.6 Changes in practice

Staff suggested ideas to improve the practice of administering medication from their experiences of being involved in MEs on the PICU. There was a strong theme of how simplification of the process when prescribing could improve safety. The consultants perceived the need for more simple guidelines, as at present guidelines are *'precisely tailored to what is quite often inadequate pharmacological data for use in paediatrics' (MFG,P1,Cons)*. Whilst the PICU has implemented a medications sheet [of the 20 most common medications used on the PICU, calculated per patient by their weight on admission to PICU], there was the perception that this could be extended to other medications in use on the PICU. Doctors highlighted that rounding up or down of doses and using fewer decimals were good safety measures to introduce. Amongst the consultants there was the perception that there were too many medications used altogether on the PICU and limiting the number of medications available would be something to review in the future.

Participants had many ideas about improving medication safety on PICU through the data collection process. The following suggestions by different participants were identified as ways of reducing MEs on PICU:

- institute protected medication administration time – a time where no interruptions or distractions were allowed;
- institute 'Smart' electronic prescribing – to reduce handwriting errors and prescribing errors;
- have a designated ' Prescribing area' – where all prescriptions (bar emergencies) were written where no interruptions or distractions were allowed;

•institute regular team feedback – for example a monthly newsletter;

•highlight an ‘Error of the week‘ - where staff were updated at handover each day, regarding an error that has recently happened on the unit, to increase awareness and team learning;

•move the current staff notice board with ME information, to a different location to make it more visible; and produce and use of more ‘cheat sheets’ of common MEs on PICU for doctors starting on rotation on the unit.

Whilst the participants perceived medication safety to be a priority, staff felt that the processes introduced in response to a ME may also make things *‘worse’* in that

> ‘*The more processes there are to follow the more likely you are to fail.' (MFG,P5,NM.)*

Participants suggested that when a process is introduced it then needs to be evaluated, its effectiveness determined and this information fed back to the staff.

4.7 Conclusion and summary of results

In summary, three MEs occurred during the observation periods, none of these errors were identified through the formal hospital reporting system for MEs or the paper form used on PICU, indicating that some MEs are underreported on the PICU where this study took place. The use of personal definitions of what constitutes a ME appeared to inform the decision process of reporting an error, this definition also varied within and across different professions. ME reporting was nurse led, doctors perceived themselves too busy and not always aware or in a position to notice and report an error. Interruptions and distractions were

observed to be commonplace and led to violations and deviation from protocols for medication administrations. Similarly staff during the focus groups and interviews also highlighted that interruptions and distractions are part of the culture and 'reality of practice' on PICU. Nurses reported it was common for doctors and families to interrupt them administering medication, doctors reported nurses disturb them when they were prescribing.

Overall staff felt that management of MEs was good, but the communication and documentation process following an error was not always consistently managed or disseminated effectively in order for shared learning to be maximised. New processes introduced took time to embed, required the senior nurses' support and sometimes introduced new problems for nurses within their daily clinical practice and routines. It was acknowledged by the management that the day to day engagement of staff in learning from MEs is difficult, leading to a fragmented style of learning, where dissemination and shared learning is not always being achieved. The current practice on PICU of learning from MEs using the reflective learning tool does not always lead to the required detailed, self-analysis and reflection of an error to demonstrate individual leaning. More often the tool is used by nurses to express the emotional impact of the error, whereas doctors more often described the error in an unemotional and objective manner. Staff often blamed themselves and then looked externally to find an excuse and rationalise the error. The results in this chapter indicated that individual learning and shared learning does not automatically take place following a ME on this PICU. The next chapter, therefore, moves on to discuss these findings in more detail.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter will both discuss and summarise the main aspects of the thesis, addressing the research questions and aims of the study, the results and their relation to published literature and will conclude with recommendations for practice and for future research. Before commencing the discussion chapter it is worth revisiting the aim of the study. This study aimed to gain a more accurate understanding of ME occurrence in one large Paediatric Intensive Care Unit (PICU) and to explore the paediatric intensive care (PIC) team's perceptions of MEs and how they perceive that they learn from them. The specific research questions asked and the answers generated are presented here first, before commencing the integrated discussion with the literature and looking at them in more detail; they are

5.2.1 How do self-reported medication administrations error rates by PICU nurses compare to those observed in practice?

Underreporting of MEs was observed on the PICU. Three MEs were observed out of 59 medication administration episodes, and none of these errors were identified through either the formal reporting system or via the paper form used on PICU. This suggests that MEs remain underreported and that direct observations of practice provide a more accurate incidence of errors and in identifying true ME rates, rather than relying on reporting alone. An additional advantage of using the observation method was the identification of areas to improve medication safety administration on the PICU. Interruptions and distractions across the whole team on PICU were frequent and observed to increase the number of violations and deviation from protocols for medication administration. The aspect of not reporting and its link to blame and fear of

punishment, was noted during the observations, focus groups and interviews and was highlighted as a contributory factor in the lack of reporting of medication errors.

5.5.2 How do doctors and nurses who work in the PICU perceive MEs, the management of errors and how they learn from them?

Staff perceptions of the reality of practice and working on PICU gave an insight into how the culture of PICU may contribute to MEs. Nurses and doctors perceived that internal and external distractions were commonplace on PICU, affecting the whole PICU team. Nurses articulated how consultants, doctors and families interrupted them during medication administration, and nurses talked of how they could not always control these interruptions and distractions. However, the doctors and consultants perceived that nurses interrupted and distracted them whilst they were prescribing and they also stated that they thought this was sometimes the result of nurses' lacking situational awareness. In contrast to the nurses, the consultants, senior doctors and ANPs stated they did have some control over these distractions. Another factor which the nurses and nurse managers perceived contributed to MEs on PICU, was the nurses noncompliance with protocols, specifically the protocol for two nurses to independently check IV medication during administration.

Communication problems around the management of MEs were highlighted, which were enhanced by shift working and inconsistencies in management. Managers did not always follow the standardised procedure and this was exacerbated by the absence of bedside nurses at the critical incident meetings. There was the perception amongst the doctors and pharmacists that better engagement of bedside nurses would lead to better understanding of the process following a ME to improve the learning process.

Whilst staff perceived that reporting of MEs is an important first step in the process of learning, they highlighted many barriers. Nurses stated that clinical workload, time, blame, punishment and prioritising other tasks inhibited reporting. Interestingly, some doctors perceived that it was the nurses' job to report MEs. Doctors perceived that their workload, time burden of paperwork, logistics, failure and blame would inhibit their reporting. From the scenarios introduced at the beginning of the nurse focus group and interviews, the likelihood of reporting was also dependent on the perceived harm and consequence to the patient of the error. Misconceptions and inconsistencies around reporting of MEs arose due to the use of personal definitions of what constituted an error, which was particularly evident with near misses.

The current reflective learning tool used by this unit, given to individuals following involvement in a ME, has the potential to share learning across the PICU team, but learning may be inhibited at the beginning if it is not handled effectively. Doctors reported that learning took place following a ME through informal discussions with their colleagues, with the added benefit of gaining support following an error. Nurses explained that feedback following a ME on the PICU was reliant on emails and the managers expressed frustration that staff did not always read and learn from. Both nurses and doctors highlighted the importance of feedback, which gave an incentive to report and learn from other errors. Nurses described how emails were a form of negative feedback following a ME on PICU. By striking a balance of communication through emails that introduced additional positive feedback on areas such as the success of interventions introduced on the PICU, may increase the incentive to read these emails.

5.2.3 What is the quality of the ME reflective learning tools submitted in the PICU?

The content analysis of the learning tools highlighted that the current practice of learning from MEs using these tools does not always lead to the required self-analysis and reflection on the error, nor demonstrates individual leaning. Overall, the quality of reflection and self-analysis was poor. Frequently, the tool seems to be used by nurses to express the emotional effects of the error and this suggests that the tool is used as a coping mechanism to deal emotionally with an error. In contrast, doctors more often described the error in an unemotional and objective manner. Staff often blamed themselves and then looked externally to find an excuse and rationalise the error. Where individual learning was identified, staff had a heightened awareness of the need to be more focused. However, the fact that these tools were given to their managers, may reflect people telling the managers what it is perceived they want to hear. The findings from the focus groups and interviews reinforced these findings that staff felt the reflective learning tool was a tick box exercise, that didn't achieve the required learning outcomes and it was not being used effectively. Additionally, management perceived the reflective learning tool as a form of documentation or record of a discussion having taken place with staff following involvement with a ME, rather than a learning tool which it was intended to be.

5.3 Integrated discussion and theoretical framework

This chapter now presents an integrated discussion of the key findings and their relationship with the existing published literature. The chapter is presented in five sections, organised under the following headings: observation of medication administration on PICU; perceived culture on PICU; factors affecting ME reporting; learning from MEs and content analysis of reflective learning tools.

Chuang et al's. (2007) theoretical framework of learning from failure will guide the interpretation of the results. A summary of this theoretical model is shown below (Diagram 6) to aid clarity to the discussion. Chuang et al. (2007) acknowledge that learning takes place at different levels amongst individuals, groups and organisations and they theorise that to improve safety, organisations must consider how the transfer and translation of knowledge takes place between these groups. The theoretical model draws upon learning theories and group behavior learning. It looks at how learning occurs over time and diffuses across levels, how best to translate individual learning into group learning and how individuals and groups determine which practices are effective and which are ineffective. This model was therefore chosen, to help highlight how the PICU may improve learning from failure and highlight the factors that might facilitate learning from failure and others that impede it. Within the discussion, analogies will be drawn where appropriate to the different propositions within the theoretical model. The model proposes 11 different propositions, which will be incorporated into the discussion where appropriate. They are listed in Appendix 18 to aid clarity and guide the discussion.

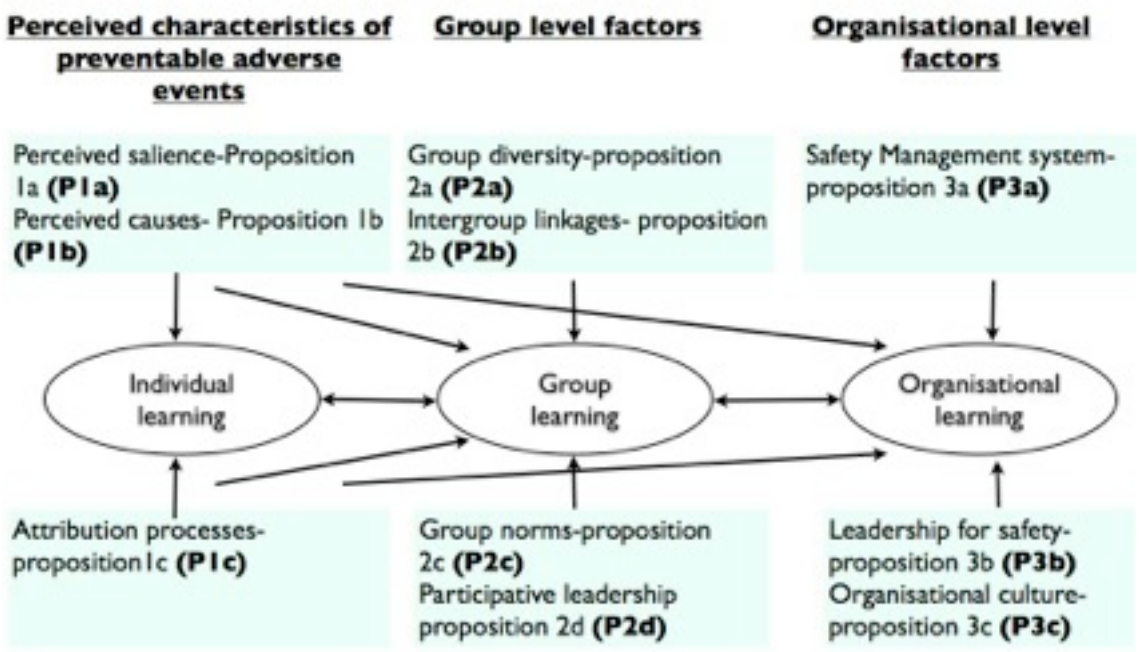

Diagram 6 of Chuang et al. (2007) theoretical model of learning from preventable adverse events in health care

5.4 Observation of medication administration on PICU

Underreporting of errors was identified during the observations of nurses administering medication on PICU and three MEs were observed out of 59 medication administrative episodes, giving an error incidence of 5.1 per 100 medication administered. None of these errors were identified through the formal reporting system for MEs used on PICU. Previous studies have shown that MEs remain underreported (Wilde and Bradley, 2005; Vincent, 2006; Sari et al., 2007; Armitage, 2010). Due to the variability and severity of illness in patients on PICU, the variety of medications and the changing environment, these observations provided a snapshot of medications being administered and as such the 5.1 errors per 100 administered may not be a true reflection of the

ME rate. Barker (1980) highlighted that direct observation may be susceptible to biased observer inference and the 'Hawthorne effect'. However, Dean and Barber (2001) in determining validity and reliability of observational methods, found this to have a limited effect over time.

Prior studies have noted the methodological difficulties in establishing the rates of MEs (Barker et al., 2002; Kopp, 2006). Ferner (2009) reports that there are many methods for counting errors, but none are entirely satisfactory. Studies that have investigated administration errors in the intensive care unit have historically involved the use of chart review and voluntary reporting systems (Kaushal et al., 2001; Flynn et al., 2002; Kopp et al., 2006). A study by Flynn et al. (2002) compared the use of direct observations to incident reporting and chart review in detecting MEs and reported that direct observations produce more accurate results in identifying actual numbers of MEs.

Failure in communication during hand over to replacement staff, compounded by several staff changes, was identified as an issue during the observations. This has resonance with Armitage et al. (2010) who also reported that verbal communication contributed to 10.4% of errors reported. The failure to identify error, as seen with Error 1, was also observed, although Error 1 was picked up by the team leader before patient discharge. Edmondson, (1996) explains that effective teams, who work together, will often catch each other's mistakes.

