

A qualitative, exploratory study of nurses' decision-making when interrupted during medication administration within the Paediatric Intensive Care Unit

Bower, R, Coad, J, Manning, J & Pengelly, T

Author post-print (accepted) deposited by Coventry University's Repository

Original citation & hyperlink:

Bower, R, Coad, J, Manning, J & Pengelly, T 2017, 'A qualitative, exploratory study of nurses' decision-making when interrupted during medication administration within the Paediatric Intensive Care Unit' *Intensive and Critical Care Nursing* , vol (in press), pp. (in press)

<https://dx.doi.org/10.1016/j.iccn.2017.04.012>

DOI 10.1016/j.iccn.2017.04.012

ISSN 0964-3397

ESSN 1532-4036

Publisher: Elsevier

NOTICE: this is the author's version of a work that was accepted for publication in Intensive and Critical Care Nursing. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in Intensive and Critical Care Nursing, [(in press), (2017)] DOI: 10.1016/j.iccn.2017.04.012

© 2017, Elsevier. Licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International <http://creativecommons.org/licenses/by-nc-nd/4.0/>

Copyright © and Moral Rights are retained by the author(s) and/ or other copyright owners. A copy can be downloaded for personal non-commercial research or study, without prior permission or charge. This item cannot be reproduced or quoted extensively from without first obtaining permission in writing from the copyright holder(s). The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the copyright holders.

This document is the author's post-print version, incorporating any revisions agreed during the peer-review process. Some differences between the published version and this version may remain and you are advised to consult the published version if you wish to cite from it.

ABSTRACT

Objective: In the paediatric intensive care unit (PICU), medication administration is challenging. Empirical studies demonstrate that interruptions occur frequently and that nurses are fundamental in the delivery of medication. However, little is known about nurse's decision making when interrupted during medication administration. Therefore, the objective is to understand decision making when interrupted during medication administration within the PICU.

Research Design: A qualitative study incorporating non-participant observation and audio recorded semi-structured interviews. A convenience sample of ten PICU nurses were interviewed. Each interview schedule was informed by two hours of observation which involved a further 29 PICU nurses. Data was analysed using Framework Analysis.

Setting: A regional PICU located in a university teaching hospital in the United Kingdom.

Findings: Analysis resulted in four overarching themes:

- (1) Guiding the medication process,
- (2) Concentration, focus and awareness,
- (3) Influences on interruptions
- (4) Impact and recovery

Conclusion: Medication administration within the PICU is an essential but complex activity. Interruptions can impact on focus and concentration which can contribute to patient harm. Decision making by PICU nurses is influenced by interruption

awareness, fluctuating levels of concentration, and responding to critically ill patient and families' needs.

KEYWORDS

Clinical decision making; exploratory; interruptions; medication administration; paediatrics; qualitative;

IMPLICATIONS FOR CLINICAL PRACTICE

- There are clear political and policy drivers for healthcare providers and professionals to improve patient safety, manage risk, and minimise harm.
- Nurses perceive that medication administration is a priority activity, however, this is not always observed in clinical practice which may compromise patient safety.
- Decision making during medication administration is affected by experience, familiarity with the medicine being prepared, interpersonal relationships and teaching.
- For future interventions to reduce interruptions to medication administration within the PICU to be effective they must comprehend the complexities of working in imperfect environments, with multidisciplinary teams, and in uncertain circumstances.

INTRODUCTION

The safe administration of medication is vital in the provision of nursing care to children (Richardson and Glasper, 2010). Critically ill children often require a treatment plan which includes significant amounts of medication preparation and administration. The medication preparation and administration process is particularly complex due to the precise and intricate calculations (Dickinson et al, 2012) which may be required at any point during the 24-hour timeframe. In addition, the critical nature of the child's illness necessitates constant nursing observation, which promotes the preparation of medication at the bedside, exposing the procedure to frequent interruptions (Bower, 2015 and Sasangohar et al, 2015).

Frontier Economics (2014) estimate that medication errors cost the National Health Service (NHS) in excess of £1 billion per annum. The Medicines and Healthcare Products Regulatory Agency (2014) quantifies that in hospitals there is an error in seven percent of prescriptions and between three and eight percent of medications administered to both adult and child inpatients. Internationally medication error rates are similar, with figures documented in North America of errors being found in 5.7% of paediatric prescriptions (Kaushal et al, 2001). However, this is likely to be an understatement as it is widely accepted within the UK that not all medication errors are reported (NHS England, 2014). These figures are important for children in critical care, as medication errors are higher in paediatric departments and intensive care units (McDowell, Ferner and Ferner, 2009) and they are three times more likely to be involved in a medication error (National Patient Safety Agency, 2007).

