The ten 'R's of safe multidisciplinary drug administration

Sharon Edwards and Sue Axe

Abstract

Nurses are responsible for medication administration, and, as with many other nursing interventions, some risk is involved. If an error occurs, a patient may suffer harm or injury, which may lead to a permanent disability or a fatality. To ensure safe drug administration, nurses are encouraged to follow the five rights ('R's; patient, drug, route, time and dose) of medication administration to prevent errors in administration. The five 'R's do not consider all causes of drug errors; instead, they focus on medication administration at the bedside so they relate only to this stage of a drug prescription. A drug's journey is more than what happens at the bedside; therefore, the reduction of errors requires more than just the five 'R's. This article proposes a multi-professional, evidence-based approach to medicines management, which all clinicians can work towards, together. Clinicians can achieve this approach by considering the National Patients Safety Agency's definition of a medication error and the values set out by the National Prescribing Centre. The approach utilizes 10 'R's, which provide a benchmark for good practice. The 10 'Rs' advocate the need for the knowledge of the causes of drug errors, how to implement strategies to reduce drug errors, how to ensure safe practice throughout the medication journey, from chemical preparation, to monitoring outcomes, to response.

Key words: Drug errors; Safe practice; Medication administration

It is important for nurses to understand the complexity of medicines management. Providing a patient with appropriate medication influences adherence, concordance, control of symptoms and further management. Nurses are at the forefront of medication interventions and care; therefore, they need to understand not only the issues related to the administration of a drug, incorporating the five rights ('R's), but also be aware of the full medication journey. A drug error can occur at any point along the medication trajectory, which involves a variety of health professionals, such as doctors, pharmacists and allied health professionals, and not just nurses administering drugs at the bedside.

Sharon Edwards, senior lecturer in nursing, Buckinghamshire New University

Sue Axe, senior lecturer in nurse prescribing, Buckinghamshire New University

sharon.edwards@bucks.ac.uk

The National Patient Safety Agency (NPSA) was set up to monitor drug errors and relates to all health professionals involved in medications management. The competencies of the National Prescribing Centre's framework (NPC, 2012) are relevant to all medical and non-medical prescribers.

Nurses administering drugs at the bedside should continue to use and incorporate the five 'R's approach to safe drug administration; however, nurses and other health professionals need to consider their roles in medication management more broadly, and this paper recommends a ten 'R's method, which can be utilized by all health professionals involved in drug administration, to aid safe practice.

Medicine errors

Medication administration is not without problems. Medication is given with good intention, but drugs are poisonous to the body and can be dangerous if mistakes are made. The NPSA (2007) reports that 1 in 10 patients experience medication-related errors. A medicine error can be defined as (NPSA, 2007: 6).

'An error in the process of prescribing, dispensing, preparing, administering, monitoring or providing medicine advice, regardless of whether harm has occurred or was possible'

The NPSA (2007) report that 71% of fatal and serious harm from medication incidents are due to:

- Unclear prescriptions
- The wrong dose being written
- The wrong frequency being prescribed
- The drug being omitted
- The medicine being delayed.

Over half of all drug errors relate to dosage, strength, frequency or a failure to administer; therefore, 'omission or failure to administer a drug, which could compromise patient safety, unless appropriate' should be added to the above quote. Other drug errors include the wrong quantity being prescribed, the drug being intended for another patient, poor labelling and storage, and out-of-date drugs.

Reason (1990) devised the Swiss chees model, which likens the occurrence of drug errors to a stack of Swiss cheese slices. The holes in the slices of Swiss cheese represent a minor error. The holes may allow a problem to pass through to the next layer, but it can be stopped as the holes in the next layer of

cheese are in different places. Therefore, the more minor errors there are, the greater the likelihood of a major error getting through. Each layer, therefore, is a defence against an error becoming realised and affecting the outcome. In relation to the journey from prescribing to administration, this model explains how errors occur if each stage is allowed to progress without appropriate defences being put in place.

Most medication errors go unreported (Nursing and Midwifery Council (NMC), 2007). According to NPSA (2007), the most serious medication incidents reported are caused by errors in administration (41%) and to a lesser extent, prescribing (32%). Fortunately, the majority of medication incidents reported have clinical outcomes of no or low harm.