Issues with transcription errors were noted (Errors 2 and 3) resulting in two errors. The transcription of medication charts during the night shift is discouraged on this PICU, as a result of previous errors (of which one was noted within the content analysis of the reflective learning tools). Fatigue on

night shifts remains a problem, and the prevalence of this type of error was identified by Armitage et al. (2010) who reported that written miscommunications contributed to 12% of error reported, when identifying contributory factors to MEs.

5.5 Perceived culture on PICU

The predominant cause of increased risk of MEs, identified by staff on PICU, were distractions and interruptions. This was consistent with the observations of nurses administering medication and identified as a contributory factor to MEs within the reflective learning tools. The literature around causation has identified that excessive interruptions and distractions are common in hospitals during the medication administrations process (IOM, 2004; Pape et al., 2005; Hewitt, 2010; Westbrook et al., 2010; Dickson and Flynn, 2011; Clark et al., 2012). The 'culture' of interrupting and distracting on this PICU, was described in varying degrees by nurses, doctors, consultants, managers and pharmacists, and as such, was noted to be embedded into the 'reality of practice'. Previous research has shown that teamwork suffers, where the cultural norm is of becoming too informal (Moray, 1994). If safety is going to be a priority within a clinical setting, every member of the team must be involved as this means that people are more likely to listen and obey rules, where there are adequate grounds to do so (Geller, 2000). Furthermore, to promote safety and error prevention, the managers must be seen to follow the same standards and values that their staff are expected to follow (Moray, 1994; Helmreich & Merrit, 1998). Similarly, Pape et al. (2005) found that safety begins with strong leadership, as employees will emulate the attitude and behavior's of those in leadership roles. Therefore, it may be an important factor that consultants, nurse managers and senior nurses

were all observed interrupting and causing distractions to nurses administering medication. This in turn is likely to influence the behavior of all staff working in the PICU, as it is seen as a ‘cultural norm’ and acceptable behavior.

Intensive care units are noisy settings and nurses frequently multitask, are hurried and interrupted; this means that they may perceive this kind of working environment as the norm. It has been suggested that to decrease errors, there should be a basic understanding of factors affecting human learning and memory (Pape et al., 2005). On this PICU nurses recognised that ‘human error’ was inevitable and talked in general terms about how external distractions and interruptions during the process of administering medications increased the likelihood of a ME. Whilst they identified terms such as ‘workload,' ‘hurrying,' ‘multitasking’ and ‘human error’ all coinciding with being interrupted and distracted, they showed little overt understanding of the human factors involved which may lead to a slip, lapse in concentration or a mistake. As such, the nurses did not appear to distinguish between the different concepts of internal and external distractions and faulty cognitive processes, involved when they were multitasking. It is important to consider the cognitive process, because nurses are considered to be ‘knowledge workers’ and Cooper (2006:59) describes knowledge workers as ‘people who think for a living,' highlighting that this cognitive processing activity is critically important for all health professionals. Other emerging studies have also looked at successful multitasking in humans, by focusing on brain chemistry and memory systems (Huff, 2007; Rock, 2009; Ofri, 2010). These studies suggest that the brain can only make one decision at a time as it does not process information simultaneously but switches back and forth, losing accuracy in the process.

Distractions therefore exhaust the brain and make it difficult to focus on the task at hand; this may also be exacerbated by nurse inexperience (Spira, 2012). An understanding of the cognitive theory around distractions would therefore seem beneficial in training staff on PICU about the importance of focusing on a single task. Such training has the potential to increase medication safety and help nurses to avoid or minimise unnecessary interruptions.

Research has demonstrated that interruptions and distractions increase the risk of MEs and procedural failures (Westbrook et al., 2010). This was demonstrated during the observation of nurses administering medications, as interruptions increased deviations from protocol. Removing external distractions entirely within a clinical environment may not be realistic. However, the consultants on the PICU talked about controlling distractions and this ability to exert control appeared to come with experience. The nursing staff appeared to find it more difficult to control distractions as is seen in another studies; Pape et al. (2005) examined different approaches to reducing distractions for nurses during the administrative process and noted the need for strong leadership and management to empower nurses to be assertive and speak up to discourage or control unwanted interruptions during medication administration. This resonates with Chuang et al.'s (2007) theoretical framework (diagram 6, P2d), that proposes that participative leadership, in which team leaders use coaching behaviors to encourage group members to speak freely and openly, will have a positive impact on how groups learn.

Deliberate social interruptions were also identified, such as gossip about life outside work. The ability of the individual to say 'no, not now' may be due to

cultural norms within the PICU, where leaders – as seen in this and other studies - either model poor behavior or do not always actively discourage interruptions (Moray, 1994). It may also be due to individual's lack of understanding of what increases the likelihood of a ME. The findings from this study resonate with those by Armitage et al. (2010) who explained that resourceful staff who are used to multitasking may normalise interruptions and organisational weakness, accepting them as part of the environment that they work in. Whilst the nurses noted that a 'change in culture' was needed so that interruptions could be stopped, it should be noted that health professionals, such as those on PICU constantly interact with each other as part of their daily routine. A study by Walji et al. (2004) looked at minimising interruptions in the health care environment and suggested that interruptions in multitasking environments act as cues to promote productivity. However, Walji et al. (2004) stipulated that for an interruption to be effective it must be at the right time, be absolutely necessary and not damage the task because of interrupting. The doctors identified interruptions as a common theme, and specified that more junior nurses may not have the situational awareness and may be more likely to interrupt. This implied that nurses did not take into account the timing of their interruption, how it may affect the doctor prescribing and how important and necessary it was to interrupt at that particular time. Leonard (2004) advised of the critical importance of teams working together and being able to speak openly to alert teams to unsafe behavior. Leonard advised all members of the team should be encouraged to see the 'bigger picture' suggesting that training and support should be given to junior nurses at the beginning of their career, so that they see the importance of having a situational awareness of the environment, as they start working on PICU. This again fits within Chuang et

al.'s (2007) theoretical framework (diagram 6, P2c) where the group (team) can identify and reflect upon the factors which contribute to errors and openly encourage the use of constructive conflict, to minimise factors like interruptions and have a positive impact on preventing MEs.

One of the norms identified within the nursing group, but not evident in the doctors' group, was that gossip was prevalent following an error. The negative effect of gossip has been noted by Scott et al. (2009) who report that it intensifies self-doubt and lack of clinical confidence and is generally seen as non-supportive in relation to MEs. Scott et al. (2009) suggest that gossip is often well anchored within a department's teamwork and culture and should be actively discouraged by all members, especially by the clinical leaders.

Communication and documentation following a ME did not always appear consistent and clear. Paper forms for reporting MEs were still in use and the managers highlighted how this often led to a delay in the error being dealt with. Lu et al. (2009) highlighted the inconveniences of paper form reporting, including paperwork going missing, handwriting being illegible and forms being only accessible to one person at a time. In the discussions by the managers it became clear that the documentation of the process of dealing with a ME needed to be more transparent and consistent. The managers identified the need for a robust process of dealing with a ME using a clear audit trail, across shift changes and between nurse managers . This further reinforces Chuang et al.'s (2007) theory (diagram 6, P2b) which suggests that intergroup linkages such as those between the nurse managers should be able to effectively

contribute and respond to nurses involved with a ME to have a positive impact on their learning.

There was a consensus amongst doctors and consultants that verbal communication following a ME was an important part of the learning process. Wu et al. (1991) reported that when doctors seek advice with their senior colleagues and are encouraged to discuss their mistakes, 98% of the doctors in their study reported at least one constructive change. Kroll et al. (2008) defines this as “the learning moment” when the most learning occurs, when the situation was discussed and feedback was constructive and supportive, even if there was some chastisement, as long as it was structured. This is an established recommendation of the General Medical Council (GMC, 1993) and fits within the theoretical framework of learning (Chuang et al., 2007) where group members receive constructive feedback allowing them to identify and reflect upon factors that contribute to MEs, so that they are able to learn from them.

Inexperienced and new nurses working in PICU did not feel sufficiently at ease to challenge more senior nursing staff and described feeling pressured to do what the senior nurses told them. Previous research that evaluated the contextual influence on the medication administration practice of paediatric nurses, reported how pressure from colleagues, not just senior nurses, influenced how closely they follow medication policy (Davis et al., 2005). Furthermore Philpin (1999) reported that when staff are socialised into powerful institutions such as hospitals, they must learn various formal and informal rules and regulations. This process of socialisation may rely on negative pressures from senior nurses to force compliance with ward culture. From a new nurse’s

point of view, Gray and Smith (1999) reported that nurses wishing to expel their status as an outsider, conform to the norms of the ward, such as those exhibited and encouraged by senior nurses. However, there is also the potential for new nurses to consult the more experienced colleagues, about medication practice, highlighting the opportunities that exist for senior nurses to enforce correct medication practice (Manias et al. 2004). The word 'enforce' could be misconstrued, and perhaps the terminology used within Chang et al's. theoretical model (diagram 6, p2d) is more preferable where the emphasis is on team leaders using 'coaching behaviors' to encourage all group members to speak freely and openly. This has been found to promote learning in interpersonally threatening situations. Getting the balance of local leadership right, in valuing safety and staff actions is sometimes challenging (Firth-Cozens, 2001). Whilst senior nurses may recognise the opportunities to offer peer support, their confident approach can often impede the confidence of junior nurses to challenge and question during the administration process (Dickinson et al., 2012). A study by Armitage and Knapman (2003)suggested that length of nursing experience and training have little effect on ME rates and as such, senior nurses are just as at risk of a ME, although they make may different types of errors. This suggests that having an open and free to challenge safety culture cannot be understated.

Although the study PICU had implemented processes to improve safety as a result of MEs, there was evidence to suggest that these processes may generate a false sense of security amongst staff, who do not feel the need for their own safety checks. It was evident from the findings that the pharmacy checks were seen as sufficient to prevent errors resulting in nurses not feeling

the need to always check the medication dosages. This suggests a poor perception of the risk and such risks have been studied under different frameworks such as risk compensation and unrealistic optimism (Ogden, 2012), which seem to have resonance with the findings of this study.

It was identified within the culture of PICU that the reasoning and intention behind new interventions introduced to reduce MEs, may become forgotten and 'routinisation' of the intervention becomes a 'reality of practice' on PICU. Routinisation can be described as a cognitive bias known as risk compensation, a theory which suggests that people typically adjust their behavior in response to the perceived level of risk, becoming more careful where they sense greater risk and less careful if they feel more protected (Wilde, 1998; Ogden, 2012). Routinisation could explain how staff may use risky behaviors such as not checking medication dosages because pharmacy has already checked it, or relying on the second nurse to check the dosage, when independent checking of dosages should occur.

The findings suggested that colleagues rely on each other to pick up any errors during independent checking of medication on the PICU. Weinstein (1983) suggests that unrealistic optimism leads people to carry out 'risky' behaviors as they have an inaccurate perception of risk and susceptibility, due in part to lack of personal experience to the problem. This can create the sense that if error has not yet happened to them, it will not happen in the future and this promotes the belief that the problem of error is infrequent. Weinstein (1983) described this as selective focus. Unrealistic optimism could be used to explain a number of themes identified within the results, such as reporting of near misses, relying on

colleagues in independent checking of medication during the administration as well as learning from MEs on the PICU (if staff feel it has nothing to do with them).

5.6 Factors affecting medication error reporting

Inconsistencies around reporting and misconceptions between staff both within and across different disciplines arose due to the use of personal definitions of MEs. This is not surprising considering the lack of universally accepted definitions (Brady et al., 2009; Yu et al., 2005; Elder et al., 2006.) This lack of consistency in error identification hinders the systematic reporting of errors (Cook et al., 2004). Along with this, Tamuz et al. (2004) found that incentives and professional hierarchies also influenced definitions of MEs, which could lead to an error being defined away. Nurses in particular discussed that the 'five rights' within the checking process were in place to pick up near misses and rectify them before reaching the patient. Treiber and Jones (2010) described this as going back to the basics, but highlight that even though nurses agree that the five rights adequately reflect the way things should be done, nurses do not agree what actually constitutes a ME. Ulanimo et al. (2007) propose that if a strict five rights definition of MEs was applied the number of MEs reported would increase greatly.

The findings show that ME reporting is mainly nurse led, as found in another research studies (Evans et al., 2006). The nurses identified barriers in place that inhibited them reporting MEs such as workload and time or being blamed and punished; these are well documented in the literature (Evans et al., 2006; Sarvadikar et al., 2010, Armitage et al., 2010). Similarly, other research has

suggested that the type and severity of the ME will influence the doctors' and nurses' priorities in reporting a ME, with nurses having a higher expectation of being blamed and criticised (Saravadikar et al., 2010). Both the nurses and consultants on the study PICU identified that punishment and disciplinary action was a likely barrier for nurses reporting an error. This is in keeping with Wolf et al. (2000) who suggested that nurses feel a greater responsibility for an error and experience greater fear for the consequences to the patient. This also resonates with the pharmacists' comments that their responsibility 'sits heavily on their shoulders'. The observations highlighted, that the lack of reporting involved both junior and senior nursing, furthermore that the senior nurse may also influence the junior nurse in whether to report or not. Interestingly the "think aloud technique" was refused by both junior and senior nurses, where they indicated that they would not feel comfortable in recording an account of their actions, when involved in an ME. This may be suggestive of a culture on this PICU, where staff do not feel comfortable in discussing MEs and warrants further exploration.

The literature around doctors' reporting MEs suggests a 'norm of selective disclosure' (Kroll et al., 2006) and this is likely to limit the systematic reporting or errors. This has some similarities with the findings in this study, the results of scenario B (Appendix 2) suggested that whilst all nurses would have definitely reported that particular ME, some of the doctors and ANPs, showed a small amount of doubt and in particular noted that the disclosure of this type of ME would be dependent on the medication involved. Heparin is classed as a high risk medication and listed as a 'never event'. 'Never events' are incidents which are considered unacceptable and eminently preventable (NHS England, 2013).

