The role of nurses in medicine administration errors


Abstract
This article explores the commonly held belief that nurses are to blame for the high rate of medication administration errors in health care. The article argues for a need to move away from a culture of blame and to consider changes to medicine and the increasing complexity of administration as potential reasons for error. Medicine administration should be viewed within the wider context of health care rather than as an isolated process in order to develop effective solutions to reduce medicine-related errors.

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Keywords
Blame culture, drug administration, drug calculations, medication errors, patient safety

Review
All articles are subject to external double-blind peer review and checked for plagiarism using automated software.

Nursing errors
Nurses receive disproportionate blame for medication errors; the nursing literature often highlights medication error rates found in research studies and reports, and attributes these to nursing administration of drugs (Brady et al 2009, McMullan et al 2010). Assumptions have also been made about limited drug calculation and numeracy skills among nurses resulting in medication administration errors (Newton et al 2009, Harvey et al 2010, Ramjan 2011). In addition, media coverage of medication errors in health care may be responsible for attributing high error rates to nurses’ practice (BBC News 2003, Hall 2006, Mail Online 2006).

Nurses may also attach feelings of guilt and blame to medication errors in which they are involved, and often continue to experience these emotions long after the event (Schelbred and Nord 2007, Treiber and Jones 2010). The case of a nurse in the US who took her own life in 2010 as a result of making a fatal medication administration error...
demonstrates the personal responsibility nurses feel when they make errors (Aleccia 2011). Placing blame for medication errors on an individual or a group of professionals, should be avoided as it does not allow the root cause of errors to be addressed (DH 2004, Vincent 2012).

**Medication error research**

Medication errors can occur during prescribing, transcribing (transferring prescriptions to different documentation), dispensing or administering drugs (Vincent et al 2009). The number of medication errors identified in research studies is dependent on the methodology used to study errors in practice (Wright 2010). The three main methodologies are: prospective chart review, direct observation and analysis of error reports (Table 1).

A prospective chart review will identify prescribing errors predominantly and few administration errors (Kaushal et al 2001, Holdsworth et al 2003, LaPointe and Jollis 2003). In contrast, studies that directly observe administration of medication are likely to focus on errors in nursing, as nurses are usually involved in the administration process (Herout and Erstad 2004, Cousins et al 2005, Han et al 2005, Kopp et al 2006). In other words, the type of study will determine the type of error identified. The analysis of error reports is limited to incidents where reports have been completed and are therefore likely to be under-representative of the actual error rate, for example Santell et al (2003), Hicks and Becker (2006), and Fanikos et al (2007).

Medication errors could go unnoticed and therefore unreported. Actual drug errors are more likely to be reported by staff than potential errors or near misses (NRLS 2009). Studies exploring nurses’ perspectives on drug errors have found that the fear of being blamed for errors has resulted in many nurses only reporting errors that have actually caused patient harm (Lomas 2010). Therefore, errors related to drug administration are more likely to be reported even though they may have arisen from one of the other stages in medicine management, such as prescribing (NRLS 2009). Because of the different methods used to study error, it is difficult to ascertain the actual medication error rate and at which stage these errors are most likely to occur.

**Defining medication error**

The rate of errors identified is also dependent on the definition used for medication error. When direct observational studies are examined to ascertain error rates and causes of errors in the administration stage, there is considerable variation in the definition of medication errors used and hence the number of errors recorded. Some studies use the standard definition of a medication administration error being any medication administered that differs from the prescription (Han et al 2005, Lisby et al 2005). Other studies, however, include administrations that differ from manufacturing guidelines or hospital policy (Taxis and Barber 2003, Wirtz et al 2003).

This has led to some studies reporting high error rates, implying that nurses are putting patients at high risk, when such errors would cause a low or negligible risk to the patient. For example, errors have been recorded for: nurses having a treatment room window open during medication preparation as this was against hospital policy (Wirtz et al 2003); using clinical judgement to alter the rate of fluid infusions (Han et al 2005); and administering bolus intravenous (IV) antibiotic injections more quickly than recommended by the manufacturer (Taxis and Barber 2003). Arguably, these errors would cause minimal harm to the patient. Such studies can, therefore, give a false impression of nurses’ involvement in medication errors, and lead to misleading conclusions and a focus on the wrong causes and solutions, for example drug calculation skills, which are often

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**TABLE 1**

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<tr>
<th>Methodology</th>
<th>Description</th>
<th>Consideration</th>
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<tr>
<td>Prospective chart review</td>
<td>Medication charts are reviewed to identify medication errors.</td>
<td>Captures prescribing errors predominantly. These errors include incorrect medication according to the British National Formulary, errors in the written prescription or incorrect medication for the specific clinical condition.</td>
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<td>Direct observation</td>
<td>Particular stages of the medication process are directly observed.</td>
<td>Usually captures administration of medication errors.</td>
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<tr>
<td>Error reports</td>
<td>Medication error reports are examined.</td>
<td>Only includes errors that have been noticed and reported. Errors are most likely to be severely under-represented using this method, which will capture errors mostly from the administration stage. Information about error depends on the detail of the report submitted.</td>
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cited as the main cause of errors despite limited evidence for this (Wright 2012a).

