Exploring the factors contributing to drug errors and how to improve knowledge

It is important to identify the factors that increase the potential for medicine administration errors and address how best to overcome these.

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Medicines administration is one of the high risk areas for nursing practice and a matter of considerable concern for practitioners, policymakers and the public. Drug errors can lead to devastating consequences for patients and for nurses’ careers. It is an integral part of nurses’ role, underpinned by legal and professional requirements (Nursing and Midwifery Council, 2008a). This article reviews the situation and makes suggestions on how to improve knowledge.

INTRODUCTION

It is perhaps taken for granted that all nurses who undertake medicines administration have been adequately trained for this aspect of their role. However, Hughes (2004) suggested that human factors such as lack of experience or skill predispose people to errors. Several studies have identified nurses’ poor mathematical competency as a key element of medication administration errors (Lee, 2008; Wright, 2007; Grandell-Niemi et al, 2003).

The National Patient Safety Agency (2007) reported that the most common types of error are those involving incorrect dosage, frequency and strength. These account for 29% of all reported errors. The Agency said it is crucial that these issues are addressed as they can result in severe harm or death. Yet evidence demonstrates that qualified nurses do not necessarily have the appropriate knowledge and skills to accurately calculate drug doses (Wright, 2007). Pape (2003) supported this, reporting that most medication errors occur at the point of administration, and that administration errors rank third in the list of causes leading to loss of function or patient death. Kohn et al (2000) argued that while some errors can be prevented, it is unlikely they will ever be eliminated as they arise from human nature. This has implications for nurse educators and student nurses. In general terms, curricula need to be developed to address these issues. In the clinical setting, student nurses administer medication under the supervision of qualified nurses.

Part of the Nursing and Midwifery Council’s (2008b) remit is to ensure that students demonstrate fitness for practice before being included on the register as qualified nurses. The NMC (2004) developed standards to support learning and assessment and these take the form of a developmental framework. These proficiency standards are the bedrock of current first level nurse education programmes, including medicines administration.

Wright (2007) found that student nurses are often not able to conceptualise the theoretical knowledge of medicines administration to the practical setting. The ability to calculate accurately the number of tablets is a routine aspect of nursing practice. A significant shift in educational provision has occurred to achieve the NMC proficiencies. For example, student nurses at the University of Wolverhampton are now assessed for medicines administration summatively in the clinical area, using an essential skills cluster booklet to enable them to link theory to practice. Therefore, it is important that continued efforts are made in pre and post registration education, in collaboration with clinical practice, to develop and promote qualified and student nurses’ mathematical and medicines administration skills to enhance competence in this area.

LITERATURE REVIEW

Medicines administration is often viewed as a basic nursing task, when in fact it requires complex interaction of a large number of specific decisions and actions, often performed under less than ideal conditions in clinical practice. This complex administration process increases the potential for errors. Conducting this literature review has highlighted a lack of empirical research on nurses’ views of the factors that contribute to medicine administration errors.

Weeks et al (2000) conducted a study looking at written drug dosage errors made by student nurses and described the mathematical competence necessary for safe calculation of medication dosages. They concluded there is a need for new approaches to teaching and assessment of medicines administration.

Clearly, the development of such skills cannot be left to chance and, as such, teaching programmes should be designed to allow for student nurses’ differing capabilities. This could involve the use of computer based learning activities alongside simulated practical sessions in the skills laboratory. Hutton (1998) supported the use of clinical skills areas as useful in enhancing student nurses’ knowledge by applying mathematical knowledge to clinical practice.

Kelly and Golby (2003) carried out a study addressing problem based learning as an approach to improving drug calculation skills. Student nurses were given drug calculation problems to solve and allowed to work out their own methods of solving the
calculations. The study has had some success in encouraging student nurses to acknowledge when answers obtained are not correct and identified that students were able to conceptualise mathematical calculations in clinical practice. Other studies have supported this, promoting the need for strategies on conceptualising information from clinical practice into drug calculations (Wilson, 2003; Leathard, 2001; Weeks et al, 2000). Table 1 shows a worked example of using information from the clinical setting in a drug calculation.