Davis et al. (2005) discussed the issue, where staff had a strong perception of harm relating medication, such as with heparin, they are more likely to strictly adhere to policy and make a clinical judgment to report it, as they have a clearer understanding of the risks involved and the benefits of reporting.

The consultants identified the nurses as being in the best position to notice an error and that the nurses had more time to report a ME. The literature review identified that doctors are not always aware that they have made an error as prescribing errors are often discovered later on in the process by the pharmacist or nurse (Dean, 2002). Similarly, the idea of nurses and pharmacists acting as a 'safety net' in detecting prescribing errors was noted by Dornan et al. (2009). In common with the findings about nurses, blame was identified as a barrier to reporting, research has identified that although the fear of blame is high in nurses, they are still likely to report an error, suggesting it may not be as strong a barrier to reporting as in doctors (Sarvadikar et al.,2010).

It was clear from the scenarios that both doctors and nurses were more likely to report an error with worse outcome for the patient, and this is shown in other studies (Wolf et al., 2000; Evans et al., 2006; Alrwisan et al., 2009). Evans et al. (2006) suggests this is due to a lack of knowledge among doctors of the need to report less serious errors, or a perception of being too busy to have the time to report. In drawing analogies with Chuang et al.'s (2007) theoretical model (diagram 6, P1a) MEs that are more prominent are more likely to attract more attention and so individuals, groups and organisations are more likely to take action and therefore learn from these events. However, learning theories have

highlighted that near-misses can be valuable in triggering organisational learning (Miner et al. 1999).

The findings highlighted that nurses may deviate from protocols at times. Reasons for this appeared comparable with the literature, in that environmental factors such as interruptions, multitasking and workload interfere with their ability to administer medications and that this in turn leads to deviation from protocols (Dickinson et al., 2010). Attitudinal influences such as complacency and approachability identified by Dickinson et al. (2010) resonated with the nurses' discussions in the focus group. However, other influences such as trustworthiness and the availability of staff to double check that were also reported by Dickinson et al. (2010) were not mentioned by the nurses in this study. The nurse managers reported that some nurses just made the decision to not follow policy. Benner et al (1999), offers the explanation that nurse are encouraged to think critically about their practice and the decision to deviate from policy forms part of their clinical judgment. Noncompliance with protocols has been identified on this PICU and many others as a cause of MAEs and reported as a causative factor of MAEs (Armitage and Knapman, 2003). The observations identified that in 86% of the medication administrations observed, staff did not visibly check the identify bands or patients' names on the prescription booklets, this inconsistency is well reported (Dickinson et al., 2010; Manias et al., 2005). This may be an ICU-related phenomena, as in ICU, nurses usually only have one patient. However, it transgresses both hospital protocol and nursing registration requirements. Dickinson et al. (2012) reported that compliance is influenced by the potential for harm. The nurses in the focus groups identified that independent double-checking during administration of

medication was often rushed and done incorrectly. Observations highlighted a complacency that the other nurse would pick up a mistake, which aligns with the previous discussion of risk compensation, where there is an unrealistic optimism that a ME will not happen. Davis et al. (2005) suggest that familiarity with colleagues also determined the adherence to protocols and checking administration. Recent research has shown there is insufficient evidence to support or refute if double checking reduces MEs (Alsulami et al., 2014a). The trust where this study took place has moved to a single checking policy with all oral medication apart from high risk ones such as warfarin or controlled medications. Furthermore Alsulami et al. (2014b) in a study looking at nurses' knowledge about the double-checking process, found nurses do not always receive formal training in how to double-check correctly. This may suggest that further training on independent double-checking of medication by nurses may be warranted to encourage and assist adherence to protocol.

5.7 Learning from MEs

The findings suggested that the engagement of the bedside nurses within the process of learning from MEs on PICU was difficult. To learn from MEs, an organisation must first engage staff in local learning processes (Edmondson, 2004). Nurse managers reported that in everyday practice there were difficulties in actively engaging staff on the PICU to learn from errors. Edmondson (2004) advocates that the collective engagement of staff to learn from errors stems from the dedicated understanding of frontline leaders with an awareness of a number of principles. Firstly, failures (MEs) present learning opportunities for sharing, highlighting that failures in hospitals are systematic in causation. As such, management of errors should be aimed at identifying the systematic

cause of an error, rather than blaming the individual. Secondly, there needs to be acknowledgment that 'quick fixes' allow the underlying causes to persist. Thirdly, there needs to be acknowledgement that employees need psychological safety in order to allow problem solving and learning. Edmondson (2004) advocates that leadership is essential in creating this learning climate, and advises that although learning may seem slow, constant effort is needed to engage people as active thinkers and learners. These principles could be useful in developing and standardising the management process following a ME in the study PICU, as this could remove blame where appropriate, address the systematic causation of error and provide further support to staff.

The pharmacists and doctors on the PICU perceived that nurses did not have adequate representation at the critical incident meetings. This then did not allow the frontline nurses to become engaged in the thinking process and to come up with solutions on improving safety. Tjosvold et al. (2004) discusses the challenges of teams learning from mistakes advising that in order for teams to engage in learning, open problem solving is required. Open problem solving allows staff to discuss errors together, understand them and make improvements without blame, although there must be a willingness to learn. Tjosvold et al. (2004) outlines that open problem solving generates positive team outcomes. Engaging more nurses in the critical incident meeting also fits with Chuang et al.'s (2007) theoretical framework in a number of ways, (diagram 6. Group diversity (P2a) which proposes the heterogeneity of group members knowledge and experience will have a positive impact on group learning from MEs. Additionally, intergroup linkages (P2c), proposes that group

norms of openness that encourage the use of constructive conflict will have a positive impact on learning from MEs.

Alternatively, Arygris and Schon (1978) concluded that people in organisations may actually interact, unknowingly, in ways to block learning. Expanding on this they suggested that managers tend to avoid emotional discussions and exercise control in conflicts, this can often lead to a close mindedness and rigidity to stick to current practices. The pharmacists perceived that hospital management were not following through with one of the hospital's 'top priorities' to reduce MEs, because nursing staff did not have clinical time to engage in critical incident meetings, as staffing levels rarely allowed this to happen on PICU. Ginsburg et al. (2009) identified that a true safety culture at organisational level understands the mechanisms that impact on safety at a departmental level. Firth and Cozens (2001) suggest that this safety culture can be created if individuals and teams are permitted to learn from errors. The findings on PICU suggest that front line nursing staff should be better engaged in discussions on MEs, so as to improve learning and bring a clearer perspective on causation of errors and to identify training issues. The work of Drach-Zahavey and Pud (2010) concluded that the effective team learning mechanisms are those that facilitate systematic gathering of information, rather than concentrating on singular medication errors. They highlight that effective team learning mechanisms engage and use all nurses on the ward via an 'integrated learning' approach, rather than just attributing learning to the nurse managers and risk management. Furthermore, Popper and Lipshitz (2000) advocated that for truly integrated learning, the same people involved in MEs should be included in generating and applying lessons learned.

Participants accounts of the reflective learning tool used on the PICU following a ME showed different perspectives. The nurse managers perceived that there was a clear difference in how nurses and doctors completed the tools, and they claimed that nurses made ‘excuses’ and doctors took ‘responsibility’. However, they also noted that, in general, the reflective accounts were too ‘generic.' Research shows that nurses pass through a number of processes to reach the point of learning (Treiber and Jones, 2010). An ‘excuse’ is where a person accepts the action was wrong but full responsibility is denied. Treiber and Jones (2010) concluded that ‘blame effusion’ must take place; this means that nurses will make excuses to make sense of an event and help them deal with the mistake effectively. In making sense of the event, the nurse looks at the context in which the error occurred, and then finds excuses. The reflective learning tool appears to offer a way of navigating the complex nature of medications errors, rather than necessarily offering ways to learn and change them. In this respect, it is aimed at the individual, rather than fixing the system level problem. On an individual level, accurate administration is deeply embedded within the principle of nursing and making a ME threatens the professional self and their own background expectations (Treiber and Jones, 2010). As such, nurses making ‘excuses’ may actually know that the responsibility for safe medication administration was theirs, but use the excuse as a means of rationalizing and making sense of the error. Trieiber and Jones (2010) outline the need to understand how nurses make sense of errors and suggest that the positive and negative emotions expressed by the nurse should be taken into account to truly understand how nurses learn from MEs and as such, there is the need to dig beneath the surface of the excuse.

The idea that the reflective tool may just address the individual's learning about a ME may give some explanation why shared learning does not always take place on the PICU. The Department of Health's (2000) central idea in patient safety is that a focus on the individual makes it harder for systems to learn from their mistakes. Chuang et al.'s (2007) theoretical model is consistent with this, that MEs caused by heterogeneous factors will have a positive impact on group and organisational learning. However, there is also a drawback to this, attribution theory has shown that making causal external attributions, means the individual is less likely to take responsibility for the error and hence learn from it (De Jong et al., 1988). The findings from the content analysis of the reflective learning tools suggest that the nurses appear to make external attributions and do not take responsibility when reflecting on errors, this may explain why some individuals do not learn from completing the reflective learning tools. Chuang et al.'s (2007) model also proposes (P1c) that individuals who attribute negative outcomes to themselves will have greater individual learning compared to those who attribute errors to systems within the organisation. This then offers a theoretical basis of why taking responsibility for an error is an important component for learning. In conclusion, individual learning and group learning are different and individual learning is more likely if the individual takes responsibility and attribute error to themselves. Group learning and organisational learning are more likely if errors are perceived to be caused by a complex interaction of multiple factors.

The nurse managers perceived that doctors took responsibility for the ME when completing the reflective learning tools. The literature shows that this is an important step in individuals learning from a ME as this is more likely tto lead to

constructive changes in practice, whereas defending an error may lead to a barriers in learning. Scott et al. (2009) looked at how nurses and doctors recover from being involved in a ME and their findings provide a deeper understanding of the emotions involved following an error. They outlined five stages: 1) the chaos and accident response; 2) intrusive reflections, where feelings of internal inadequacy develop; 3) restoring personal integrity; 4) enduring the inquisition and finally obtaining emotional first aid; and 5) moving on. They claim the first three stages may occur simultaneously. Taking the influence of these factors and stages into account and when the reflective learning is given to the staff member could greatly affect how the reflective learning tool is completed. One doctor's account during an interview gave evidence to this effect as they noted that if you are given the tool to complete in the chaos of the aftermath of the incident, where feelings of internal inadequacy usually occur, the reflective learning tool may be too intrusive, At this time, the tool may not allow staff to restore their personal integrity and allow them to truly reflect and gain the most out of the process. However, guidelines for the management of MEs, suggest that the ME should be dealt with as soon as possible after the event; this timing warrants further research.

During the interviews and focus groups, all participants were shown a new intervention (short anonymous e-learning, focused reflective learning tool as a questionnaire) [Appendix 17]. The intention was this would be given to all staff involved with a ME regardless of their role. Feedback indicated that the tool would be more useful than the current tool in helping staff to learn from a ME. In comparison to the current reflective learning tool it could be emailed to the individual who could complete it at a time that felt mutually appropriate to them

and when it felt less intrusive. To gain more out of the reflection, the new tool could be completed after the manager's initial meeting following an error and when the individual had received appropriate support. The new tool is structured to guide reflection, establish causation factors and gain insight into how the error could be prevented, this anonymised information could then be collated to promote shared learning across the team.

The notion of support and psychological safety through actively engaging staff in the learning process is important (Edmonsdon, 2004). Staff perceptions of management were generally positive and the managers noted the importance of supporting staff involved with a ME. However, some of the nurse managers talked about the inconsistencies between the different styles of management. Chuang et al.'s (2007) theoretical framework claims that different leadership styles may affect the learning and these depend on the coaching behaviors used and leadership approaches that value safety will have a positive impact on medication safety.

Studies looking at how doctors' engage and learn from errors, such as Kroll et al.'s (2008) work describe 'the learning moment' when the most learning occurs. This happens when the situation is discussed, the feedback is structured, constructive and supportive, even if there is chastisement. In contrast, humiliation by a senior doctor can lead to doctors never understanding their own errors (Kroll et al., 2008). Burack et al. (1999) suggest that the increased awareness of MEs may cause 'desensitisation' and hence prevent learning. Doctors in previous studies have reported that formal teaching, involving small group discussions, focusing on real errors and presented by senior doctors who

have been involved with MEs, provides important support and learning (Fischer et al., 2006).

As part of the learning process and the management of MEs on PICU, staff discussed the 'reality of practice' in disseminating information on MEs within the PICU in order for shared learning to take place and increase medication safety. There appeared to be three main methods of disseminating information: the summary of the critical incident meeting emailed to PICU staff;verbal discussions amongst the doctors; and further emails between the nursing staff and nurse managers. The adjustment of behaviour by means of feedback has been identified as an essential component of learning (Walshe, 2003). Edmondson (2002) points to the superiority of using the full cycle of learning, but in the 'reality of practice' this may lead to 'patchy learning' where the steps of this cycle are used separately and unsystematically leading to a lack of shared knowledge and little change in practice (Drach-Zahavy and Pud, 2010).

Findings from this study suggest that emails may lead to a 'fragmented' style of learning, similar to the 'patchy learning' described by Edmondson (2002) and Drach-Zahavy and Pud (2010). Firstly, examining the finding, this may be due to the type of error put on the critical incident summary being picked from a list of errors where not all errors were available on the summary. Secondly, because the process stopped following dissemination, no further evaluation of learning from a particular error took place, so some staff would read the email and have an awareness of MEs on the PICU, others may choose not to read the email. It appeared that some types of ME, were only reevaluated if the same error took place again, starting the whole process off of reporting an error. This suggests that the fully cycle of learning and re-evaluation does not always take place.

Edmondson (2002) demonstrated that actual learning occurs in the final stages of the cycle when changes are put in place and re-evaluation occurs.