**Causes of medicine-related errors**

It is important to identify the cause of errors so that potential solutions can be implemented and medication error rates reduced. The cause of nursing errors identified in the literature is difficult to ascertain because of the different methodologies and definitions used when studying error. Some studies identify specific causes across the whole medication process such as wrong dose, which could be an error in prescribing or administering drugs (Fanikos et al 2007). Other studies examine the causes of error in more detail and give error rates for each stage of the administration process so that specific causes of medication administration errors can be examined (Han et al 2005, Kopp et al 2006).

The most common causes of medicine-related errors appear to be drug omissions (Barker et al 2002, NRLS 2009) and wrong time or rate of administration specifically in relation to IV fluids (Han et al 2005). Other errors include not labelling IV additives (Cousins et al 2005), not allowing diluents to dissolve before drawing up (Wirtz et al 2003), and medications and infusions given at a different time to that recommended (Taxis and Barber 2003). However, even when the cause of an error has been highlighted – for example, omission of medication – the cause itself does not give sufficient information about why the error occurred or what contributed to the error (Wright 2010). For example, it could be the result of a slip or mistake, being distracted or interrupted, the patient not being on the ward, the patient’s cannula not being patent or medication not being available.

Factors contributing to medication errors may include healthcare professionals and the wider context of the working environment. Table 2 lists examples of medication errors and causes from the author’s experience, as well as errors reported to the NRLS.

**Context of drug administration**

Medication administration is one component of medication management and is not carried out in isolation. Administration of medicines is affected by the environment in which this process occurs, the structures and systems in place to support the process, as well as the culture and expectations of those in the healthcare setting. For example, nurses will often speak to doctors to correct prescribing errors rather than complete error reports, nurses are interrupted frequently when administering medications on wards (Biron et al 2009), searching hospital wards for equipment to infuse drugs is common, and each department will have its own systems for ordering, storing and monitoring medications. Therefore, the systems and culture of individuals and an organisation can have a significant influence on whether a medication error is made, and whether it is noticed and reported. The need for a systems approach to investigate errors in health care is an area that has been highlighted and championed by the Clinical Human Factors Group (Patient Safety First 2010), and is essential to ensure patient safety.

**Medicines**

Medication administration has become much more complex in the past 40 years. The number of medications has increased; an estimated 1,000 medications were available worldwide in 1961 compared with an estimated 10,000 in 1996, some of which have similar sounding names (Leape 1996). The number is likely to be even higher today. Many medications are supplied by different drug companies and can have different brand names and packaging, adding to the complexity of medicines administration (Joshi et al 2007). This is especially problematic when different medications have similar looking or similar sounding generic or brand names (Joshi et al 2007). In addition, the routes for administering medications have also increased (Sheu et al 2009).

Medications can now be administered via peripherally inserted central catheters, Hickman, central and epidural catheters, patient-controlled analgesia devices, intramuscular or subcutaneous injections, percutaneous endoscopic gastrostomy tubes, dermal patches or the oral route. Medications are also now prescribed more often as continuous infusions that are administered using a range of different electronic infusion devices – all of which make prescribing and administering more complex and, therefore, more prone to error (Sheu et al 2009).

One of the difficulties that has emerged with the plethora of administration routes is that medications are being administered via the wrong route because the wrong catheter is being used – a difficulty highlighted in theatres where drugs were administered via an epidural catheter rather than intravenously. This has led to research on changing the infusion taps so that each catheter and route is easily identifiable (Bell 2007). This system change to prevent errors in wrong route administration has already been implemented in some secondary care trusts, where purple syringes that cannot be attached to a cannula are used.
for oral medications, to prevent oral medication being administered intravenously. The current complexities of prescribing and administering medications have increased the risk of errors in health care (Tang et al. 2007).

**Drug calculations**

While the administration of medication has become more complex because of the increasing number of drugs and routes available, the calculations relating to medicine doses have also changed.

Calculations for oral medications and bolus injections in adult nursing have become much easier. Drug manufacturers generally produce tablets and weight/volume strengths that coincide with the usual doses of the drugs for adults, making calculations straightforward. Medications that are prescribed as dose per weight of the patient are often calculated by the pharmacist and written on drug charts, reducing the need for nurses to do the calculation, although they still need to verify the dose before administering the drug. Many syringes are also prefilled with the usual dose.