Interruptions are frequently listed as key causes for medication errors (Anthony et al, 2010, Colligan and Bass, 2012, Westbrook et al, 2010 and Fore et al, 2013). Parker

and Coiera (2000) highlight that interruptions can generate conditions which may increase the risk of in memory lapses. Problems with memory recall within a medication situation can have a negative impact on patient safety. It has been demonstrated that there is a 12.7% increase in clinical errors when interruptions occur (Westbrook et al, 2010) and studies frequently list interruptions as a cause of mistakes (Fore et al, 2013). In addition, intensive care nurses are interrupted every five minutes, especially during high-severity tasks, which include medication administration (Sasangohar et al, 2015).

Within the intensive care environment, it has been demonstrated that not all interruptions are detrimental to patient safety. Sasangohar et al (2015) identified that some interruptions related to the communication of important information about a task or patient. Furthermore, Sasangohar et al (2015) identified that interruptions which included personal conversation occurred more frequently during low severity tasks (which did not include medication administration). This suggests that on occasions interruptions are filtered when critical tasks are being completed demonstrating a decision-making process.

Healthcare teams have evaluated several different types of interventions to reduce interruptions to medication administration. These studies have been performed primarily within adult settings (Sasangohar et al, 2015, Anthony et al, 2010, Colligan et al, 2012) and not specifically in PICU. The interventions include sterile cockpit areas (Anthony et al, 2010, Fore et al, 2013, Colligan et al, 2012), coloured tabards (Pape, 2003 and Verweij et al, 2014), checklists (Pape, 2003), lanyards and education programmes (Relihan et al, 2010). Frequently multiple interventions are instigated at the same time making it difficult to discern which intervention is effective

(Relihan et al, 2010) reducing the effectiveness of the results (Raban and Westbrook, 2013).

Multiple interruption handling strategies have been identified within the literature; prioritisation (primary task is prioritised over a less urgent secondary task), multitasking, delegation, engagement (primary task is suspended for a priority secondary task) and blocking (ignoring the interruption) (Colligan and Bass, 2012 and Sitterding et al, 2014). Each strategy results in different actions and can produce a different outcome to the primary task. Dougherty, Sque and Crouch (2011) examined risk taking and decision making during intravenous medication preparation and found that interruptions to decision making were a major theme within medication administration. Colligan and Bass (2012) found that these decisions were influenced by risk and workflow assessments and experience. Conversely, a study (Sitterding et al, 2014) which examined situational awareness and interruptions found that the most common handling strategy used was engagement. It was identified that the decision-making process was influenced by factors such as constant auditory and visual processing, the impact of stress on memory and stacking of jobs (Sitterding et al, 2014).

Current literature indicates that the phenomenon of interruptions to medication administration in the unique environment of PICU has not been explored. In addition, there is limited analysis of the decision-making process when nurses are interrupted. Before appropriate interventions can be developed and implemented it is key that factors which influence decision making are identified and their impact examined.

METHODS

The aim of the study was to explore and understand PICU nurse decision making when interruptions occur during medication administration in the critical care environment. The selection of a qualitative exploratory method allowed human behaviour to be examined in its natural setting (Streubert and Carpenter, 2011 and Denzin and Lincoln, 1994). A guiding principle within this study was that the data collected should reflect the reality that PICU nurses experience, therefore a combined non-participant observation and semi-structured interview design was selected. The field notes collected during the observation phase informed the schedule of the interviews. An interpretivist approach allowed theory to be generated from the rich data provided by both observation and interview (Mustafa, 2011). A critical realist lens was used within the data analysis to focus on understanding reality as it exists and seeking to understand and provide explanations for these events and outcomes (Clarke, 2008). The aim of these approaches was to understand decision making by exploring what was observed in practice, what was perceived by nurses and identifying any underlying structures that were influential. The study was approved by a Higher Education Ethics Review process and governance approval obtained from the Hospital Trust in which the study was conducted.

For the purpose of this study an interruption was operationalised as 'A break in continuity of complete focus on the task of preparing medication.' (Anthony et al, 2010)

Participants and setting

The setting of the study was a regional PICU located in a large, tertiary, university teaching hospital in the United Kingdom. All qualified nurses working on the PICU were invited to participate within the study. A convenience sample of ten nurses consented to be observed and interviewed, a further 19 nurses consented to be observed within the medication process. The unit medication policy requires the independent double checking of the majority of medicines. The sample size was guided by the factors described by Morse (2000); scope, nature, quality and design. The scope, nature and quality of this study was focused on a clear, obvious topic which was related to recent medication administration events ensuring participants were able to talk easily about the subject. These factors contributed to the conclusion that a smaller sample would be acceptable. In addition, design of the study facilitated data collection during both observation and interview, therefore, generating double the amount of data.