When reporting of an error has occurred, lack of feedback can take away the incentive to report again, as one doctor explained it ‘disappeared off into the ether..... It takes away the incentive'. This is well documented in the literature that lack of feedback can form a motivational barrier to reporting medication errors (Walker and Lowe, 1998; Mcardle et al., 2003; Waring, 2005). In contrast, too much feedback may lead to desensitisation (Burack et al., 1999). The overuse of emails was evident in the findings of this study with the nurses, in particular, expressing the need for a balance of emails . So whilst staff should be made aware of MEs that occur on the PICU, there should also be more positive feedback on the success (e.g., the reduction in the number of MEs) of the interventions introduced; this would mean that staff could see the benefit.

5.8 Content analysis of reflective learning tools

The layout of the current reflective learning tools (Appendix 16) and the way in which they are introduced to staff following a ME allows for varying levels of self-analysis, which appears to be dependant on the individual who has completed the tool. Put simply, the tools were classified into two groups ‘brief’ (n=19) and ‘detailed’ (n=20) reflections, indicating that just over half were too brief to ascertain whether any true reflection and evidence of learning had taken place. This is in line with some of the evidence gained from the focus groups and interviews in which staff talked of using the tool as a tick box exercise and that it was not achieving its goal of identifying areas for individuals to learn. Armitage (2011) identified that brief reports may arise when the nurse or doctor has no idea of causation and therefore are unable to identify the

learning and development required to put the ideal steps in place to prevent the ME reoccurring. The lack of text in the brief reports and illegible writing also hampered some of the analysis.

The differences between how nurses and doctors completed the reflective learning tools and the emotional impact following an error have already been discussed in section 5.2. However, it is noted here that the reflective learning tool generated evidence that was in concordance with data from the focus groups and interviews. although the content analysis did identify that some individuals had become more focused and more situationally aware following a ME. The response to these errors were individualistic in nature and scope, and the lessons learned reflect a doubling of efforts by staff, rather than fixing system level problems (Treiber and Jones, 2010). The impression is that staff are navigating their way through a complex system rather than actually trying to fix it. Attribution theory suggests that if individuals attribute negative outcomes to themselves, and take some responsibility, they are more likely to make constructive changes, but if they attribute blame to others or the organisation they are unlikely to do anything in response to the ME (Chuang et al., 2007).

5.9 Limitations of the study

The limitations of this study constrain its overall quality and generalisability. The study was small scale and undertaken in a single study centre and it relied on convenience sampling which is not the most robust sampling strategy, Also, there were recruitment issues due to a reliance on participants' volunteering to take part in their own free time. However, the findings were broadly consistent

with the literature identified, suggesting that the findings may be representative of the perceptions of MEs by staff in other hospital settings.

A weakness of the observations was the relatively small amount of administration episodes observed; this was limited by the availability of the sole field researcher. The limited duration of the observations therefore raises questions about whether the findings are a true reflection of the error rate, as it was likely that within a busy environment such as PICU to miss some errors, as medications were being given simultaneously. However, the underreporting of errors was clearly identified.

The theoretical model chosen to propose how to facilitate learning, did not take into account near misses. The model was intended to apply to situations where MEs have been reported by those involved. As this is not always the case on this PICU, some of the propositions identified may not be applicable to learning from all forms of error. An area of the theoretical model, where analogies were not drawn was around organisational linked to the hospital's risk management team. It maybe beneficial to include their perspective in future research.

5.10 Summary of findings

The reality of practice on PICU should be taken into account when addressing the prevalent contributory factors that increase the likelihood of a ME occurring, such as interruption and distractions. The findings in this study concur with the findings relating to the reporting and causation of MEs from other studies. The findings suggested that a lot of the problems that arose around learning from

MEs on PICU appeared to be the polar opposite of what Chuang et al (2007) model proposed in order to facilitate an environment conducive to learning.

5.10.1 Recommendations for practice

The following recommendations for practice are proposed:

1. Tackling the climate/culture of PICU

    •Reducing blame and fear of punishment, by promoting constructive support from senior staff. This should include tackling the culture of gossip and the consequences to the nurses following involvement with a medication error.

    •Interruptions/ distractions and hierarchy - Leaders should be encouraged to establish cultural norms where informal interruptions and distractions are actively discouraged across the whole PICU team, nurses also need to feel empowered to reject interruptions.

    •Reporting- A clear and shared definition of what constitutes a ME should be made a priority to change attitudes of all staff regarding the purpose of reporting errors and near misses. Whilst it was identified within the study, that time and workload may inhibit reporting, there is a need to increase staff awareness that failing to learn from a mistake, could lead to another patient suffering harm. Therefore clarity across the PICU is required on who is responsible for reporting a medication error, where the triggers for reporting an error are clearly defined to all staff on the unit.

2. Management of medication errors on PICU

    •Better engagement of staff in medication safety, by providing clinical time for staff nurses to rotate into the PICU critical incident meetings. This should also include a better balance of emails sent to staff, where positive feedback is given to staff about successful medication safety interventions.

    •Reduce inconsistencies in the management of MEs by introducing clearer guidelines, flowcharts and shared computer access to specific PICU documentation, so that information is up to date and accessible to all managers on all shifts.

    •Increase support for staff involved in a ME prior to them completing a reflective learning tool so as to reduce blame and allow staff to express the emotional affect of the error.

5.10.2 Recommendations for research

The following recommendations for future research are proposed:

1. A process improvement study using rapid cycle testing to define, measure, analyse, improve and control interruptions and distractions on the PICU, using observations of nurses administering medication and doctors prescribing.
2. Further study is also warranted to evaluate the implementation of the new reflective learning tool on the PICU study to determine (1) the impact on individual and shared learning and (2) the best time for completing the tool (e.g., immediately after error as is current practice or at a less anxious time).
3. Development of a tool for managers on PICU to improve consistency around management following a ME to ensure clearer communication and documentation. Future work could also include the role of leadership, as it would be interesting to see how the nurse manager's role influences the creation of a positive learning climate.

CHAPTER 6: CONCLUSION

The complex nature of the medication process provides a challenge in identifying how staff learn from medication within a busy environment of PICU. The study has taken the 'reality of practice' on PICU into consideration to improve the understanding of how learning may take place. Causative factors identified such as informal interruptions and distractions should be controlled, and improvements should be sought into how the PICU team's situational awareness of the PICU environment can be improved. A lot of problems that arose on PICU were identified as being in opposition to what the theoretical framework by Chuang et al., (2007) proposed in order to facilitate an environment conducive to learning. The framework guided the discussion and helped to identify possible areas where improvements could take place on PICU. Such as the importance of participative leadership, in establishing cultural norms, where informal interruptions and distractions are actively discouraged and coaching behaviors by management, encourage group members to speak freely and openly and encourage constructive conflict.

Staff engagement should be sought at all levels to promote learning. Staff need to see the relevance of new safety processes implemented, through positive feedback. MEs remain underreported on this PICU. A clearer definition and repeated guidance of what constitutes a ME may have the potential to improve reporting. Perceived barriers such as lack of clear definitions of what constitutes a ME, blame and punishment and time and workload, inhibit reporting across all professions.

Self reflection and analysis following involvement in a ME, does not always take place to identify learning opportunities. The current reflective learning tool does not facilitate a very useful reflection on the error and is unlikely to promote either individual or shared learning across the unit. The findings suggest that support and guidance is required to enhance reflection and learning and assist nurses to handle difficult situations emotionally. Further research is warranted to evaluate tools that guide reflection and enhance learning, to have greater affect on MEs, which in the most part are deemed ‘preventable'.

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APPENDICES

Appendix 1 Topic guide for focus groups and interviews

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EXPLORING MEs AND DOCTORS AND NURSES PERCEPTIONS OF THEM IN THE PAEDIATRIC INTENSIVE CARE UNIT (PICU)

TOPIC GUIDE FOR FOCUS GROUPS

To examine: How do doctors and nurses' who work in the PICU perceive

- MEs
- The management of MEs
- How they learn from MEs

INTRODUCTION

Introduce self

Explain nature of research and topics to be discussed

Stress confidentiality

Explain what happens to data collected – transcribed, reported and anonymity

Introduce tape recorder

Ground rules – one person to speak at a time, everyone's views important so want to hear from everyone, no right or wrong answers, looking for range of views.

Mobile phones off

Invite any questions.

PERCEPTIONS OF MEs – hand outs given to participants

Discuss 4 scenarios: Which scenarios would likely result in an incident form being completed

Following discussion, ask the participants to actually grade the scenarios on a scale 1-5 in severity and likelihood to report as a medication error?

INCIDENT REPORTING OF MEs

Thinking about these scenario's and the current incident reporting system for MEs – 'Ulysses'

What do you feel are the 3 main barriers to reporting?

Views on difference between reporting near miss/ actual error.

CONTRIBUTORY FACTORS TO MEs ON THE PICU

View on groups understanding of causative factors that contribute to medication errors on this PICU

- What do you think are the top 3 factors that contribute to MEs on this PICU?

- In order to reduce MEs on this PICU, what are the top 3 things you think could be implemented to reduce the number of MEs?

LEARNING FROM Medication ERRORS ON THIS PICU

Thinking about your experiences of learning from MEs and improving safety on this PICU – you don't need to share any personal experiences – but how do you think doctors (or nurses) 'learn' from errors so they don't make the same mistakes again?

- Does the culture in this PICU make it easy to learn from the errors made by others?

  i.e. is it an individual process/team learning process

- Is it difficult to discuss medication errors on this PICU?

- What views do you have on the current reflective learning tool and the way it is used?

- Would you find this tool more effective/or ineffective if you didn't have to give it back to the managers to see?

If this PICU introduced a new intervention which combined a number or processes involving:-

Show tool on presentation screen

- An anonymous (non-manager seen) short e-learning tool (questionnaire) to be completed by all staff involved in an error regardless of their role

- Monthly feedback of the results of this anonymous data collected, formally to the whole PICU team in a variety of formats

- Short focused training programme for staff on MEs.

What are your views on this as an idea to reduce errors?

How do you normally become aware of MEs on this PICU?

In what other way could this PICU improve this?

Is there a ME or near miss experience on the unit which has led to a change in your practise.

MANAGEMENT OF MEs ON THIS PICU

In the last five minutes we will discuss how managers working within this PICU address medication errors/near miss

What one word would you use to explain management of medication errors on this unit?

Looking at how managers support staff involved with MEs on this PICU

What do you think could be the best process?

Appendix 2 Scenario's for focus groups and interviews

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Scenario for focus group – doctors

A heparin infusion is prescribed incorrectly equating to a times 10 overdose.

How likely do you think a critical incident form would be completed for each scenario?				
Would not report				Definitely report
1	2	3	4	5

Please circle a number for each scenario

A. The error is detected prior to administration to the patient.

1 ------- 2 ------- 3 ------- 4 ------- 5

B. The error is detected 2 hours later, after safety checks of drug infusions following hand over to nursing staff on commencement of next shift – The patient suffers no adverse outcome resulting from this error.

1 ------- 2 ------- 3 ------- 4 ------- 5

C. The error is detected following the patient having a large gastrointestinal bleed and increased APTT ratio. The patient suffers no permanent damage resulting from this error.

1 ------- 2 ------- 3 ------- 4 ------- 5

D. The error is detected following the patient having a large gastrointestinal bleed and increased APTT ratio. The patient later suffers cerebral bleeding and subsequently dies.

1 ------- 2 ------- 3 ------- 4 ------- 5

Appendix 3 Observation template

Participant Number ..... Drug Administered .....

Oral/ Intravenous/topical/inhaler	administrator	2nd checker	
Visually checks Patient ID Band	☐	☐	.....
Dosage checked / calculation correct	☐	☐	.....
Right re-constitution of drug	☐	☐	.....
Right Route – checked prescription	☐	☐	.....
Right Date – checked prescription	☐	☐	.....
Check correct drug vial / expiry date	☐	☐	.....
Right Time (time within 30 minutes)	☐	☐	.....
PRN drugs interval time checked	☐	☐	.....
Independently checked by second checker		☐	.....

Further checks for IV drugs

Appropriate diluent used		☐	.....
Correct drug concentration		☐	.....
Correctly labelled		☐	.....
Correct infusion rate programmed		☐	.....
Correct route i.e. peripheral/CVL		☐	.....
Drug compatible with other drugs in IV line		☐	.....
Bolus of drug given over correct time		☐	.....

Reason for deviation from protocol.....

.....

.....

Appendix 4 Focus group and interview invitation to participate

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EXPLORING MEDICATION ERRORS AND DOCTORS' AND NURSES' PERCEPTIONS OF THEM IN THE PAEDIATRIC INTENSIVE CARE UNIT

FOCUS GROUPS

We want to hear from you!

As a member of the PICU nursing /medical team you are invited to attend a focus group as part of a study to explore medication errors in this PICU

This study forms part of future plans around medication errors looking at tools to 'improve learning' from errors and methods into improving PICU 'team shared learning' from errors.

Three focus groups will be undertaken, with around 8 staff per group.

One focus group each, for Nursing staff (band 5/6), Doctors, Consultant/Managers.

We need your input!

Date Time Seminar Room – Education Centre

To be part of one of these focus groups or receive more information please contact:

Dr Lyvonne Tume (lead researcher) on email @ Lyvonne.tume@alderhey.nhs.uk
Joanne Johnston (student researcher/PIC Nurse) on email @ joanne.johnston@alderhey.nhs.uk

Appendix 5 Participation information sheet for Doctors and ANP's

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Exploring MEs and Doctors' and Nurses' Perceptions of them in the Paediatric Intensive Care Unit

Participant information sheet for DOCTORS/ANP

We would like to invite you to take part in our research study. Before you decide, we would like to explain what the study is about, and what joining the study will involve. The researcher, Jo Johnston, will go through the information sheet with you and answer any questions you have.

What is the purpose of the study?

The aim of the study is to gain a more accurate understanding of ME occurrence in this PICU and to explore the PIC team's perceptions of MEs and how they perceive that they learn from them. This study is the researcher's MSc project. It also forms part of future research plans around MEs looking at (1) tools to improve learning from errors and (2) methods into improving PICU team shared learning from errors.