### Table 2: Examples of medication errors, causes and solutions

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<th>Example incident</th>
<th>Root cause</th>
<th>Solution</th>
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<td>A newly qualified staff nurse on a hospital ward administered a medication to a patient via a Hickman catheter when it was prescribed to be administered subcutaneously. The patient required monitoring, but was not harmed.</td>
<td>The staff nurse was inexperienced at managing Hickman catheters. The patient was a haematology patient and was being cared for in a side room on a respiratory ward by nurses not experienced in this area of care. The patient required a large number of medications to be administered and the nurse was rushing, aware that she had 12 other patients to attend to on the ward. The nurse had drawn up the medications to be given intravenously in 10mL syringes and the medication to be given subcutaneously in a 5mL syringe with an orange needle to help differentiate. Stress at undertaking a new clinical task and the busy ward led to her administer all of the drugs intravenously.</td>
<td>A decision was made not to accept haematology patients on the respiratory ward.</td>
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<td>A care home resident was administered 50 units of Humulin M3 insulin instead of the prescribed 24 units. The patient required monitoring, but was unharmed.</td>
<td>The system in place in the healthcare setting for insulin prescriptions was to use a dark blue medication prescription chart for morning doses and a light blue chart for afternoon doses. The morning dose had been written on a light blue medication chart, but the PM had been amended to read AM. The nurse reported that she picked up the right colour chart out of habit, but did not check the time of the insulin prescribed, assuming it to be the afternoon dose.</td>
<td>One medication chart per resident is now used for insulin medications.</td>
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<td>A patient on a hospital ward was administered 100mg of Oramorph instead of the 30mg prescribed. The patient required monitoring, but was not harmed.</td>
<td>The usual stock dose strength of Oramorph available on the ward is 10mg/5mL. The pharmacy had sent Oramorph strength 100mg/5mL to the ward. Both nurses who checked dose strength of Oramorph thought it read 10mg/5mL. The incident happened at night.</td>
<td>The pharmacy was made aware that a different dose was sent to the ward. Nurses on the ward were made aware of the error. A new system was introduced; the nurse accepting controlled drugs on the ward used a yellow alert sticker on high-strength Oramorph solutions.</td>
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<td>A patient was administered 80 units of insulin instead of the prescribed 8 units. The patient required emergency treatment and recovered.</td>
<td>The prescription chart was unclear. The abbreviation ‘U’ was used for unit, which was misread as a 0.</td>
<td>The National Patient Safety Agency (2010) has issued guidance that abbreviations for units should not be used and that the word unit is written in full.</td>
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<tr>
<td>A child was administered a 240mg paracetamol suppository instead of the required 120mg. No harm came to the child.</td>
<td>The prescription dose for paracetamol is given according to the weight of the child. The child was weighed and the dose of 240mg correctly calculated. The weighing scales were later seen to have been tampered with and set to weigh in pounds. The scales are always set to weigh children on the unit in kilograms. The child’s weight was, therefore, assumed to be in kilograms when it was actually in pounds.</td>
<td>A clear label was added to the weighing scales so that everyone always returned the setting to kilograms.</td>
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In pediatrics, however, oral and weight/volume calculations are more complex. Drugs are often manufactured in adult doses so that portions of the ampoules have to be used and dose per weight calculations are much more common in pediatric nursing. In addition, pediatric care tends to involve small measurements of medications, often involving nanogram and microgram weights, therefore drug calculations can be more prone to error (Takata et al 2008).

**Continuous infusions**

Just as oral and weight/volume doses of medicines have become easier to calculate in adult nursing, the administration of medicines via other routes and the range of routes have become more complex. Continuous infusions of medications such as furosemide, heparin and insulin, for example, are common and can involve complex calculations to make up the drug into a solution, determine the concentration of the solution and ascertain the rate at which to set the infusion to ensure that the prescribed amount of the medication is administered. Nearly all continuous IV infusions in secondary care are administered by electronic infusion devices, which will vary depending on the type used in the hospital, which is another potential cause of error if nurses are working with unfamiliar equipment (Nuckols et al 2008).

The use of IV routes is more common than intramuscular or oral routes. For example, IV paracetamol and IV anti-emetics are given more commonly post-operatively. The variety of routes and doses for the same drug, as well as the complexities involved in prescribing and obtaining the correct concentrations and calculating rates for IV infusions, increase the potential for medicine-related errors.

**References**

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Skills and knowledge

The skills and knowledge required to administer medication safely in health care have changed, particularly in light of complexities involved in medicines management previously discussed. Studies have called for an increase in pharmacological education within nurse education (Morrison-Griffiths et al 2002, Ndosi and Newell 2008). The complexity of administering medications indicates that pharmacological knowledge is required to support the administration of drugs and clinical decision making involved in medicines management.

A whole system approach to medication management should be adopted, providing education on a range of skills, not just drug calculations. This has implications for the skills and knowledge taught to pre-registration nurses (Patient Safety First 2010, Wright 2012b) and is an area only touched on briefly in the Standards for Pre-registration Nursing Education (Nursing and Midwifery Council 2010).

Conclusion

Changes in medicines management, particularly relating to administration, suggest the need to consider not only the nurse’s role, but also a whole system approach, including the context and setting in which this task takes place. Nurses need to be aware of the constraints and external influences that could affect their ability to administer medicines. It is not helpful to blame individual nurses for medication errors. Instead, all factors, including those that involve processes and the organisation, should be considered in terms of how they could have contributed to the error. Only when the true cause of an error and all contributing factors have been considered, can effective solutions be put in place to reduce medicine-related error rates.


Nursing and Midwifery Council (2010) Standards for Pre-registration Nursing Education: NMC, London.