The samples of nurses interviewed were all female with between five and thirty years' experience. Nurses from the three grading bands available were included; Band 5 (staff nurse) – n=3, Band 6 (junior sister) – n=3 and Band 7 (sister) n=4. A limitation of the sample is that no male or recently qualified nurses were recruited, which may have contributed to a bias in the data collected. However, these categories of nurses were recruited into the sample of observed nurses (n=19) so their actions were included in the analysis of the observed data but their perceptions were not explored.

All participants involved in the interviews and observations were asked to give informed consent, through the administration of information sheets in advance. Parents were also asked to consent to the observation taking place.

Data collection

Non-participant observations

Observable actions and events were recorded within the field notes during the 20 hours of observations conducted. The field notes recorded both interruptions external to and those initiated by either of the nurses. Frequency rates, length of interruptions, content of conversations and body language were recorded within the field notes. These were then used to inform the schedule of the semi-structured interviews.

Semi-structured interviews

Ten face-to-face interviews were conducted and recorded by a single researcher (RB) as soon as clinical workload allowed after the observation period. The interviews were completed in an office away from the clinical area, nursing care was provided by other available PICU nurses. The questions were structured by the observational data and individual to each interview, but open ended to allow in-depth response (Fontana and Frey, 1994). The individuality of each situation contributed to a range in the length of interviews from 21 – 48 minutes.

Reflexivity

Reflexivity demands that the researcher (RB) demonstrates understanding about their relationship with the participants (Santiago-Delefosse et al, 2016). Within this study the researcher was an insider, investigating an issue within an environment

where she had previously worked (Gair, 2012). Morse (1994:222) highlights the issues of being an inside researcher, she states that an investigator should not conduct research within their own work environment. She believes there may be occasions where the investigator has access to information that an employee should report and an ethical researcher should keep confidential. The clarity provided in the Participant Information Sheet ensured that all participants were aware that errors would be reported and practice issues address through education, before they consented. The researcher was allocated a prolonged period of study leave before the research was conducted, so that she was not rostered to be a team member, and had relinquished all line management responsibilities for the four months preceding data collection. Trustworthiness is essential in research so it was important that the researcher collected data that recorded the actions and relationships as they actually happened rather than her perception of the event (Dougherty, Sque and Crouch, 2011). A reflexive diary was maintained to allow the researcher to examine her own perceptions and their impact on the research (Ortlipp, 2008). When analysing the data, a code was allocated for researcher impact so that it was transparent when this occurred and its influence examined. During the analysis phase it was essential that the researcher did not allow familiarity and empathy to influence deeper interpretation of the data (Asselin, 2003). The data analysis was reviewed by another researcher (JM) to ensure this process was robust.

Data Analysis

Data analysis followed an adapted seven stage Framework Analysis (Gale et al, 2013). The framework was adapted to incorporate an in-depth analysis using critical realism. The use of this paradigm encourages the researcher to examine observable

events, perceptions of what is happening and unseen structures or systems which may influence appearances (Clarke, 2008). Initially the audio data was transcribed verbatim by the researcher (RB). It is noted within Framework Analysis (Gale et al, 2013) that familiarity with the data is essential and this transcription strategy enhanced this familiarisation process. Furthermore, it has been highlighted that the use of a hired transcriber can lead to omissions or alterations or words (Tilley and Powick, 2002). The transcripts were then inductively coded using descriptive coding which summarised topics in small sections creating master codes (Saldana, 2013). Initially five transcripts were coded and reviewed by a second researcher (JM) for verification before the remaining transcripts and field notes were completed. Master codes were then reduced to sub codes with comprehensive definitions. The sub codes were then grouped into categories (Gale et al, 2013) creating four overarching themes (see table 1), which were then stratified into the different levels within critical realism. A matrix was produced for each theme which included evidence from each individual participant. This ensures that participants own expression infiltrate the interpretation (Gale et al, 2013 and Smith and Firth, 2011). Finally, analytical memos were produced for each theme which allowed data to be related to theory and the mapping of relationships (Gale et al, 2013).

FINDINGS

Analysis of the data generated four themes, summarised in Table 1.

Table 1 – Main themes

Guiding the medication process	Definition – knowledge, actions, comments, which are structured by policy, codes, checklists or interventions
Critical realism lens applied	Associated codes
Empirical (human perceptions of what's actually happening?)	Effective Intervention Ineffective Intervention Being Seen as Rude Medication as a Priority
Real (structures and systems which appear underneath appearances)	Impact of Knowledge Maintenance of Professionalism Missed Opportunity
Actual (events and outcomes that occur in the world)	Patient Safety Check Medicines Management Non-Adherence to Policy

Focus, Concentration and Awareness	Definition – nurses ability to increase and decrease concentration, focus and awareness
Critical realism lens applied	Associated Codes
Empirical (human perceptions of what's actually happening?)	Interruption Awareness Ability to Dual Focus Ability to Focus on Primary Task
Real (structures and systems which appear underneath appearances)	Desensitisation to Interruptions Conversational Influence
Actual (events and outcomes that occur in the world)	Responding to Patient Condition Fluctuating Levels of Concentration