Why have you been chosen to participate?

You are a doctor or ANP working on the PICU at Alder Hey Hospital.

What will happen if I take part?

Three focus groups will be undertaken, with around 6 staff per group. One focus group each, for nursing staff (Band 5 & 6), medical staff, and managers to generate discussion about MEs in general on PICU. They are not intended to discuss individual events that people have been involved with. They will be conducted in a quiet and private room in the education centre on a date and time convenient to the participants. Each focus group will last approximately 1 hour. With your consent the focus groups will be audio recorded, this audio recording will then be transcribed and ALL identifying details (any names etc.) removed. The audio tapes will then be destroyed. Should you not wish to be audio recorded, you will be unable to participate as part of the focus group.

Do you have to take part or can you change your mind?

You do not have to participate in this study; it is up to you to decide whether or not you wish to take part. If you would like to take part, we would ask you to email the researcher directly. Prior to the start of the focus group you will be asked to sign a consent form. You will be completely free to withdraw from the study (i.e. leave the focus group) at any point. You do not have to give a reason. Once the focus group data are transcribed and anonymised, all identifying details will have been removed so we will not be able to remove your responses.

What are the advantages and disadvantages to being in the study? The information gained by the study may help to improve how MEs are perceived and managed on this PICU and help us to understand how PICU nurses and doctors 'learn' from them. The focus group will take place at a mutually convenient time. The focus groups do not intend to cause anyone any distress, however asking questions may remind you of a past event which may be

upsetting for you. You do not have to answer any questions you do not want to and can leave the focus group at any time if you wish.

Will the information be kept confidential?

In order to allow us to remember everything that has been said in the focus group, the groups will be audio recorded. These tapes will then be transcribed; with any names and identifiable references removed so that individuals participating in the focus groups (or any patients) cannot be identified. Information will be stored on a secure password protected computer on the PICU at Alder Hey. Only the lead researcher, Dr Lyvonne Tume and nurse-researcher, Joanne Johnston will be involved in moderating the focus groups and transcribing them. It is anticipated that some direct quotes may be used, when the study is published, which again will not identify any individual participant. Any discussions within the focus groups will be treated as confidential, unless any information is disclosed about poor clinical practice (as defined by the GMC Code of Professional Conduct or the NMC Code of Professional Conduct), in which case this will be referred to your consultant supervisor.

What will happen to the results of this study?

The results of this study will be presented within the Children's Nursing Research Unit at Alder Hey, PICU and Alder Hey Children's Foundation Trust. This will be via Grand Rounds, PICU meetings, PICU mandatory training, staff induction and the Trust's Safe Medication Committee. It is intended to submit this information for presentation at a PICS meeting and for publication in a peer reviewed journal.

How can I gain further information?

You can contact the lead researcher, Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk or nurse-researcher and PIC nurse, Joanne Johnston, on email @ joanne.johnston@alderhey.nhs.uk . Should you have any concerns please contact: Clinical Lead, PICU, Alder Hey Children's Hospital FT, Dr Steve Kerr @ steve.kerr@alderhey.nhs.uk. Dean of School of Health, UCLan, Preston, Dr Nigel Harrison, on email @ NHarrison@uclan.ac.uk

Who has reviewed this study?

Research in the NHS involving staff, which does not involve patients or families, does not need to be looked at by a Research Ethics Committee. Approval has been sought through UCLAN university ethics committee and through the senior PICU management team at Alder Hey NHS Foundation Trust

Appendix 6 Participation information sheet for nurses

Alder Hey Children's NHS
NHS Foundation Trust

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University of Central Lancashire

Exploring MEs and Doctors' and Nurses' Perceptions of them in the Paediatric Intensive Care Unit

Participant information sheet for NURSES

We would like to invite you to take part in our research study. Before you decide, we would like to explain what the study is about, and what joining the study will involve. The researcher, Jo Johnston, will go through the information sheet with you and answer any questions you have.

What is the purpose of the study?

The aim of the study is to gain a more accurate understanding of ME occurrence in this PICU and to explore the PIC team's perceptions of MEs and how they perceive that they learn from them. This study is the researcher's MSc project. It also forms part of future research plans around MEs looking at (1) tools to improve learning from errors and (2) methods into improving PICU team shared learning from errors.

Why have you been chosen to participate?

You are a Band 5 or 6 Nurse working on the PICU at Alder Hey Hospital.

What will happen if I take part?

Three focus groups will be undertaken, with around 6 staff per group. One focus group each, for nursing staff (Band 5 & 6), medical staff, and managers to generate discussion about MEs in general on PICU. They are not intended to discuss individual events that people have been involved with. They will be conducted in a quiet and private room in the education centre on a date and time convenient to the participants. Each focus group will last approximately 1 hour. With your consent the focus groups will be audio recorded, this audio recording will then be transcribed and ALL identifying details (any names etc.) removed. The audio tapes will then be destroyed. Should you not wish to be audio recorded, you will be unable to participate as part of the focus group.

Do you have to take part or can you change your mind?

You do not have to participate in this study; it is up to you to decide whether or not you wish to take part. If you would like to take part, we would ask you to email the researcher directly. Prior to the start of the focus group you will be asked to sign a consent form. You will be completely free to withdraw from the study (i.e. leave the focus group) at any point. You do not have to give a reason. Once the focus group data are transcribed and anonymised, all

identifying details will have been removed so we will not be able to remove your responses.

What are the advantages and disadvantages to being in the study?

The information gained by the study may help to improve how MEs are perceived and managed on this PICU and help us to understand how PICU nurses and doctors 'learn' from them. The focus group will take place outside of your clinical shift at a mutually convenient time. Staff will be paid 1.5hours (bank) for their hours' time to attend this focus group. The focus groups do not intend to cause anyone any distress, however asking questions may remind you of a past event which may be upsetting for you. You do not have to answer any questions you do not want to and can leave the focus group at any time if you wish.

Will the information be kept confidential?

In order to allow us to remember everything that has been said in the focus group, the groups will be audio recorded. These tapes will then be transcribed; with any names and identifiable references removed so that individuals participating in the focus groups (or any patients) cannot be identified. Information will be stored on a secure password protected computer on the PICU at Alder Hey. Only the lead researcher, Dr Lyvonne Tume and nurse-researcher, Joanne Johnston will be involved in moderating the focus groups and transcribing them. It is anticipated that some direct quotes may be used, when the study is published, which again will not identify any individual participant. Any discussions within the focus groups will be treated as confidential, unless any information is disclosed about poor clinical practice (as defined by the NMC Code of Professional Conduct), in which case this will be referred to the unit manager.

What will happen to the results of this study?

The results of this study will be presented within the Children's Nursing Research Unit at Alder Hey, PICU and Alder Hey Children's Foundation Trust. This will be via Grand Rounds, PICU meetings, PICU mandatory training, staff induction and the Trust's Safe Medication Committee. It is intended to submit this information for presentation at a PICS meeting and for publication in a peer reviewed journal.

How can I gain further information?

You can contact the lead researcher, Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk or nurse-researcher and PIC nurse, Joanne Johnston, on email @ joanne.johnston@alderhey.nhs.uk. Contact details should you have any concern: Clinical Lead, PICU, Alder Hey Children's Hospital FT, Dr Steve Kerr @ steve.kerr@alderhey.nhs.uk. Dean of School of Health, UCLan, Preston, Dr Nigel Harrison, on email @ NHarrison@uclan.ac.uk

Who has reviewed this study?

Research in the NHS involving staff, which does not involve patients or families, does not need to be looked at by a Research Ethics Committee. Approval has been sought through UCLAN university ethics committee and through the senior PICU management team at Alder Hey NHS Foundation Trust.

Appendix 7 Participation information sheet for managers

Alder Hey Children's NHS
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Exploring MEs and Doctors' and Nurses' perceptions of them in the Paediatric Intensive Care Unit

Participant information sheet for Team Leaders/Managers

We would like to invite you to take part in our research study. Before you decide, we would like to explain what the study is about, and what joining the study will involve. The researcher, Jo Johnston, will go through the information sheet with you and answer any questions you have.

What is the purpose of the study?

The aim of the study is to gain a more accurate understanding of ME occurrence in this PICU and to explore the PIC team's perceptions of MEs and how they perceive that they learn from them. This study is the researcher's MSc project. It also forms part of future research plans around MEs looking at (1) tools to improve learning from errors and (2) methods into improving PICU team shared learning from errors.

Why have you been chosen to participate?

You are a Clinical Nurse Manager currently working on PICU who encounters and has experience in managing MEs on this unit.

What will happen if I take part?

Three focus groups will be undertaken, with around 6 staff per group. One focus group each, for nursing staff (Band 5 & 6), medical staff, and managers to generate discussion about MEs in general on PICU. They are not intended to discuss individual events that people have been involved with. They will be conducted in a quiet and private room in the education centre on a date and time convenient to the participants. Each focus group will last approximately 1 hour. With your consent the focus groups will be audio recorded, this audio recording will then be transcribed and ALL identifying details (any names etc.) removed. The audio tapes will then be destroyed. Should you not wish to be audio recorded, you will be unable to participate as part of the focus group.

Do you have to take part or can you change your mind?

You do not have to participate in this study; it is up to you to decide whether or not you wish to take part. If you would like to take part, we would ask you to email the researcher directly. Prior to the start of the focus group you will be asked to sign a consent form. You will be completely free to withdraw from the study (i.e. leave the focus group) at any point. You do not have to give a reason. Once the focus group data are transcribed and anonymised, all

identifying details will have been removed so we will not be able to remove your responses.

What are the advantages and disadvantages to being in the study?

The information gained by the study may help to improve how MEs are perceived and managed on the PICU and help us to understand how PICU nurses and

doctors 'learn' from them. The focus group will take place at a mutually convenient time, probably after a nurse manager's

meeting. For staff that are not on shift that day, they will be paid 1.5 hours (bank) for their hours' time to attend this focus group. The focus groups do not intend to cause anyone any distress, however asking questions may remind you of a past event which may be upsetting for you. You do not have to answer any questions you do not want to and can leave the focus group at any time if you wish.

Will the information be kept confidential?

In order to allow us to remember everything that has been said in the focus groups, the groups will be audio recorded. These tapes will then be transcribed; with any names and identifiable references removed so that individuals participating in the focus groups (or any patients) cannot be identified. Information will be stored on a secure password protected computer on the PICU at Alder Hey. Only the lead researcher, Dr Lyvonne Tume, and nurse-researcher, Joanne Johnston, will be involved in moderating the focus groups and transcribing them. It is anticipated that some direct quotes may be used, when the study is published, which again will not identify any individual participant. Any discussions within the focus groups will be treated as confidential, unless any information is disclosed about poor clinical practice (as defined by the NMC Code of Professional Conduct), in which case this will be referred to the unit manager.

What will happen to the results of this study?

The results of this study will be presented within the Children's Nursing Research Unit, PICU and Alder Hey Children's Foundation Trust. This will be via Grand Rounds, PICU meetings, PICU mandatory training, staff induction and the Trust's Safe Medication Committee. It is intended to submit this information for presentation at a PICS meeting and for publication in a peer reviewed journal.

How can I gain further information?

You can contact the lead researcher, Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk or nurse-researcher and PIC nurse Joanne Johnston on email @ joanne.johnston@alderhey.nhs.uk

Who has reviewed this study?

Research in the NHS involving staff, which does not involve patients or families, does not need to be looked at by a Research Ethics Committee. Approval has been sought through UCLAN university ethics committee and through the senior PICU management team at Alder Hey NHS Foundation Trust.

Appendix 8 Participation information sheet for consultant's

Alder Hey Children's NHS
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Exploring MEs and Doctors' and Nurses' perceptions of them in the Paediatric Intensive Care Unit

Participant information sheet for Consultants

We would like to invite you to take part in our research study. Before you decide, we would like to explain what the study is about, and what joining the study will involve. The researcher, Jo Johnston, will go through the information sheet with you and answer any questions you have.

What is the purpose of the study?

The aim of the study is to gain a more accurate understanding of ME occurrence in this PICU and to explore the PIC team's perceptions of MEs and how they perceive that they learn from them. This study is the researcher's MSc project. It also forms part of future research plans around MEs looking at (1) tools to improve learning from errors and (2) methods into improving PICU team shared learning from errors.

Why have you been chosen to participate?

You are a Consultant currently working on PICU who encounters and has experience in dealing with MEs on this unit.

What will happen if I take part?

Three focus groups will be undertaken, with around 6 staff per group. One focus group each, for nursing staff (Band 5 & 6), medical staff, and managers to generate discussion about MEs in general on PICU. They are not intended to discuss individual events that people have been involved with. They will be conducted in a quiet and private room in the education centre on a date and time convenient to the participants. Each focus group will last approximately 1 hour. With your consent the focus groups will be audio recorded, this audio recording will then be transcribed and ALL identifying details (any names etc.) removed. The audio tapes will then be destroyed. Should you not wish to be audio recorded, you will be unable to participate as part of the focus group.

Do you have to take part or can you change your mind?

You do not have to participate in this study; it is up to you to decide whether or not you wish to take part. If you would like to take part, we would ask you to email the researcher directly. Prior to the start of the focus group you will be asked to sign a consent form. You will be completely free to withdraw from the study (i.e. leave the focus group) at any point. You do not have to give a reason. Once the focus group data are transcribed and anonymised, all

identifying details will have been removed so we will not be able to remove your responses.

What are the advantages and disadvantages to being in the study?

information gained by the study may help to improve how MEs are perceived and managed on the PICU and help us to understand how PICU nurses and doctors 'learn' from them. The focus group will take place at a mutually convenient time for all attendee's. The focus groups do

not intend to cause anyone any distress, however asking questions may remind you of a past event which may be upsetting for you. You do not have to answer any questions you do not want to and can leave the focus group at any time if you wish.

Will the information be kept confidential?

