The role of paediatric nurses in medication safety prior to the implementation of electronic prescribing: a qualitative case study

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ABSTRACT

Objectives: To explore paediatric nurses' experiences and perspectives of their role in the medication process and how this role is enacted in everyday practice.

Methods: A qualitative case study on a general surgical ward of a paediatric hospital in England, one year prior to the planned implementation of ePrescribing. Three focus groups and six individual semi-structured interviews were conducted, involving 24 nurses. Focus groups and interviews were audio-recorded, transcribed, anonymised and subjected to thematic analysis.

Results: Two overarching analytical themes were identified: the centrality of risk management in nurses' role in the medication process and the distributed nature of nurses' medication risk management practices.
Nurses' contribution to medication safety was seen as an intrinsic feature of a role that extended beyond just preparing and administering medications as prescribed and placed nurses at the heart of a dynamic set of interactions, practices and situations through which medication risks were managed. These findings also illustrate the collective nature of patient safety.

Conclusions: Both the recognised and the unrecognised contributions of nurses to the management of medications needs to be considered in the design and implementation of ePrescribing systems.

KEYWORDS

nurses, paediatrics, patient safety, qualitative research, risk management

INTRODUCTION

The administration of medication in hospitals is a complex and multistage process that is mostly managed by nurses,[1] who are thus well positioned to enable safe medication management and prevent medication errors from reaching the patients [2,3]. Likewise, because nurses administer the majority of the medications, nearly all errors can be directly affected by nursing care.[4,5]

In paediatrics, the safe delivery of medications presents additional challenges and opportunities for error.[5] Improper dosing and mode of administration are leading causes of

medical errors in paediatrics.[6] Variation in weight-based dosing and multiple concentrations are required to provide accurate measurement of very small doses in clinically acceptable volumes for administration and make both the prescribing and administration of medicines more complex.[6] Many medications are only available in adult doses and forms [7,8] and must be manipulated and adjusted for use in children at the point of administration by nurses. In addition, the environment in which paediatric nurses practice gives rise to additional challenges and risks including interruptions and a high workload[4,5] particularly in tertiary settings where patients may have higher levels of acuity and complex treatment needs. Lessons learned from such high-risk settings for nursing work could be of particular value.

While it is known that medication administration is particularly prone to errors,[2,3,5,9] there is little consensus on how these may arise.[9] There is a need for better understanding of the complex interrelationship between nurses' behaviour and the health care environment at the point of medication administration.[9] This is particularly important given the rapid growth of electronic prescribing (ePrescribing), the implementation and impact of which could be better understood in the context of a greater understanding of existing practices.

This study explores the role of nurses in the medication process in one paediatric surgical ward prior to the implementation of an ePrescribing system. Our aim was to examine nurses' experiences and perspectives and to analyse how their role is enacted through the medication safety practices reported by nurses.

METHODS

We undertook a case study [10,11] using grounded theory methods [12], in which the nursing staff of a paediatric surgical ward was the unit of analysis. The setting was an 18-bed general surgical ward in a paediatric hospital in England, one year prior to the planned implementation of a new ePrescribing system. Patients were aged between 1 month and 16 years, admitted daily for elective and emergency surgery, including both minor and complex procedures in a range of surgical specialties (ear, nose and throat; plastic; orthopaedic; abdominal; and thoracic). Length of stay varied from overnight to 7-10 days or longer depending on complexity. Nurses on the ward were not qualified to prescribe and had access to nurse prescribers only through specialist teams. The majority of the prescribing was done by medical staff. Medicines administration was managed by dedicated medicine rounds at set times, usually performed by a nurse in charge and a second nurse. Pain relief was administered as required between medicine rounds.

The research team included one senior registered nurse (TJ) who, at the time of data collection, was a senior nurse on the ward. The rest of the team had no prior involvement with the ward.

The sampling strategy focused on nursing staff qualified to administer medicines on the selected ward. In the UK, this requires a degree in nursing and to be registered with the Nursing and Midwifery Council (and renewed every three years). Initial sampling relied on a purposeful (maximum variation) strategy [13] based on the ward's staffing rationale, which categorised nurses according to three levels of competence: novice, competent and expert (Table 1). Theoretical sampling [12] was then used to narrow the focus on emerging analytical categories and to develop and refine them.