Influences on interruptions	Definition – variables which influence the impact or reaction to interruptions
Critical realism lens applied	Associated Codes
Empirical (human perceptions of what's actually happening?)	Learning from Experience Impact of Change Drug Complexity Impact of Errors Impact of Role Parental Influence Saving Time
Real (structures and systems which appear underneath appearances)	Impact of Normal Personal Touch Acceptance of Culture

Actual (events and outcomes that occur in the world)	Communication Preparation and Planning, Impact of Environment Impact of Experience Teaching versus Administration
--	---

Impact and recovery	Definition – comments, actions or reactions that indicate the impact of interruptions and strategies nurses use to carry on with medication task.
Critical realism lens applied	Associated Codes
Empirical (human perceptions of what's actually happening?)	Impact of Interruption Recovery Strategy Visual Impact Safe Time in Place
Real (structures and systems which appear underneath appearances)	Creation of Frustration
Actual (events and outcomes that occur in the world)	Verbal Confirmation Actions Repeated Checks Attempt to Reduce or Prevent Interruptions Delay, Deflect or Downgrade Interruptions

Guiding the medication process

A novel concept that emerged was a perception that responding with silence, when interrupted, was unacceptable. When dealing with interruptions it was important to nurses that they did not appear to demonstrate an attitude that could be interpreted as rudeness. It was perceived that they would be viewed as being rude if they ignored the other person,

'you almost have to acknowledge them em so you are not coming across rude' (Interview 9 line, 135).

Interestingly when nurses did respond with silence it caused discomfort, they felt that they had to apologise afterwards even though it was evident that they were in the

middle of preparing or administering a medication. These feelings were consistent whether the nurse was interrupted by another member of staff or a parent,

'you do feel you know obliged to answer because they are worried about their child and you've got to answer their questions although that's quite distracting' (Interview 10, line 124-126).

There was also a perception from three nurses that if silence was the response to a question the interrupter would think that the nurse had not heard their question. It was felt that this would lead to more questions and interruptions. This was evident when one nurse described the decision-making process when she was interrupted programming a pump,

'so I was aware that I was in the process of programming the pump and she'd asked me a question, however, I knew I was nearly at the very end of administering the drug so for the sake of 10 seconds I would be finished and I would be able to address what she was saying but I didn't want it, it's a little bit difficult cause I didn't want her to think I hadn't heard what she was saying' (Interview 3, line 129-132).

The key result of this process was that the full conversation was delayed until after the medication process had been completed without demonstrating a behaviour that could be perceived as rude.

Focus, concentration and awareness

Focus and concentration within the medication administration process were observed to fluctuate significantly. There were periods where all nurses looked relaxed, with their body positioned in an upright stance and no evidence of facial tension. They also had an awareness of their patient's condition and of the environment around them, this was demonstrated by frequent glances at their patient

or nearby bed spaces. This decrease in concentration was frequently associated with periods within the medication process when the task was viewed as simple, for example 50mls of plain solution were aspirated from a bag of fluid.

In contrast, there were occasions when nurses were bent over their trolley reading or using a calculator when their face looked tense and almost unapproachable. These periods were described by eight nurses as periods of 'zoning out' all background noise would be filtered out and only critical alarms or shouts for help would be responded to as highlighted in the quote below.

Within the observation today I watched two nurses administer both drugs they were familiar with and one that was new to them both. I was surprised by the change in demeanour that was displayed between the episodes. When the unfamiliar drug was prepared, they were very focused, hunched over the BNFC, clarifying information between them, checking and re-checking and then midway through drawing up went back and checked again. When preparing familiar drugs, they were more upright looking around the unit, watching all 3 of the patients they were caring for. The levels of concentration were not at all equal. (Reflective diary excerpt)

There were also occasions when there was a significant lack of awareness of interruptions,

'I wasn't interrupted enough to be aware' (Interview 3, line 92).

Five of the nurses interviewed discussed their lack of awareness of interruptions and were surprised at how many interruptions had been recorded in the field notes.

Several nurses interviewed identified interruptions that occurred during the preparation phase, which prevented the start of the process, but they then felt that they had not received any further interruptions when in fact they had experienced

many interruptions during the process. This indicated that awareness of interruptions was present during the preparation phase and decreased once the physical part of the procedure began. During the preparation phase, increased focus was observed, several of the nurses appeared to be more aware of interruptions if these broke through the increased level of concentration.