In order to allow us to remember everything that has been said in the focus groups, the groups will be audio recorded. These tapes will then be transcribed; with any names and identifiable references removed so that individuals participating in the focus groups (or any patients) cannot be identified. Information will be stored on a secure password protected computer on the PICU at Alder Hey. Only the lead researcher Dr Lyvonne Tume and nurse-researcher Joanne Johnston, will be involved in moderating the focus groups and transcribing them. It is anticipated that some direct quotes may be used, when the study is published, which again will not identify any individual participant. Any discussions within the focus groups will be treated as confidential, unless any information is disclosed about poor clinical practice (as defined by the GMC Code of Professional Conduct), in which case this will be referred to the PICU Clinical Director.

What will happen to the results of this study?

The results of this study will be presented within the Children's Nursing Research Unit at Alder Hey, PICU and Alder Hey Children's Foundation Trust. This will be via Grand Rounds, PICU meetings, PICU mandatory training, staff induction and the Trusts Safe Medication Committee. It is intended to submit this information for presentation at a PICS meeting and for publication in a peer reviewed journal.

How can I gain further information?

You can contact the lead researcher, Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk or nurse-researcher and PIC nurse, Joanne Johnston, on email @ joanne.johnston@alderhey.nhs.uk

Who has reviewed this study?

Research in the NHS involving staff, which does not involve patients or families, does not need to be looked at by a Research Ethics Committee. Approval has been sought through UCLAN university ethics committee and through the senior PICU management team at Alder Hey NHS Foundation Trust.

Appendix 9 Consent form for focus groups and interviews

Alder Hey Children's NHS
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CONSENT FORM

Project title: Exploring MEs and doctors' and nurses' perceptions of them in the Paediatric Intensive Care Unit (PICU)

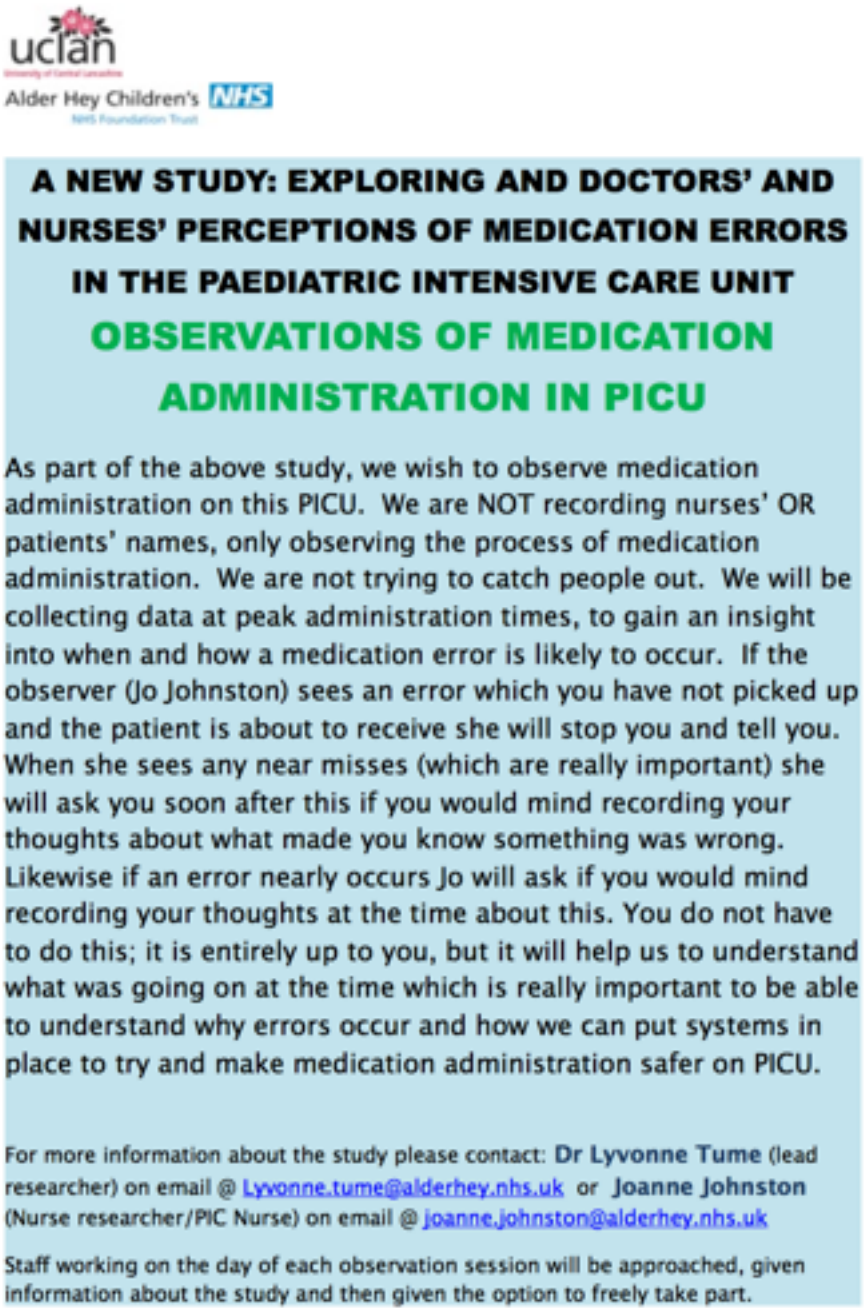
Name of researchers: Dr L Tume and Mrs Joanne Johnston

Please initial each box

I have read the participant information sheet and had the opportunity to ask questions and discuss this study	☐
I agree to keep any discussion within the focus group confidential	☐
I agree for this focus group to be audio recorded	☐
I agree for non-identifiable quotes from the focus group to be published	☐
I understand that I am free to withdraw from the study at any time, without having to give a reason	☐
I understand that relevant sections of the data collected during the study may be looked at by responsible individuals from Alder Hey Children's Hospital or from regulatory authorities, where it is relevant to their taking part in this research	☐
I agree to take part in this study	☐

_____	_____	_____
Name of participant	Date	Signature
_____	_____	_____
Name of person taking consent	Date	Signature

Appendix 10 Invitation to participate in observations



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Alder Hey Children's NHS

A NEW STUDY: EXPLORING AND DOCTORS' AND NURSES' PERCEPTIONS OF MEDICATION ERRORS IN THE PAEDIATRIC INTENSIVE CARE UNIT

OBSERVATIONS OF MEDICATION ADMINISTRATION IN PICU

As part of the above study, we wish to observe medication administration on this PICU. We are NOT recording nurses' OR patients' names, only observing the process of medication administration. We are not trying to catch people out. We will be collecting data at peak administration times, to gain an insight into when and how a medication error is likely to occur. If the observer (Jo Johnston) sees an error which you have not picked up and the patient is about to receive she will stop you and tell you. When she sees any near misses (which are really important) she will ask you soon after this if you would mind recording your thoughts about what made you know something was wrong. Likewise if an error nearly occurs Jo will ask if you would mind recording your thoughts at the time about this. You do not have to do this; it is entirely up to you, but it will help us to understand what was going on at the time which is really important to be able to understand why errors occur and how we can put systems in place to try and make medication administration safer on PICU.

For more information about the study please contact: **Dr Lyvonne Tume** (lead researcher) on email @ Lyvonne.tume@alderhey.nhs.uk or **Joanne Johnston** (Nurse researcher/PIC Nurse) on email @ joanne.johnston@alderhey.nhs.uk

Staff working on the day of each observation session will be approached, given information about the study and then given the option to freely take part.

Appendix 11 Information sheet for observations for nurses

Exploring MEs and Doctors' and Nurses' Perceptions of them in the Paediatric Intensive Care Unit

Participant information sheet for NURSES- Observations of Medication Administration

We would like to invite you to take part in our research study. Before you decide, we would like to explain what the study is about, and what joining the study will involve. The researcher, Jo Johnston, will go through the information sheet with you and answer any questions you have.

What is the purpose of the study?

The aim of the study is to gain a more accurate understanding of ME occurrence in this PICU and to explore the PIC team's perceptions of MEs and how they perceive that they learn from them. This study is the researcher's MSc project. It also forms part of future research plans around MEs looking at (1) tools to improve learning from errors and (2) methods into improving PICU team shared learning from errors.

Why have you been chosen to participate?

You are a Band 5, 6 or 7 Nurse working on the PICU at Alder Hey Hospital.

What will happen if I take part?

As part of the above study, we wish to observe medication administration on this PICU. We are NOT recording nurses' OR patients' names, only observing the process of medication administration. We are not trying to catch people out. We will be collecting data at peak administration times (approx. 2 hour periods), to gain an insight into when and how a ME is likely to occur. If the observer (Jo Johnston) sees an error which you have not picked up and the patient is about to receive she will stop you and tell you. When she sees any near misses (which are really important) she will ask you soon after this if you would mind audio-recording your thoughts about what made you know something was wrong. Likewise if an error nearly occurs Jo will ask if you would mind recording your thoughts at the time about this. You do not have to do this; it is entirely up to you, but it will help us to understand what was going on at the time which is really important to be able to understand why errors occur and how we can put systems in place to try and make medication administration safer on PICU

Do you have to take part or can you change your mind?

You do not have to participate in this study; it is up to you to decide whether or not you wish to take part. Prior to the planned observations, the researcher will go through this participant information sheet with you, if you volunteer to take part, you will be asked to sign a consent form. You will be completely free to withdraw from the study (i.e. not be observed) at any point. You do not have to give a reason.

What are the advantages and disadvantages to being in the study?

The information gained by the study may help to improve how MEs are perceived and managed on this PICU and help us to understand how PICU nurses and doctors 'learn' from them.

Will the information be kept confidential?

In order to allow us to remember everything that has been said, your thoughts at the time of any near miss ME will be recorded with your consent. These tapes will then be transcribed; with any names and identifiable references removed so that individuals participating in the observations (or any patients) cannot be identified. Information will be stored on a secure password protected computer on the PICU at Alder Hey. Only the lead researcher, Dr Lyvonne Tume and nurse-researcher, Joanne Johnston will be involved in transcribing them. It is anticipated that some direct quotes may be used, when the study is published, which again will not identify any individual participant. Any discussions within the observations will be treated as confidential, unless any information is disclosed about poor clinical practice (as defined by the NMC Code of Professional Conduct), in which case this will be referred to the unit manager.

What will happen to the results of this study?

The results of this study will be presented within the Children's Nursing Research Unit at Alder Hey, PICU and Alder Hey Children's Foundation Trust. This will be via Grand Rounds, PICU meetings, PICU mandatory training, staff induction and the Trust's Safe Medication Committee. It is intended to submit this information for presentation at a PICS meeting and for publication in a peer reviewed journal.

How can I gain further information?

You can contact the lead researcher, Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk or nurse-researcher and PIC nurse, Joanne Johnston, on email @ joanne.johnston@alderhey.nhs.uk

Who has reviewed this study?

Research in the NHS involving staff, which does not involve patients or families, does not need to be looked at by a Research Ethics Committee. Approval has been sought through UCLAN university ethics committee and through the senior PICU management team at Alder Hey NHS Foundation Trust.
Contact details should you have any concerns/issuesDirector of Studies Dr Lyvonne Tume, on email @ Lyvonne.tume@alderhey.nhs.uk. Clinical Lead,

PICU, Alder Hey Children's Hospital FT, Dr Steve Kerr @ steve.kerr@alderhey.nhs.uk. Dean of School of Health, UCLan, Preston, Dr Nigel Harrison, on email @ NHarrison@uclan.ac.uk

CONSENT FORM

Project title: Exploring MEs and doctors' and nurses' perceptions of them in the Paediatric Intensive Care Unit (PICU)

Observations of Nurses administering Medication on PICU

Name of researchers: Dr L Tume and Mrs Joanne Johnston

Please initial each box

I have read the participant information sheet and had the opportunity to ask questions and discuss this study ☐

I agree to audio record my thoughts following a near miss medication error. ☐

I agree for non-identifiable quotes from the focus group to be published ☐

I understand that I am free to withdraw from the study at any time, without having to give a reason ☐

I understand that relevant sections of the data collected during the study may be looked at by responsible individuals from Alder Hey Children's Hospital or from regulatory authorities, where it is relevant to their taking part in this research ☐

I agree to take part in this study

_____	_____	_____
Name of participant	Date	Signature
_____	_____	_____
Name of person taking consent	Date	Signature

Appendix 12 Final NVivo audit trail

Nodes

Name	Sources	References	Created On
location off the unit	7	22	08/10/2013
Nurses	7	38	02/12/2013
Perceptions of medication errors - Nursing	7	38	09/10/2013
training issues	5	26	22/10/2013
new recruits	4	5	22/10/2013
experience of senior nursing staff	5	11	22/10/2013
Medical Staff and ANP	7	56	02/12/2013
Perceptions of medication errors - medical and ANP	7	56	09/10/2013
Paediatricians	1	4	14/11/2013
Prescribing aids	3	20	21/10/2013
Professionalism	3	3	27/11/2013
anaesthetics	4	13	21/10/2013
dissemination	8	61	21/10/2013
verbal dissemination	5	11	21/10/2013
emails	8	23	21/10/2013
suggested improvements	8	74	21/10/2013
electronic prescribing	2	8	21/10/2013
Barriers to reporting errors	8	40	02/12/2013
barriers to reporting - medical	5	22	21/10/2013
Barriers to reporting - nursing	6	18	09/10/2013
Reporting of Medication Errors	9	93	08/10/2013
scenario 3 and 4	2	2	21/10/2013
checking if incident forms are completed	4	8	21/10/2013
Scenario 2	5	16	08/10/2013
specific drug reporting	5	12	21/10/2013
consequence	5	9	27/11/2013
near misses	8	37	08/10/2013
Scenario 1	7	18	08/10/2013
Experience medication errors	9	454	08/10/2013
human error	5	9	12/11/2013
Positive	7	19	09/10/2013
eg's of good practice	7	44	22/10/2013
Bad practice	7	46	02/12/2013
negative	8	32	09/10/2013
communication	9	62	21/10/2013
culture of safety	9	103	21/10/2013
Contributory factors	9	134	21/10/2013
patients coming from theatre	3	8	21/10/2013
interruptions and distractions	6	61	21/10/2013
Learning	9	291	02/12/2013