Table 1 - Levels of competence for nursing staff as defined by the selected ward

CATEGORY	DESCRIPTION
NOVICE	Newly qualified nurses with less than two years of experience.
COMPETENT	Band 5 nurses with at least two years of experience.
EXPERT	Band 6 nurses and senior Band 5 nurses with more than two years of experience.

This study was conducted as part of a service evaluation and did not require NHS ethical approval. Potential participants were approached (TJ) and given information sheets detailing the study and basic information about the interviewer(AF). All those approached agreed to take part and gave written consent.

Initial topic guides were developed by the research team based on documentary analysis of key hospital policies and clinical experience, in consultation with an external senior nurse who provided further critique and suggestions. Data collection took place in two stages. In stage 1 three focus groups (one with novice nurses, one with expert nurses and one with a mixture of competent and expert nurses), were held at an external venue and lasted 60-70 minutes, involving a total of 18 participants (Table 2). A second moderator (CC/TJ) took notes and debriefed with the moderator after each session. Stage 2 consisted of six semi-structured individual interviews (with one novice, two competent and three expert nurses), lasting 40-65 minutes.

Focus groups and interviews were audio-recorded, transcribed and anonymised. Empty drug charts and anonymised examples of drug charts were used as discussion aids and incorporated into the dataset to assist insight into cultural features and technical operations during data analysis.

Table 2 – Number of participants by type of session and level of competence

Data collection stages	Session	Level of competence			Total
		Novice	Competent	Expert	
Stage 1 Focus Groups	Focus Group 1	6			**6**
	Focus Group 2			6	**6**
	Focus Group 3		2	4	**6**
Total participants (stage 1)		**6**	**2**	**10**	**18**
Stage 2 Semi-structured interviews	Interview 1			1	**1**
	Interview 2	1			**1**
	Interview 3		1		**1**
	Interview 4			1	**1**
	Interview 5		1		**1**
	Interview 6			1	**1**
Total participants (stage 2)		**1**	**2**	**3**	**6**
Total study participants		**7**	**4**	**13**	**24**

Data analysis started following stage 1. Emerging findings informed further data collection and sampling decisions during stage 2 using the constant comparative method [14] and memo-writing, until saturation was achieved. Data coding and categorisation were assisted by NVivo 10 software. Concurrent data analysis was led by AF and critically revised by CC. After data collection was completed, AF refined the initial codification while GH and KS undertook independent analyses of two sub-sets of the data. The three coding reports were then discussed by the research team and a resulting codebook was agreed and applied by the lead researcher to the whole dataset. Coded data were then collated into themes, which were discussed and agreed by the research team. As a result, two overarching analytical themes were established: the centrality of risk management in nurses' role in the medication process; and the distributed nature of nurses' medication risk management practices.

RESULTS

The critical role of nurses as risk managers in the medication process

Most routine practices reported by participants as part of their role in the medication process were related to risk management, with checking procedures being central to their descriptions of their roles:

> "As a senior nurse, my role is to ensure that the medicines policy is followed and that the right patient gets the right medicine; but equally, there would be a number of checks that I would do on the prescription chart before I would administer the medicine." (Interview 6, Expert)

These procedures included both single-checking-techniques, such as “checking that the prescription is legible, that it’s got a route prescribed, that the dose prescribed is accurate” (Interview 6, Expert); and double-checking-techniques, such as “getting people [fellow nurses] to check your doses and medications and drawing it [intravenous medication] up, with identifying the patients.” (Interview 2, Novice).

Participants highlighted the importance of adopting a critical attitude towards prescriptions as an intrinsic feature of their approach to medication checking:

> “I think you just do it [the checking procedures] without thinking but obviously, when you think about it, you are obviously checking all the time.” (Interview 5, Competent)

This critical approach goes beyond the formal checking of prescriptions, usually associated with a nurse’s role, and was seen as an essential part of their role:

> “I think it [analysing a prescription critically] is part of the nurse’s role. If you’re administering the medicine, then you need to know why you’re administering that medicine and to be able to explain to the parent and the family as well.” (Interview 6, Expert)

Although acting upon disagreements with prescribers was more clearly associated with seniority, nurses of all levels highlighted the importance of rationalising and agreeing with any decisions made by prescribers before proceeding to prepare and administer any medicines, even if junior staff had to seek indirect routes to act upon any disagreements with prescribers:

> “If we didn’t agree with the dose or something, we might speak to the senior member of staff and then get the doctor to come and change the dose if we’re not happy to give it.” (Focus Group 1, Novice)

Therefore, nurses’ interventions on the prescribing phase of the medication process and their routine engagement with the identification and mitigation of prescribing-related risks, suggests that their role and responsibilities extend beyond the administration phase.