There was an indication in many of the interviews that it was 'normal' to experience interruptions during medication administration. One interviewee noted that it felt like a normal level of interruptions, when 11 had been documented. This indicated that there was a high tolerance of interruptions, to the medication process and it was accepted without question as exemplified;

'the infusions I felt that we were interrupted a little bit more than normal but they're the same things that people wanted so I think it's just because it's a busier shift. But I would of, I have previously been interrupted for the same things, for the keys, for someone wanting to get in your IV trolley or conversations between ourselves. It felt quite standard'. (Interview 4, line 64-67)

This desensitisation to interruptions is an underpinning structure to the lack of awareness. There appears to be a concept of interruption fatigue, which is similar to that seen when nurses are exposed to frequent alarms (Sowan et al, 2015).

Influences on interruptions

On several occasions undergraduate student nurses were also asked to perform actions or hold conversations on behalf of the registered nurse in an effort to reduce interruptions to the medication process. These actions demonstrated a decision making process which attempted to reduce the impact of the interruption. The student would be asked to perform a task which stopped the nurse from having to

break away from the medication process completely, therefore reducing the impact. However, this delegation of jobs creates a different interruption as the registered nurse has responsibility for that student and they are required to watch or listen to the conversation to ensure it is completed correctly. This often created a situation where the nurse carried on with the medication process but also tried to listen to or watch the task they had delegated to the student. The following diary excerpt describes this,

'within the observation today, the nurse asked the student to answer questions from a Clinical Nurse Specialist (CNS), initially I thought this would be a good juggling act to ensure drugs were administered on time and communication with CNS would be timely. But I didn't anticipate the length of time the nurse would have to focus on two activities as she was administering the drugs and listening to make sure correct information was shared'.

Impact and recovery

Impact of interruptions and recovery were observed to be affected by underlying frustrations. Those feelings were seen to be created by a variety of stimulants, the drug itself, staff availability and their skill set and an uncontrollable environment. Often situations which created frustration lengthened the medication process allowing more interruptions to occur. The actual emotion attached with frustration appeared to create interruptions, for example a drug that does not dissolve encourages vigorous shaking and a conversation about why it will not dissolve. The lack of available staff to check medication was particularly relevant when patients were located in side rooms, this was exemplified by the following quote,

'I think it was a bit challenging to get someone to come and check my medication cause I was in a side room. Em so although I was planned in advance and had sent my student to get the medications that I needed I wasn't able to, to do the medications until I had someone to check them with me so I think em that did affect things' (Interview 8, line 49-52).

In such situations, nurses were observed to start the checking process on their own, in an effort to save time when the checker was available and to ensure timely administration of medication. However, this strategy was flawed because the process was then not completed with full concentration and interruptions responded to because it was assumed checks would be repeated when the checker arrived.

DISCUSSION

Findings from this study confirm previous reports that decision making when interrupted during medication administration is a complex process, involving multiple interruption handling strategies (Colligan and Bass, 2012, Sitterding et al, 2014 and Dougherty, Sque and Crouch, (2011). Although the actions of PICU nurses have not been specifically reported in previous empirical research, findings from this study identify that all four of these strategies were used. These include: blocking: multitasking: mediation and engagement. The use of these strategies was influenced by factors such as familiarity and experience with the medication, clinical stability of the child and parental presence. In contrast to the existing literature, this also illuminated underlying structures and perceived factors that influence decision making. This has provided novel understanding as to why certain strategies are applied by PICU nurses and factors that are influential. It is evident within the findings of this study that engagement, mediation and multitasking are used regularly. However, blocking was used less frequently when the interrupter was a person, rather than a machine. When it was employed some nurses appeared to feel uncomfortable. This reluctance was associated with the concept of being seen to be rude. Jaworski (1993) within the field of linguistics discussed the power of silence within language highlighting that it can be interpreted as a hostile reaction to a question. In contrast, Leigner (2003) states that silence can also be a form of communication, in this situation the nurse is communicating that they need to concentrate and cannot respond. Yet, Chan (2013) identifies that non-verbal actions must be easily understood by receivers otherwise this could lead to misunderstanding. Nurses interviewed perceived that not responding to interruptions was potentially detrimental to both professional working relationships and

communication with families which are essential for providing holistic care for the child. This aligns with the theory that non-verbal communication is easily misunderstood (Chan, 2013), nurses may choose not to use the strategy of blocking as it may be misinterpreted as a sign of rudeness which may influence relationships negatively or affect the delivery of compassionate care, however, this action may be in the best interests of the child.

Study findings have identified that decision making when interrupted is influenced by many factors; the process, environment, knowledge, drug complexity, familiarisation, experience, culture and concentration level. Li, Magrabi and Coiera (2012) describe different cognitive levels associated with procedural, problem solving and decision making tasks. It was identified within this study that some phases of the process have greater levels of concentration than others. When calculating or making decisions, interruptions appeared to be more likely to be ignored or deflected, whereas when nurses are performing an automated process they feel more inclined to respond to interruptions as they have spare attentional resources (Sitterding et al, 2014). These different cognitive levels were identified within the findings of this study, but in addition it was also noted that nurses perceive that the multiple levels of concentration within the process influence their response to interruptions. Whilst calculating a dose they were more likely to block an alarm, but when completing an automated task such as drawing up a plain solution they would engage, mediate or multitask to deal with an alarm.