Nodes

Name	Sources	References	Created On
anonymous vs manager seen	5	16	21/10/2013
new e-learning tool	6	37	21/10/2013
Reflection learning tool	8	39	21/10/2013
Training	8	32	09/10/2013
Induction	5	20	09/10/2013
How do we learn	9	80	21/10/2013
change in practice	9	48	21/10/2013
missed opportunities to learn	9	39	21/10/2013
it dosnt effect me!!	2	4	21/10/2013
Management	9	75	02/12/2013
management of medication errors	9	75	21/10/2013
Managers perspective of medication error reportin	3	15	10/11/2013

Appendix 13 Analysis of data from focus groups and interviews

Inconsistencies and Misconceptions			
PICU Culture	**Non compliance/ compliance**	**Engagement and Learning**	**Evaluation and feedback**
<u>Inconsistent reporting</u> -Personal definitions of a ME used in the decision process of reporting a ME vary amongst colleagues.	**Medics non-compliance with Reporting** -few report -expectation nurses will report -acceptance that errors are normal - more likely to report if consequence to the patient -mistake rectifiable – do not report -logistics -medication dependable i.e. high risk medications	❖**Initially** -Paediatricians- general and ICU induction -Anaesthetists – general induction -Nurses -general induction and MSD	**<u>Dissemination</u>** ❖Medical staff receive feedback by -reflecting verbally to colleagues, easier to disseminate -supporting colleagues on shift -emails -handover -critical incident meeting -supervisory sessions

Contributory Factors	❖**Nurses compliance with reporting** -nurse led -nurses actively encouraged -time constrained -If trained use Ulysses -still use paper form	❖**Current Reflection tool** -individual learning -generic answers -paper exercise -lack of feedback -done because you have to, not seen as a learning exercise -used by management as record of action. -written to please -more clarification and detail needed ❖Timing of reflection tool being given to staff -time lapse – shift work -Denial – need support initially and spoken to confidentially.	❖**Nursing staff receive feedback by** -emails -handovers -fragmented -gossip – not always professional -noticeboard – not well located -would like to receive positive feedback to evaluate how an improvement process has gone
Non – compliance -following protocol -2 nurses independently checking **Internal Environment** -Multi-tasking -loose focus Slips, mistakes			

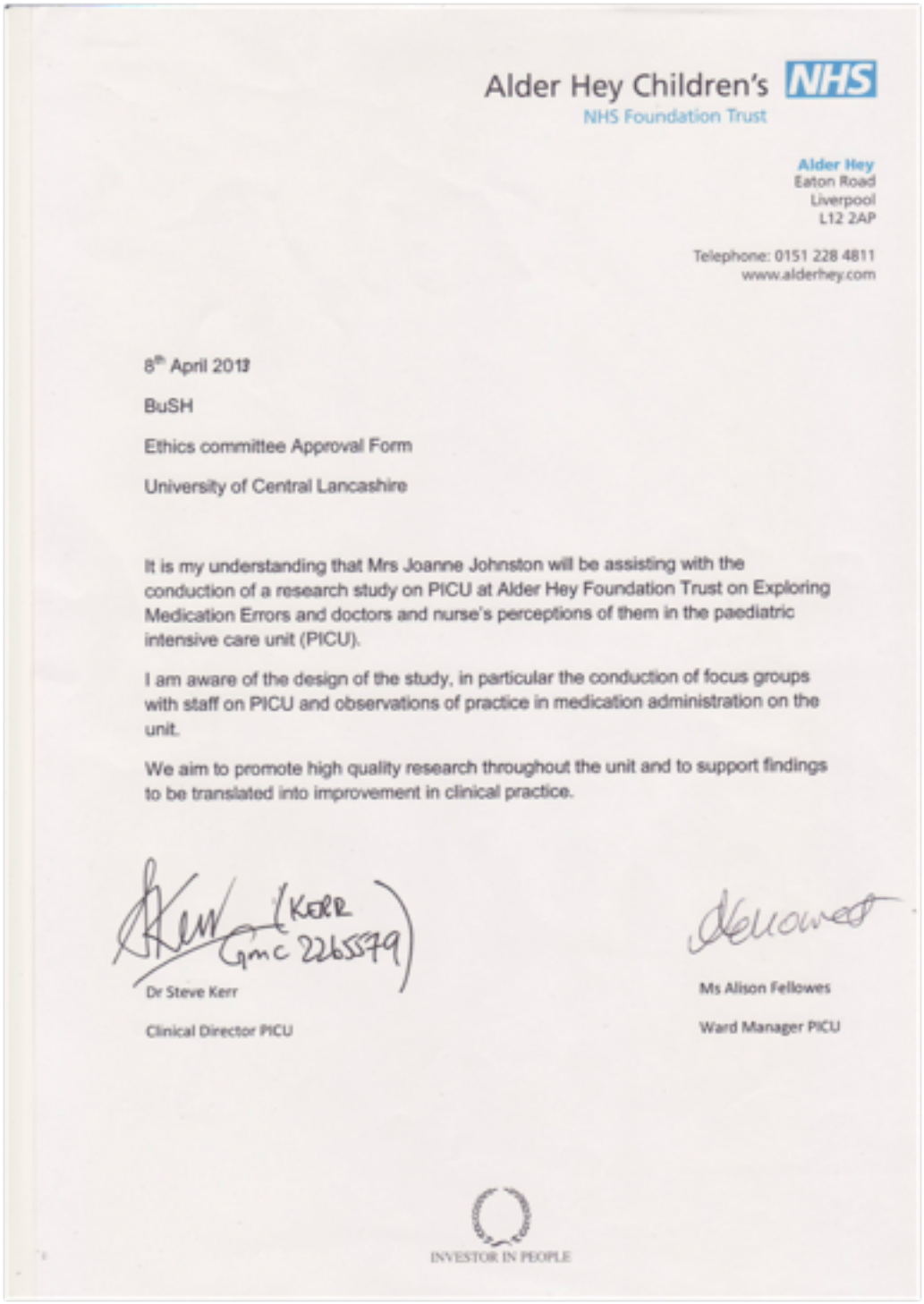
External Environment 1. - **Distractions** during prescribing 2. -Distractions during administration 3. -Distractions are across the board 4. **-Interruptions** 1.-by staff 2.- by family Lack of awareness of how the unit is functioning at a given time and prioritisation can lead to inappropriate interruptions due to -lack of communication -time pressure/ perceived business	❖**Barriers to reporting** -training -accessibility -time/workload -awareness -an error picked up is seen as part of the checking process -blame -failure - medics -gossip -reporting colleagues -Ulysses – too long -repercussions for career - nursing	❖**Improvements** -need to embed in practice – people don't like change if evaluated -they are not fedback to staff if they have worked -keep focus on -otherwise – drifts, fades, errors return	❖**Feedback is an incentive to report** - **But a balance is needed i.e.** 1. The error 2. Process to address this 3. Feedback if worked -Staff feel they don't see the relevance to the new process implemented
❖Non-standard dosing of medication with patients from theatre may be utilised for upto 24 hours.	❖**Management** of MEs are Inconsistently managed due to -documentation -accessibility -different managerial approaches In addition to how they are reported -Ulysses -emailed -paper form – can be missed	❖**Engagement of staff** -nurse not represented at incident meetings -nurses not given clinical time to attend -select group attend critical incident meeting -staff should rotate -involve staff at all levels to engage them in the learning process.	**Evaluation** of how an improvement process has worked -staffs views may differ from management views -feedback needed both ways.

Culture of:- ❖Senior nursing – rush and pressurise junior staff ❖Non-professionalism of staff 1. Informal 2. Not focused 3. Too busy socialising		**Safety Mechanisms** -individual mechanisms used by staff to prevent errors -The unit implement processes to stop errors however:- -can lead to other errors eg -pharmacy – green pen -programmable pumps- still need to check manually -check lists – medications not always independently checked ❖Too many process -not always enforced	**Openness** to parents about MEs -improves trust
❖New registrars starting rotation different support for -anaesthetist -paediatrician		-should be able to challenge openly without offence	Locations outside of PICU -disseminate by 1. Lessons of the week 2. Rotation of staff in clinical incident meetings -incident reporting forms are shorter and more user friendly – report everything -

Appendix 14 Table 8: Data collected for medication administration error episodes

	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	Total over 10 day period	Mean Number of medications per day	Median number of medications per day
oral/ topical	407	313	332	330	447	398	364	445	361	285	3682	368.2	362.5
IV/bolus	154	117	191	147	85	128	125	154	139	116	1356	135.6	133.5
INFUSION	56	79	41	58	43	58	60	70	45	40	550	55	57
LEVEL 3/4	6	6	31	10	12	9	0	3	4	4	85	8.5	6
TOTAL	623	515	596	545	587	593	549	672	549	445	5674	567.4	568
NO OF PATIENTS	20	18	20	21	19	19	18	19	17	15	186	18.6	19
average number of medications per bed space												30.6	29.9

Appendix 15 Approval letter from PICU



Alder Hey Children's NHS
NHS Foundation Trust

Alder Hey
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Liverpool
L12 2AP

Telephone: 0151 228 4811
www.alderhey.com

8th April 2013

BuSH

Ethics committee Approval Form

University of Central Lancashire

It is my understanding that Mrs Joanne Johnston will be assisting with the conduction of a research study on PICU at Alder Hey Foundation Trust on Exploring Medication Errors and doctors and nurse's perceptions of them in the paediatric intensive care unit (PICU).

I am aware of the design of the study, in particular the conduction of focus groups with staff on PICU and observations of practice in medication administration on the unit.

We aim to promote high quality research throughout the unit and to support findings to be translated into improvement in clinical practice.

(KERR GMC 2265579)

Dr Steve Kerr

Clinical Director PICU

Ms Alison Fellowes

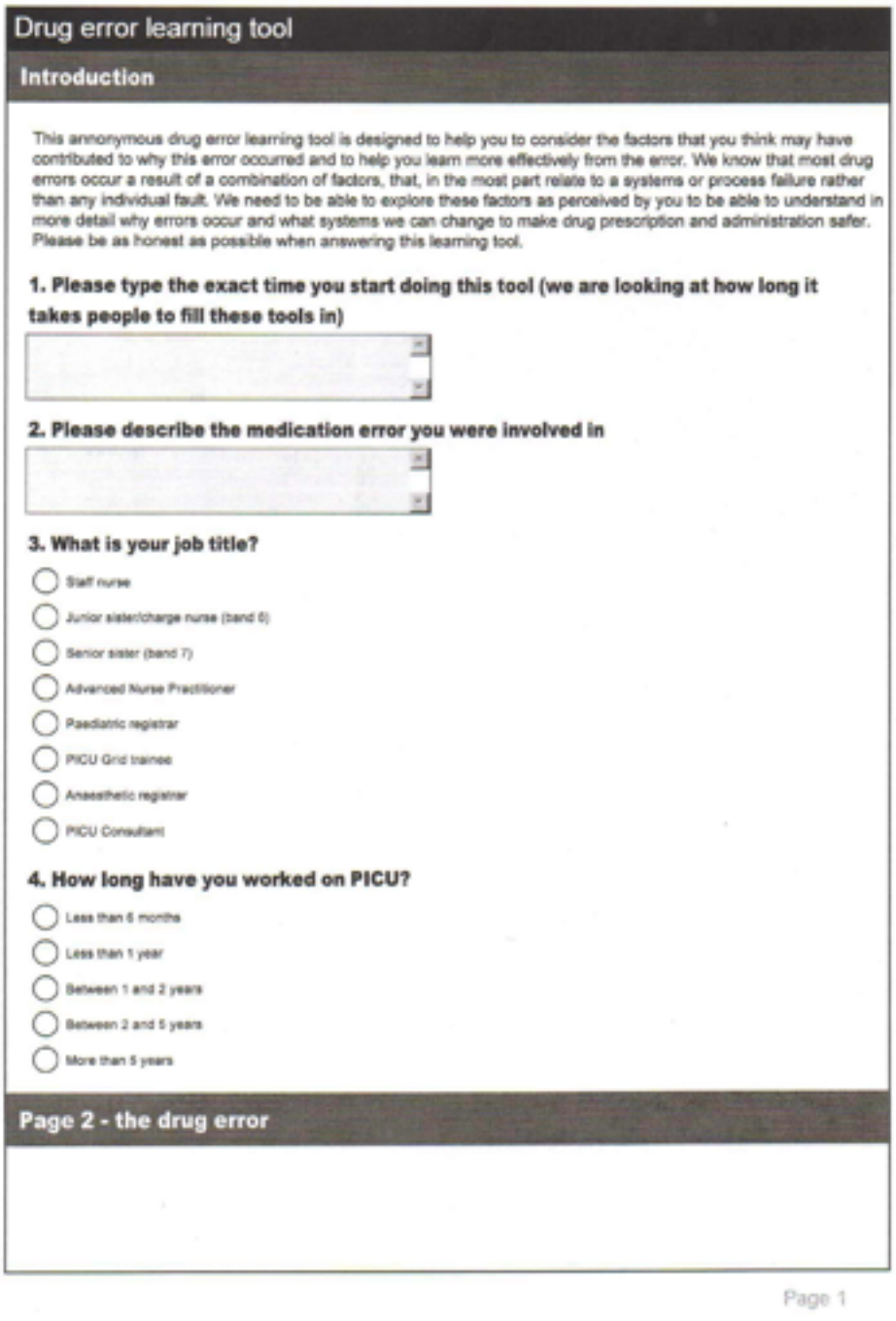
Ward Manager PICU

INVESTOR IN PEOPLE

Appendix 16 Current reflective learning tool

Reflective Learning Tool **Analysis of Errors**
Description of incident
Problems identified
Analysis of Problems
Reflection
Learning / development required

Appendix 17: New E-learning tool for learning from errors on PICU



Drug error learning tool

Introduction

This annonymous drug error learning tool is designed to help you to consider the factors that you think may have contributed to why this error occurred and to help you learn more effectively from the error. We know that most drug errors occur a result of a combination of factors, that, in the most part relate to a systems or process failure rather than any individual fault. We need to be able to explore these factors as perceived by you to be able to understand in more detail why errors occur and what systems we can change to make drug prescription and administration safer. Please be as honest as possible when answering this learning tool.