Nurses also engaged in the identification and mitigation of risks related to the ordering and supply of medications:

> “We're aware of what patients are using more of, whether that's regular drugs or whether it's controlled drugs, because the controlled drugs are checked every day as well. So we know where the level is. So, again, it's about making sure that that is informed to those who actually can do something about it so we don't end up in a situation whereby you haven't got any.” (Focus Group 2, Expert)

Nurses were very aware of the importance of their contribution to medication safety and saw it as intrinsic to their role, with most participants reporting how their clinical priority setting revolved around medicines administration: “I try and prioritise my medicines to be on time

and then fit everything else in around the medicines most of the time" (Interview 4, Expert). Likewise, dealing with potential errors or near misses was seen as a routine part of their work: "At least on a daily basis there's something wrong with somebody's drug chart on the ward" (Focus Group 2, Expert).

The most commonly identified potential errors or near misses were perceived to be related to the prescription of wrong doses and administration delays:

> "Wrong doses. (…) Nurses forgetting to give drugs and giving them late. Or doctors prescribing drugs four times a day when they should be three times a day. Or the availability of drugs sometimes is a problem (…) if it's a non-stock drug, can sometimes mean that a child can be waiting four, five, six hours before the drug's available and they actually give it." (Interview 1, Expert)

Administration delays were tied to a wide range of issues including interruptions, human factors and mistakes, stock and supply problems, prescription errors, or issues specifically related to paediatrics such as child medication-taking behaviour:

> "Often compliance of patients holds you back a bit, with children not being willing to take the medications." (Interview 2, Novice)

Other important challenges routinely encountered and dealt with by nurses included issues that could be exclusively associated with using a paper-based prescribing system, such as misplaced drug charts or the legibility of the prescriptions due to unclear handwriting or insufficient space available in the drug charts:

> "The legibility of the prescriptions can be a problem (…) you may have the name of a drug that you think it is, but it may not be easy to decide what the exact dose is. If in doubt, then you can't give the medicine until you get the prescriber to come and re-prescribe it." (Interview 6, Expert)

However, despite dealing with a range of medication risks on a daily basis, participants emphasised that errors were infrequent:

> "So it [the drug chart] is in pharmacy getting checked, people misplacing the charts… We go around looking for charts that have been put down somewhere and you don't know where they are. But, again, most of the time it doesn't really affect giving them on time really." (Interview 2, Novice)

Nurses appeared to play an important role as risk managers, helping to ensure safety by identifying near misses, omitted actions or incomplete tasks and acting upon them.

Distributed medication risk management

Equally important to nurses' role in administering medications was the finding that they were at the heart of a dynamic set of relationships, interactions, practices and situations through which medication risks were managed.

While some medication risks were dealt with through individual strategies: "I always write a list and I try and write it in order and I cross off every hour as it goes" (Interview 5, Competent); most medication risks managed by nurses could only be dealt with through collaboration:

> "A lot [of our work] is based on teamwork, which works really, really well on the ward. There's always somebody who can help you to do your medicines and things. Again, it does work really well [but] a lot depends on teamwork." (Interview 2, Novice)

In some instances, this meant working directly with other nurses to manage everyday risks (e.g. not being able to give drugs on time) and prevent them from harming the patient. Coordinated strategies such as drug rounds were seen as a useful and systematic method for "help[ing] with the workload of the nurses" (Interview 2, Novice) and "go[ing] round in order, to each individual bed, to check when drugs are due and to make sure the drugs are given" (Interview 1, Expert).