A critique by Wright (2007) examined the way in which drug calculations are taught, and suggested that the widely taught formula of “what you want, divided by what you have, multiplied by what it is in” removes the clinical context and translates into meaningless mathematical problems, relying on students having the ability to manipulate numbers. To perform accurate drug calculations, Wright (2004) suggested that two skills are required: first, student nurses need to have basic mathematical skills to calculate accurately the equation given and second, they need to be able to conceptualise clinical information presented to extract relevant information to solve a calculation.

Fry (2007) conducted a cross sectional survey to establish the views of nurses in the medical directorate of a large teaching hospital on a list of factors that potentially contributed to medication errors, and explored personal and professional views of reporting these incidents. The sample size was 244 registered nurses employed permanently in 15 medical wards.

The contributing factors highlighted for medication errors were: distractions in the environment; training and education; medication products and packaging; and inability to read the drug chart. Out of 136 respondents, 33% revealed they had been involved in a medication incident or error. One significant finding was that nurses in higher bands were identified as having made the most errors.

Reason (2000) suggested that distractions can be a contributing factor in medication errors, as identified in this particular study. In the clinical setting senior nurses have greater responsibility and may have to do several clinical and management tasks simultaneously, such as carrying out the drug round, supervising students and responding to telephone calls. These have to be carried out irrespective of staffing levels and the type of ward.

Other literature repeatedly emphasises that diligent, competent healthcare professionals make mistakes intermittently and even more so when activity increases (Rex et al, 2000). Errors can occur because of multiple factors such as the complexity of the healthcare system that nurses work in. Rogers et al (2004), in a national survey of nurses using self report questionnaires, found the risks of making an error increased significantly when registered nurses worked shifts longer than 12 hours or more than 40 hours per week. The study revealed that working overtime increased the odds of making at least one error, regardless of how long the shift was originally scheduled. Although this research also involved procedural, transcription and charting errors, of the 199 errors and 213 near errors, more than half the errors (58%) and near errors (56%) involved medicines administration. The relationship of errors or near errors and hours worked, including overtime, were not affected by age, type of hospital unit or size of hospital.

Rogers et al’s (2004) study suggested a link between poor working conditions and threats to patient safety. These factors demonstrate Reason’s (2000; 1990) theory, whereby fatigue and understaffing must be considered as latent conditions.

Carlton and Blegen (2007) discussed latent failures and argued they involve two kinds of situations: those that provoke conditions in the workplace, such as time pressure, understaffing, inadequate equipment, fatigue and inexperience, and those that are long lasting conditions, such as untrustworthy alarms and unworkable procedures. These deficiencies can lie undetected for several years before they come to light, usually by a culmination of errors.

Whitman et al (2002) suggested that increased activity in the clinical area raises the risk of medication errors. They suggested that clinical areas with patients who are more seriously ill and have more complex medication regimens influence medication errors. The most frequent types of errors in this study (dosage and time) suggest time pressures and use of inadequate equipment as causes. For example, infusion pumps used to administer intravenous medication are often left in cupboards for long periods of time, not charged electrically and not serviced yearly, which can cause dosage errors. Reason (2000) identified these reasons as error provoking latent conditions that could lead to multiple errors if the situation is not acknowledged and acted on.

**DISCUSSION**

The literature review clearly identified a number of contributing factors to why medicines administration errors occur, and this needs to be addressed. It must be acknowledged that clinical nurses often have little control over contributing factors.

In clinical practice, a competency framework for medicines administration is now used in most NHS Trusts. The Department of Health (2004) introduced the Knowledge and Skills Framework, which is a developmental review process designed to do the following:

- Identify the knowledge and skills that individual practitioners need to apply in their post;
- Help guide the individual’s development;
- Provide a fair and objective framework on which to base review and development for all staff.