1. Please type the exact time you start doing this tool (we are looking at how long it takes people to fill these tools in)

2. Please describe the medication error you were involved in

3. What is your job title?

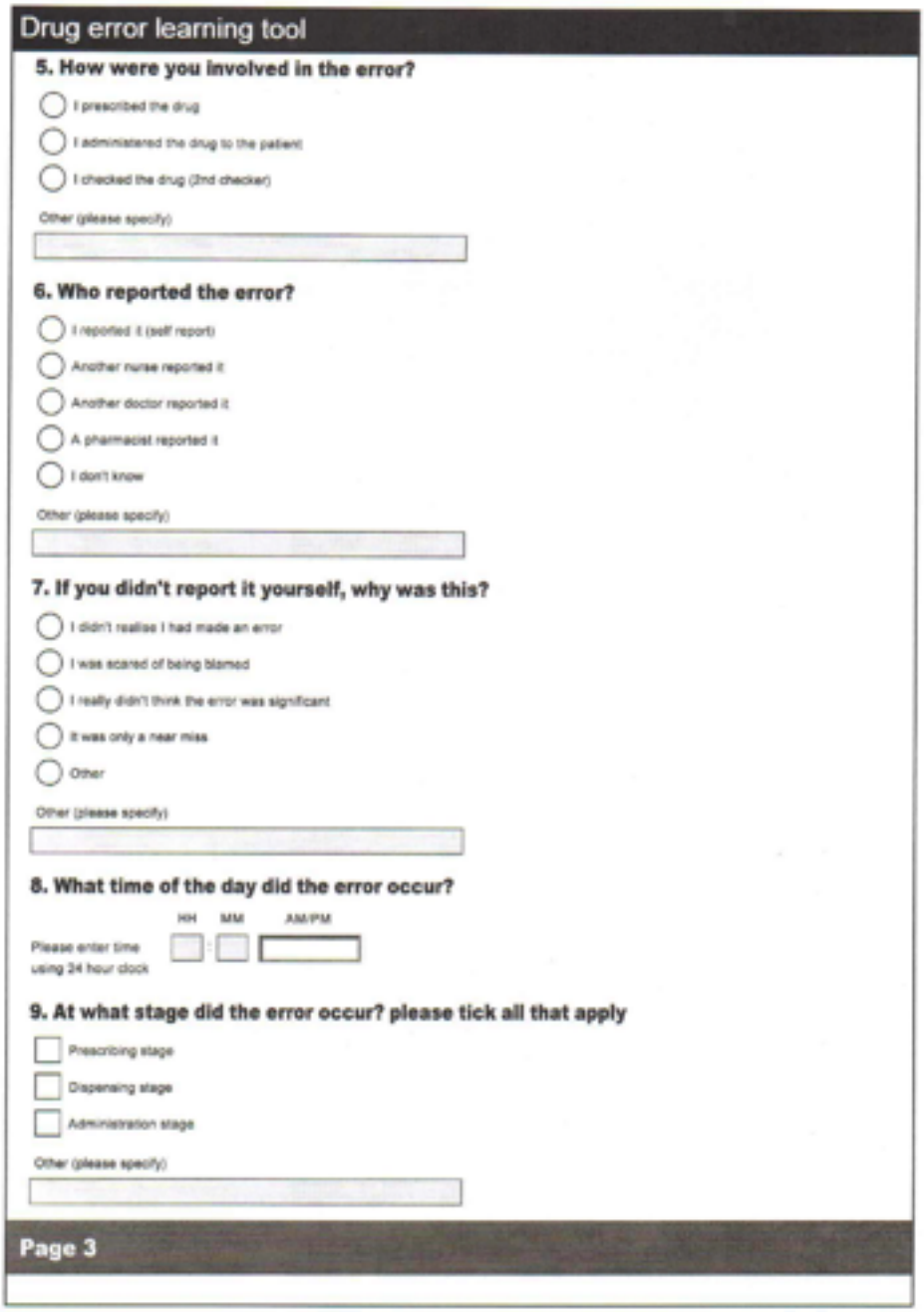
- Staff nurse
- Junior sister/charge nurse (band 6)
- Senior sister (band 7)
- Advanced Nurse Practitioner
- Paediatric registrar
- PICU Grid trainee
- Anaesthetic registrar
- PICU Consultant

4. How long have you worked on PICU?

- Less than 6 months
- Less than 1 year
- Between 1 and 2 years
- Between 2 and 5 years
- More than 5 years

Page 2 - the drug error

Page 1



Drug error learning tool

5. How were you involved in the error?

- ◯ I prescribed the drug
- ◯ I administered the drug to the patient
- ◯ I checked the drug (2nd checker)

Other (please specify)

6. Who reported the error?

- ◯ I reported it (self report)
- ◯ Another nurse reported it
- ◯ Another doctor reported it
- ◯ A pharmacist reported it
- ◯ I don't know

Other (please specify)

7. If you didn't report it yourself, why was this?

- ◯ I didn't realise I had made an error
- ◯ I was scared of being blamed
- ◯ I really didn't think the error was significant
- ◯ It was only a near miss
- ◯ Other

Other (please specify)

8. What time of the day did the error occur?

Please enter time using 24 hour clock — HH : MM AM/PM

9. At what stage did the error occur? please tick all that apply

- ☐ Prescribing stage
- ☐ Dispensing stage
- ☐ Administration stage

Other (please specify)

Page 3

Page 2

Drug error learning tool

10. In a bit more detail can you describe the circumstances surrounding the error?

11. Can you remember what your thoughts and feelings were at the time when the error occurred? If so, could you describe these

12. What drug or drugs were involved in the error?

13. What were the clinical actions required as a result of the drug error? Please tick all that apply

- ◯ Nothing extra required
- ◯ Extra monitoring required (eg drug levels or more monitoring eg blood tests for liver function etc)
- ◯ Some extra treatment or care was required to prevent further injury/harm (eg including a longer ventilation time or HF required to improve drug clearance)
- ◯ Emergency actions required to prevent serious injury
- ◯ Other

Other (please specify)

Page 4

Drug error learning tool

14. Please indicate the type/s of error that occured in this case (tick all that apply)

- ☐ Drug omission
- ☐ Drug expired
- ☐ Drug given without authorisation
- ☐ Drug not available
- ☐ Monitoring error eg drug given to drug allergic patient or drug given when level too high
- ☐ Inadequate clinical observations as part of drug administration
- ☐ Overdose (standard)
- ☐ Overdose (10 times or greater)
- ☐ Underdose (standard)
- ☐ Underdose (10 times)
- ☐ Extra dose given
- ☐ Wrong drug given to patient
- ☐ Wrong patient given drug
- ☐ Wrong rate of drug/fluid
- ☐ Wrong route of drug given
- ☐ Drug given at wrong time
- ☐ Inadequate checking/communication at handover
- ☐ Labelling error
- ☐ Other

Other (please specify)

Page 6 - preventable actions

15. In the case of this drug error are there any processes or system changes that you think might have prevented the error occuring?

The managers response to the error

16. How long after the shift the drug error occurred did a manager speak to you?

- ○ The shift that it happened
- ○ Within a day or 2
- ○ Within a week
- ○ Longer than a week
- ○ Don't know

Other (please specify)

Page 4

Drug error learning tool

17. After a discussion with your manager about the error how did you feel? Tick all that apply

- [ ] I felt like the manager did not blame me and I felt supported by them
- [ ] I was very upset about the error itself but felt supported by the manager
- [ ] Angry with the way the manager dealt with me
- [ ] Made to feel like I was an idiot and the error was entirely my fault
- [ ] Like I won't ever report an error ever again
- [ ] I was just really upset about being involved in this error
- [ ] I felt reassured and supported after the dicussion with my manager and know that I will report errors in future
- [ ] Don't know

Other (please specify)

18. What was the result of your discussion with the manager? Tick all that apply

- [ ] My drug administration was temporarily suspended
- [ ] My prescribing was temporarily suspended
- [ ] My prescribing must be supervised by a senior
- [ ] I have been asked to do some re-training
- [ ] It has been recommended I get more supervision and training
- [ ] Changes have been made to the way we do things (systems) to avoid this error hapening again
- [ ] The manager said that this error has highlighted risks within PICU which we need to deal with
- [ ] I have been given time off for stress/illness/personal factors
- [ ] Referral to other support servcies such as counselling or occupational health
- [ ] Nothing really
- [ ] I don't know

Other (please specify)

Rate the factors that you think contributed to this error

A number of factors are commonly found to be associated with medication errors. These factors are listed below, please rate each factor, considering what, if any role, this factor played in this medication error.

Drug error learning tool

19. What do YOU think are the factors that contributed to this error occuring (rate from 0 to 5) Please rate all of these factors in relation to this event

	0 Not contributing at all to this case	1	2	3	4	5 Extremely important factor in this case
Communication: trust wide	○	○	○	○	○	○
Communication: between unit staff	○	○	○	○	○	○
Communication: written documentation on ward	○	○	○	○	○	○
Device (pump/infusion device) not programed/used correctly	○	○	○	○	○	○
Device (pump/infusion device) not working properly	○	○	○	○	○	○
Double checking error	○	○	○	○	○	○
Drug stock control inadequate	○	○	○	○	○	○
High workload	○	○	○	○	○	○
Interuption/distraction	○	○	○	○	○	○
Knowledge deficit	○	○	○	○	○	○
Knowledge was misapplied	○	○	○	○	○	○
Labelling error	○	○	○	○	○	○
Lenght of staff experience on unit	○	○	○	○	○	○
Lookalike/soundalike drug name	○	○	○	○	○	○
Mathematical/calculation error	○	○	○	○	○	○
Patient clinical status	○	○	○	○	○	○
Personal stress	○	○	○	○	○	○
Policy or guideline not followed	○	○	○	○	○	○
Policy or guideline not available/could not find	○	○	○	○	○	○
Poor skill mix of staff on duty/available	○	○	○	○	○	○
Poor staffing levels	○	○	○	○	○	○

Other (please specify)

Your learning from the error

Drug error learning tool

20. Is this the first time you have been involved in a drug error?

- ◯ Yes
- ◯ No

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21. If you have been involved in a drug error previously, was it a serious one?

- ◯ Yes
- ◯ No

Other (please specify)

22. Has your practice (or the way you do things) when you prescribe/check or administer drugs changed since the previous drug error?

- ◯ No, not at all
- ◯ A little bit
- ◯ Neutral
- ◯ Yes i do some things differently
- ◯ Very much so
- ◯ Don't know

Other (please specify)

23. How has it changed?

24. Did you talk about the previous error with anybody?

- ◯ Yes
- ◯ No

Comments

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Drug error learning tool

25. Do you think the way you prescribe/check or administer drugs will change as a result of this error?

- ◯ No, I don't think so
- ◯ It might change slightly
- ◯ Neutral
- ◯ Yes, I will do things differently
- ◯ Very much so, I will be much more careful now with checking/prescribing drugs
- ◯ I Don't really know

Other (please specify)

26. If so, how will you change what you do?

27. Have you or will you talk to anyone about this drug error?

- ◯ Yes
- ◯ No
- ◯ I don't know

Other (please specify)

28. Do you know at least one colleague who would be a supportive listener, who you could talk to about a medication error?

- ◯ Yes
- ◯ No
- ◯ Not sure

Other (please specify)

Learning from other peoples drug errors in PICU

Drug error learning tool

29. How often do you hear about other drug errors that have occured on PICU?

- ◯ Never
- ◯ Only when it is a very serious error
- ◯ Sometimes I get the odd email and realise something must have happened
- ◯ We always know about the significant drug errors that have occured on PICU
- ◯ Other

Other (please specify)

30. How does this feedback of other errors affect you?

- ◯ It doesn't because I never hear about them
- ◯ We get so many emails I just read it and forget about it
- ◯ It does make me aware of some risks to be aware of
- ◯ Not a lot, it would be better if it someone told us about the error
- ◯ Other

Other (please specify)

31. What factors/things (if any) from this error would you like to feed back (or possibly warn) to the PICU team?

32. Please put in the exact time you have finished completing this tool (so we know how long the tools take to complete)

Thank you

Thank you for completing this drug error learning tool, your answers will help us to understand how errors occur on PICU and how we can deal with them better.

Appendix 18 List of propositions within Chuang et al. theoretical framework

Proposition 1a: Preventable adverse events perceived as being more salient will have positive impacts on individual, group and organisational learning from the events.

Proposition 1b: Preventable adverse events that are perceived to be caused by heterogeneous factors will have positive impacts on group and organisational learning from the events.

Proposition 1c: The extent to which individuals attribute preventable adverse events to their own error will trigger greater individual learning compared with when they attribute events to organisational or administrative factors.

Proposition 2a: Heterogeneity of group members' knowledge and experience with preventable impact on group learning from preventable adverse events.

Proposition 2b: Intergroup linkages consisting of divers knowledge and resources specific to adverse events within an organisation will have a positive impact on group learning from preventable adverse events.

Proposition 2c: Group norms of openness and norms that encourage the use of constructive conflict will have positive impacts on group learning from preventable adverse events.

Proposition 2d: Participative leadership approaches that value safety will have a positive impact on group learning form preventable adverse events.

Proposition 3a: Effectively used safety management systems will have a positive impact on organisational learning from preventable adverse events.

Proposition 3b: Leadership for patient safety will have a positive impact on organisational learning from preventable adverse events.

Proposition 3c: Safety culture will have a positive impact or organisational learning from preventable adverse events.