Most critically, however, nurses were required to interact with other professionals across the hospital to ensure medication safety, particularly given that many drugs being used in paediatrics (and particularly in tertiary care) are off-label or unlicensed for the paediatric population. This forced nurses to regularly interact with pharmacists and doctors to ensure patient safety:

> "A consultant had prescribed something and we checked it in the BNF and it was twice as high as the maximum that the child could have. So we talked with pharmacy and pharmacy agreed that it was higher than what the child should have. We then had to go back to speak to the consultant." (Interview 1, Expert)

Nurses' interactions involved a range of professionals and practices, such as getting a dose or drug checked or confirmed, a drug chart re-prescribed, a patient re-assessed, a drug time confirmed, a new drug ordered and supplied, or having to manage multiple interactions at the same time:

> "Sometimes they [the patients] are under multiple teams. And the surgeon's prescribed them analgesia, but the medical teams prescribe their medicines (…) and you can just be chasing two or three teams at times." (Focus Group 3, Expert)

While some interactions would be relatively easy to manage and complete, others would be more complex or onerous and could make the task more difficult to complete:

> "If we were to approach a child and the cannula had tissued we'd go and get straight in touch with our doctors to say: our child needs their IV antibiotic but the cannula's gone, can you come up and re-cannulate them?" (Focus Group 1, Novice)

A defining feature of these interactions and practices was, inevitably, time. Reaching other professionals to prompt or ask them to do something takes time. Although, this could range from quick interactions (such as making a phone call to confirm drug information) to more time-consuming activities (such as getting a drug chart re-written), there was always an investment of time by the nursing staff in initiating and following up each interaction:

> "You're kind of expecting that it [the medication] will have been prescribed correctly, so if it's time for your meds (…) and actually it's wrong that does slow it down, because you can't then give it because you know it's wrong. But we also can't give the dose that we know is right, because we can't prescribe. So unless the doctors are on the ward there and then and will quickly change it, you've got to bleep them and then they could be in theatre and you've got to wait for them to come out." (Interview 4, Expert)

The elapse of time during nurses' interactions made evident that their risk management practices were also distributed across a range of situations, and therefore tied to a number of ongoing clinical encounters and potentially competing rationales for priority-setting:

> "Asking for a drug chart to be re-written in their [doctors'] priorities of jobs that they need to do is probably low. But if you think about your patient's care, it's high." (Focus Group 2, Expert)

This often translated into feelings of stress and pressure for nursing staff. Given the relatively rigid time constraints of medicine administration, time spent by nurses in contacting other professionals or waiting for something to be done before their work could be safely completed, together with a sense of dependency on others, could lead to feelings of stress and pressure:

> "It generates frustration, I think, and stress. A bit of a frustration in the fact that you know the child should have had this medicine one hour ago and you haven't been able to give it." (Interview 6, Expert)

These feelings were also associated with a strong sense of personal responsibility due to the possibility of risks actually reaching the patients in the event of an actual error, and the subsequent potential impact on their professional reputation:

> "That [re-writing a prescription] is probably just a low priority really for them [doctors]. If they're in theatre, it's just a small thing: 'I've just to come and change the drug chart…' but actually, for us, it's now a drug that's late. (…) for us as well if a medicine is given more than two hours late then it's a form [to report an error] just regardless of the reason." (Interview 4, Expert)

DISCUSSION

Main findings

This study contributes to making explicit the often hidden and taken-for-granted aspects of nursing work. Within that, we contribute a new idea: everyday risk management practices, which are both informal and collective in nature, are a defining feature of the role of nurses in the medication process in hospital wards.

Nurses were aware of the importance of their contribution to medication safety and reported how their clinical priority setting revolved around medicines administration. Consistently, prescription checking procedures were found to be central to nurses' descriptions of their role and nurses of all levels of experience highlighted the importance of adopting a critical attitude towards prescriptions. Thus, their role appeared to extend beyond preparing and administering medications as prescribed [2].

Although the practice of questioning prescriptions was seen as part of nurses' professional culture, it was also tied to professional knowledge and experience. Thus, acting upon any disagreements with prescribers through direct questioning was associated with seniority. This finding suggests that individual nurse's confidence and ability to assess the risks of medication administration [2,15,16] could be of relevance, particularly in paediatrics, where the evidence base for prescribing is often scarce or non-existent [8] and off-label and unlicensed use of drugs are widespread practices [17,18].