It was evident within the findings that there were periods of time when concentration was at its maximum. This was usually associated with a calculation, dilution decision or the programming of a pump. On these occasions their facial expression and body language appeared to demonstrate complete focus on the task. Findings indicated

that when the complexity of the medication was increased or unfamiliar, nurses described being in a 'zone' where all background noise was filtered out. Interestingly, this 'zone' is similar to the 'sterile cockpit' intervention that has been trialled within the literature (Anthony et al, 2010 and Colligan and Bass, 2012). Criticism of this intervention within the literature was that it reduced the frequency of all interruptions which then impacted on communication and teaching. Furthermore, it was evident within this study that the 'zone' was used less frequently when teaching occurred as explanation of the process would be offered to the student. This indicates that nurses are taught that conversation is acceptable within the process as they do not observe consistent levels of focus and concentration. Environment did not appear to influence the use of the 'zone' as it was observed in action in both a quiet side room and a noisy, busy environment.

Findings revealed that nurses perceived interruptions during medication administration became normalised. This was observed, described in interviews and rationalised by nurses into the decision-making process, culminating in a culture which allowed, accepted and promoted desensitisation. As identified by Colligan and Bass (2012) who found a culture of interruption acceptance, highlighting that nurses were willing to engage with interruptions.

Although the term of 'interruption desensitisation' appears novel within the literature, it seems to have similar characteristics to that of 'alarm fatigue.' Cvach (2012) identified that desensitisation occurs due presence of a high false alarm rate and that impact of this phenomenon is noted to disrupt workflow and contribute to errors, which is confirmed by the findings from this study. Interestingly, despite the potential risk, study findings identify that nurses not only accepted interruptions but had a lack of awareness that they had been interrupted when asked to recall the events.

However, when reminded of interruptions nurses were able to recall decisions they had made, the rationale for them and their impact.

Within the findings it is evident that nurses perceive medication to be a priority activity but this is not always supported by the actions observed. It is perceived to be a task that should be delivered in a safe and timely manner. There were occasions when patient instability had to be prioritised before medication, equally there were non-essential interruptions, for example non-medical conversations when medication should have been the priority. Sitterding et al (2014) noted that engagement was the most frequently used handling strategy, where the interruption is a higher priority task. This aligns with the findings which demonstrate that there are occasions when patient safety requires a response to the interruption, such as an acute change or deterioration in patient condition. Conversely, there are occasions when interruptions from other professionals are tolerated too easily and these need to be challenged by the nurse who is responsible for the delivery of safe medication (Colligan and Bass, 2012 and Biron, Lavoire and Loisele, 2009).

The perception that medication administration is a priority activity is supported and demonstrated by its use as a structure which supports the plan of care for the day. Jennings, Sandelowski and Mark (2011) describe this as the temporal structure, where the shift is viewed positively if medication is delivered on time. Interestingly Chan et al (2013) found that nurses viewed the completion of tasks on time as delivering efficient care. However, the findings within this study indicated that although medication administration structured the day, multiple interruptions to the individual episode delayed medication administration reducing efficiency.

However, there are limitations which should be acknowledged, this qualitative study was conducted in a single unit which produces rich data which is not generalisable but may be transferable to other environments. In addition, the in-depth exploration of behavioural, perceived and structural factors in decision making provides a robust platform for further exploratory work to be undertaken to develop and test themes in other settings.

The convenience sampling technique selected PICU nurses for interview, which resulted in a sample which was all female and did not include newly qualified nurses. However, the sample of nurses interviewed contained representation from all bands within the PICU nursing structure. The sample included nurses with a diverse range of experience allowing for in-depth exploration of themes and issues. In addition, the data captured in the observation phase did include newly qualified nurses and male nurses which was also analysed within the framework.

CONCLUSION

Medication administration is a vital component of patient safety within PICU. Nurses are essential in the delivery of the process and therefore pivotal to maintaining patient safety. This study has illuminated novel factors such as family support, the role of non-verbal communication and an undulating process of concentration that appear significant to nurses' decision making when interrupted during medication administration. There is definite scope for these to be considered and embedded within future interventions which aim to improve medication safety and reduce non-essential interruptions. However, relevance of these factors to other sites and settings need to be explored to ensure interventions are acceptable and improve patient outcome within the PICU environment.