This should be a partnership between management and staff. We argue that medicines administration should be part of this process. This particular tool may prove useful in enhancing staff nurses’ knowledge and ability to improve skills in mathematics and medicines administration. This will lead to improved quality of care for patients and may see a reduction in medication errors.

The new role of practice placement coordinator has been developed within schools of health in higher education institutions. Part of the role involves supporting staff and students in the clinical setting to improve the theory-practice gap.

Widening participation has become a general policy in higher education and, as a result, students’ educational attainment at entry varies considerably. This has led to students entering nurse training courses with different qualifications, such as NVQ at level 3 and GCSEs.

One consequence and challenge for universities is students’ mixed ability. Before widening participation, prospective student nurses were required to have the minimum

**TABLE 1. WORKED EXAMPLE**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td></td>
</tr>
<tr>
<td>Route: Oral</td>
<td>Dose required x volume</td>
</tr>
<tr>
<td>500 x 5 = 10.5ml</td>
<td>240</td>
</tr>
<tr>
<td>Available as 240mg per 5ml syrup</td>
<td>Dose available</td>
</tr>
</tbody>
</table>

Type: Analgesic
of GCSE grade C mathematics to gain entry onto nurse training programmes. Quite rightly, most universities have embraced the concept of widening participation. Nonetheless, it is imperative that student nurses’ mathematical skills are developed for them to be able to safely calculate and administer medication.

FUTURE IMPLICATIONS
As nurse educators, our duty is to develop a curriculum that reflects both theory and practice to enable student nurses to become competent in medicines calculation and administration. This also applies to practice mentors who have the responsibility to help students link theory to practice in the clinical setting. In the School of Health, drug calculation workshops have been used as a way of improving student nurses’ knowledge and skills.

Other ways in which learning could be enhanced are by using simulated and blended learning. Koper (2005) supported simulated learning and saw it as essential to build the required competence in an effective way. Simulated learning therefore takes place in the clinical skills laboratory, where students have the opportunity to complete medicines administration. Blended learning offers student nurses a combination of face to face and online learning (Rooney, 2003). With this in mind, the five Rs (right person, right drug, right dose, right route, and right time) have been introduced into the nursing curriculum, adapted from Cohen (2003).

Qualified nurses are accountable for their actions and omissions in accordance with the NMC (2008b) code of conduct. The onus is on the individual to keep updated with the issues that are pertinent to medicines administration. If individual staff nurses recognise they are not competent in this area, they should seek help to increase their level of competence and knowledge. The DH (2004) advocated a blame free culture in which it is possible to learn from mistakes.

There is a clear need to develop strategies to enable qualified and student nurses to calculate accurately and administer medication safely. The NMC (2008b) stipulated that nurses have a duty of care to patients and no acts or omissions should lead to any harm. Within the nursing curriculum, medicines administration needs to be included throughout the three years of the programme. Students need to access a range of resources that should be available in print and also online. Medicines administration and calculation workshops should be held regularly and be mandatory for student nurses. Using the clinical skills laboratory would help students relate theory to practice situations if opportunities for simulated learning were provided.

Some trusts have introduced regular mandatory updates and drug tests with pass marks for qualified nurses as a way to improve skills and knowledge of medicines administration.

CONCLUSION
In conducting this review, it became evident that UK nurses’ views on the contributing factors in medication error have not been explored in great depth. Most studies were carried out in the US and New Zealand. There is a need for further empirical research in the UK to ascertain nurses’ views, as currently their experiences and knowledge appear to be undervalued. Ideally, it is nurses who should carry out this research as they have a better understanding of today’s complex healthcare environment and the pressures and challenges they face on a day to day basis.

The review has identified a number of factors that increase the potential for medication errors in practice and these need to be addressed in the clinical setting. Nurse educators also need to consider issues around patient safety and medicines administration, and take steps to tackle these in the curriculum.

REFERENCES