Such circumstances could also be related to another finding, the prescription of wrong doses.[6,19] There was a perceived need for nurses to be competent to perform mathematical calculations [20] to determine the correct dose and volume of medications [6] and therefore be able to identify potential dosing errors. Nevertheless, participants' most commonly dealt with the potential error of administration of drugs at the wrong time [21]. This was tied to a wide range of issues such as interruptions [22,23], human factors [3,15], stock and supply problems [1], prescription errors [1,21], patient-related problems or medication-taking behaviour issues during medicine administration [1], and issues specifically related to the use of paper-based prescribing such as misplaced drug charts or illegible handwriting [21]. Some of these risks may disappear or be mitigated with the introduction of ePrescribing, which in turn could lead to the introduction of new types [24] and meanings [25] of risk.

Participants acknowledged that they are well positioned to prevent errors from reaching patients [2,3] and saw dealing with potential errors or near misses as a routine part of their work, undertaken on a daily basis. Errors were rare, which suggested the effectiveness of their risk management practices. This finding could also be relevant in the context of ePrescribing, which will increase exponentially an organisations' ability to collect data on medication. Such systems have previously been shown to have an impact on how accountability and performance are addressed [26]. Thus, ePrescribing could be seen as an opportunity to make visible and

document informal practices that improve safety such as the documentation of near misses. But, on the other hand, ePrescribing also has the potential to reshape and intensify blaming processes and increase pressure on performance.

Our findings provide further evidence on the complexity of nursing work and how this can have an impact on patient safety [5,22] by revealing key aspects of how the nurses' role was enacted in their everyday work – what we characterise as the *distributed nature of medication risks managed by nurses* – with nurses being at the heart of a dynamic set of interactions, practices and situations through which risks are managed, thus demonstrating the collective nature of patient safety [27].

Although medication safety practices led by nurses appeared to be distributed over time and across a range of professionals, situations and practices, most risks emerged as a potential issue for an individual nurse at a specific point in time, i.e. when medicines were due to be administered. Within this context, nurses had to interact with a range of professionals to ensure medication safety and manage the competing demands of drug administration and other professionals' work, while coping with the routine pressures and risks derived from the rest of their workload [2,5].

Such situations were linked to feelings of stress and pressure [15], together with a strong sense of personal responsibility due to the possibility of risks actually reaching their patients and having an impact on their professional reputation in the event of an actual error. These findings might be seen as additional risks to nurses' ability to adequately perform their role [2], giving rise to individual differences in the propensity for medication errors based on personal abilities, confidence, experience, attitudes and susceptibilities to stress during the administration of medication [15]. But, on the other hand, these findings could be seen as evidence of nurses exercising agency and assuming moral responsibility to ensure safety as part of a wider system of which they are co-constructors [27].

Our findings engage with recent contributions to patient safety that go beyond the system/individual distinction [27]. Likewise, our findings are consistent with recent calls for more research into the complex interrelationship between nurses' behaviour and the health care environment around medication administration [9].

Implications for practice

Our findings could be relevant to those involved in the implementation of ePrescribing systems to help them consider how implementation might breach or support existing practices [28] and incorporate the often 'hidden work' of frontline nurses.[29] This extends to designing evaluations of ePrescribing systems which need to take into consideration nurses' role and practices in relation to medication safety. We intend to consider our findings in relation to those of an on-going longitudinal study in the same hospital, that is exploring the effects of implementing ePrescribing.[30]

STRENGTHS AND LIMITATIONS

This study has some limitations. Nurse prescribers were not part of the study and, therefore, findings focus on the traditional role of nurses as medicine administrators. In addition, our study was restricted to one paediatric surgical ward so the generalisability of the findings is uncertain. However, the high-stakes nature of nursing work in paediatrics has generated learning that might benefit other lower risk settings.

CONCLUSIONS

This study illustrates the importance of nurses' contribution to medication safety, which was seen as an intrinsic feature of a role that extended beyond preparing and administering medications as prescribed. Our findings provide further evidence on the complexity of nursing work and how this can have an impact on patient safety. Furthermore, by identifying key aspects of how nurses enacted their role in everyday practice – with nurses being at the heart of a dynamic set of interactions, practices and situations through which medication risks are managed – this study illustrates the collective nature of patient safety. Both the recognised and the unrecognised contributions of nurses to the management of medications needs to be considered in the design and implementation of ePrescribing systems.

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Ethics approval
Advice obtained from the UK National Health Service Health Research Authority classed this study as service evaluation and therefore a National Research Ethics Service ethics application was not required. Written consent was obtained from all participants.

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