Whilst this was a small exploratory study several implications for practice have been identified. Interventions to reduce interruptions to medication administration within PICU must address the needs of both the child and the family. Decision making is affected by experience, familiarity with the medication being prepared, interpersonal relationships and bedside teaching. These factors need to be embedded into clinical medication education strategies. Finally, nurses perceive that medication administration is a priority activity, however, this is not always demonstrated in clinical practice and this needs to be challenged.

REFERENCES

- Anthony, K., Wiencek, C., Bauer, C., Daly, B., and Anthony, M. K. (2010) 'No Interruptions Please: Impact of a no Interruption Zone on Medication Safety in Intensive Care Units.' *Critical Care Nurse* 30 (3), 21-30 10p
- Asselin, M.E., 2003. Insider research: Issues to consider when doing qualitative research in your own setting. *Journal for Nurses in Professional Development*, 19(2), 99-103
- Biron, A., Loiselle, C. and Lavoie-Trembley, M. (2009) 'Work Interruptions and Their Contribution to Medication Administration Errors: An Evidence Review'. *Worldviews on Evidence-Based Nursing* 6 (2) 70-86
- Bower, R. (2015) 'Evaluating Interruptions to Medication Administration in Paediatric Critical Care: An Observational study'. In: RCN International Research Conference. Held 20-22 April 2015 at Nottingham University, Nottingham, UK
- Chan, Z. C. Y. (2013) 'A Qualitative Study on Non-Verbal Sensitivity in Nursing Students'. *Journal of Clinical Nursing* 22 (13), 1941-1950
- Chan, E. A., Jones, A., and Wong, K. (2013) 'The Relationships between Communication, Care and Time are Intertwined: A Narrative Inquiry Exploring the Impact of Time on Registered Nurses' Work'. *Journal of Advanced Nursing* 69 (9), 2020-2029
- Clark, A (2008). 'Critical Realism'. In *The Sage Encyclopaedia of Qualitative Research Methods*. Ed. by Given, L. London: Sage Publications. [online] available from <http://www.bahaistudies.net/asma/criticalrealism.pdf> [19.2.16]

Colligan, L. and Bass, E. J. (2012) 'Interruption Handling Strategies during Paediatric Medication Administration'. *BMJ Quality & Safety* 21 (11), 912-917

Colligan, L., Guerlain, S., Steck, S. E., and Hoke, T. R. (2012) 'Designing for Distractions: A Human Factors Approach to Decreasing Interruptions at a Centralised Medication Station'. *BMJ Quality & Safety* 21 (11), 939-947

Cvach, M. (2012) 'Monitor Alarm Fatigue: An Integrative Review'. *Biomedical Instrumentation & Technology* 46 (4), 268-277

Denzin, N. and Lincoln, Y. (1994) *Handbook of Qualitative Research*. London: Sage

Dickinson, C. J., Wagner, D. S., Shaw, B. E., Owens, T. A., Pasko, D., and Niedner, M. F. (2012) 'A Systematic Approach to Improving Medication Safety in a Pediatric Intensive Care Unit'. *Critical Care Nursing Quarterly* 35 (1), 15-26

Dougherty, L., Sque, M., and Crouch, R. (2011) 'Decision-Making Processes used by Nurses during Intravenous Drug Preparation and Administration'. *Journal of Advanced Nursing* 68 (6), 1302-1311

Fontana, A. and Frey, J. (1994) in *Handbook of Qualitative Research*. ed. by Denzin, N. and Lincoln, Y. London: Sage

Fore, A. M., Sculli, G. L., Albee, D., and Neily, J. (2013) 'Improving Patient Safety using the Sterile Cockpit Principle during Medication Administration: A Collaborative, Unit-Based Project'. *Journal of Nursing Management* 21 (1), 106-111

Frontier Economics (2014) '*Exploring the costs of unsafe care in the NHS*'. A report prepared for the Department of Health, London: Frontier Economics

Gair, S. (2012) 'Feeling Their Stories: Contemplating Empathy, Insider/Outsider Positionings, and Enriching Qualitative Research'. *Qualitative Health Research* 22(1) 134-143

Gale, N.K., Heath, G., Cameron, E., Rashid, S. and Redwood, S., 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, 13(1), 117. [online] available from <http://bmcmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-13-117> [24.4.16]

Jaworski, A. (1993) *The Power of Silence: Social and Pragmatic Perspectives*. Sage Publications

Jennings, B. M., Sandelowski, M., and Mark, B. (2011) 'The Nurse's Medication Day'. *Qualitative Health Research* 21 (10), 1441-1451

Kaushal, R., Bates, D., Landrigan, C., McKenna, K., Clapp, M., Federico, F. and Goldmann, D. (2001) 'Medication errors and adverse events in pediatric inpatients.' *Journal of American Medical Association* 285 (16):2114-20

Li, S. Y., Magrabi, F., and Coiera, E. (2012) 'A Systematic Review of the Psychological Literature on Interruption and its Patient Safety Implications'. *Journal of the American Medical Informatics Association: JAMIA* 19 (1), 6-12

Liegner, E., (2003). The silent patient. *Modern Psychoanalysis*, 28(1), 69

McDowell, S. E., Ferner, H. S., and Ferner, R. E. (2009) 'The Pathophysiology of Medication Errors: How and Where They Arise'. *British Journal of Clinical Pharmacology* 67 (6), 605-613

Morse, J. (1994) in *Handbook of Qualitative Research*. ed. by Denzin, N. and Lincoln, Y. London: Sage

Morse, J. (2000) Determining sample size. *Qualitative health research*. 10(1), 3-5.

Mustafa, R. (2011) 'The P.O.E.Ms of Educational Research: A beginners' Concise Guide'. *International Education Studies* 4(3), 23-30 [online] available from www.ccsenet.org [25.11.15]

National Patient Safety Agency (NPSA) (2007) Safety in Doses. [online] available from <http://www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=61626&> [11.1.16]

NHS England and Medicines and Healthcare Products Regulatory Agency (2014) Patient Safety Alert Stage Three: Directive Improving medication error incident reporting and learning. [online] available from <https://www.england.nhs.uk/wp-content/uploads/2014/03/psa-sup-info-med-error.pdf> [11.1.16]

Ortlipp, M. (2008) Keeping and using reflective journals in the qualitative research process. *The qualitative report*, 13(4), 695-705.

Pape, T. M. (2003) 'Applying Airline Safety Practices to Medication Administration'. *MEDSURG Nursing* 12 (2), 77-94

Parker, J. and Coiera, E. (2000) 'Improving Clinical Communication: A View from Psychology'. *Journal of the American Medical Informatics Association: JAMIA* 7 (5), 453-461

Raban, M. Z. and Westbrook, J. I. (2013) 'Are Interventions to Reduce Interruptions and Errors during Medication Administration Effective?: A Systematic Review'. *BMJ Quality & Safety* 23 (5), 414-421

Relihan, E., O'Brien, V., O'Hara, S., and Silke, B. (2010) 'The Impact of a Set of Interventions to Reduce Interruptions and Distractions to Nurses during Medication Administration'. *Quality & Safety in Health Care* 19 (5), e52-e52

Richardson, J. and Glasper, E. A. (2010) *A Textbook of Children's and Young People's Nursing*. 2nd edn : Elsevier Health Sciences

Saldana, J. (2013) *The Coding Manual for Qualitative Researchers*. London: Sage

Santiago-Delefosse, M., Gavin, A., Bruchez, C., Roux, P. and Stephen, S.L. (2016) 'Quality of qualitative research in the health sciences: Analysis of the common criteria present in 58 assessment guidelines by expert users'. *Social Science & Medicine*, 148, 142-151.

Sasangohar, F., Donmez, B., Easty, A. C., and Trbovich, P. L. (2015) 'The Relationship between Interruption Content and Interrupted Task Severity in Intensive Care Nursing: An Observational Study'. *International Journal of Nursing Studies* 52 (10), 1573-1581

Sitterding, M. C., Ebright, P., Broome, M., Patterson, E. S., and Wuchner, S. (2014) 'Situation Awareness and Interruption Handling during Medication Administration'. *Western Journal of Nursing Research* 36 (7), 891-916

Smith, J. and Firth, J. (2011) 'Qualitative data analysis: the framework approach'. *Nurse Researcher*, 18(2), 52-62.

Sowan, A.K., Tarriela, A.F., Gomez, T.M., Reed, C.C. and Rapp, K.M. (2015) 'Nurses' perceptions and practices toward clinical alarms in a transplant cardiac intensive care unit: Exploring key issues leading to alarm fatigue'. *JMIR Human*

Factors, 2(1), p.e3. [online] available from

<http://humanfactors.jmir.org/2015/1/e3/?trendmd-shared=1> [30.5.16]

Streubert, H. and Carpenter, D. (2011) *Qualitative Research in Nursing*.

Philadelphia: Wolters Kluwer / Lippincott Williams and Wilkins

Tilley, S. A., & Powick, K. D. (2002). 'Distanced data: Transcribing other people's research tapes.' *Canadian Journal of Education* 27(2/3), 291–310

Westbrook, J., Woods, A., Rob, M., Dunsmuir, w. and O'Day, R. (2010) 'Association of Interruptions with an Increased Risk and Severity of Medication Administration Errors'. *Archives of Internal Medicine* 170(8), 683-690

Verweij, L., Smeulers, M., Maaskant, J. M., and Vermeulen, H. (2014) 'Quiet Please! Drug Round Tabards: Are they Effective and Accepted? A Mixed Method Study'. *Journal of Nursing Scholarship*. 46 (5), 340-348