Two groups of patients are particularly vulnerable to medication errors (Barber, 2013): children, who are three times more likely than the average adult to be subject to a medication error (owing mainly to the complex calculations required), and patients with known allergies.

Causes of drug errors

The five 'Rs' (*Table 1*) were put into place in an attempt to reduce drug errors (Barber, 2013). Other rights include the right reason and documentation (Elliott and Liu, 2010). Elliott and Liu (2010) argue that the quality of drug administration or occurrence of a medication error are not solely a matter of adhering to the five 'R's. Jones (2009) states that the use of checklists such as the five 'R's does not fully address the issues related to the causes of medication errors. Choo et al (2010) argues that these rights fail to reflect human, system and environmental factors—the key causes of drug errors.

Environment

The literature suggests that many medication errors are related to human error and environmental factors, since drug administration often takes place in noisy environments with poor lighting (Jones, 2009) (*Table 2*). Fry and Dacey (2007) suggest that to reduce human and environmental error, such as distractions, protected time during medication administration could be introduced. This includes the use of a bright tabard (Hitchen, 2008) or the use of a visual reminder such as a 'do not disturb' message (Pape et al, 2005), whereby patients and staff are discouraged from disturbing a nurse who is administering medications. However, the effectiveness of this intervention in reducing human factor errors has not been thoroughly researched.

The quality of team communication has been linked to improvements in patient outcomes (Institute of Healthcare Communication, 2011). Therefore, conceivably, any links to a reduction in medication errors, owing the use of a tabard or reminders, is more likely to occur because of an improvement in team communication, as all team members are aware a drug round is being performed, thus reducing distractions.

Attempts to reduce medication errors owing to faulty system factors have included the introduction of information technologies, such as computerized physician order entry, bar-coding of drugs, and automated dispensing devices (Bates, 2000). Fowler et al (2009) suggest that technology can improve patient safety, but further study is required to determine the impact of these technologies on the reduction of medication errors (Durham, 2015).

Culture

Information regarding the prevention and reduction of medicine errors is widely available (Bates, 2007). There is a need to immediately report all near-misses and medication errors, regardless of whether a patient has been harmed, to ensure a learning experience (Armitage, 2008). However, according to the Agency for Healthcare Research and Quality (2014), the consequences for nurses who report medication errors (such as suspension from work, disciplinary action, or being reported to the NMC for misconduct) can be an issue.

Performance

Nurses can further reduce human factors in medication errors (leading to morbidity and mortality in hospitalized patients) by keeping their skills up to date (Sneck et al, 2015). Regular or annual updates for nurses verify that they are competent in medication administration and have theoretical knowledge and drug calculation skills. The implementation of these updates allow policies and procedures to represent nurses as autonomous

Table 1. The five 'R's of safe drug administration

Number	R	Information
1	Right patient	Ensure medications are administered to the correct patient by checking the wristband
2	Right drug	The prescription of a drug should be clear and legible. The generic name, and not the trade name, should be used (unless appropriate). Highlight any antiobiotics allergies on the wristband as well as on the drug chart
3	Right dosage	Check the name of the drug against the dosage of the medication to be administered
4	Right time	A drug needs to be administered at the appropriate time(s) for effective outcomes (antibiotics, for example)
5	Right route	Some drugs cannot be administered by the oral route (GTN or insulin, for example). Others have to be administered IV for 100% bioavailability

GTN: glyceryl trinitrate; IV: intravenous

Table 2. Causes of medication errors

Human errors	Faulty system errors	Environmental errors
Poor calculation or competence, or lack of confidence	Unclear error reporting processes, which provide no clear definitions of medication errors and near-miss events	Distractions from other nurses or patients (which can be hard to ignore)
Poor adherence to prescription/ administration protocols	Limited or no easily accessible resources, such as electronic databases, to research unfamiliar drugs	Lack of awareness of when and where an error can occur
Poor knowledge of medications	Lack of staff, poor management or leadership, or lack of funds	Poor lighting on night shifts
Complacency, misconceptions or incorrect interpretations	Ambiguous protocols, policies and procedure guidelines for prescribing and drug administration	Busy ward
Misinterpretation of packaging information ('not for oral use', for example)	Drug companies' packaging not clearly marked or labelled	Noisy environments
Fatigue, inexperience or poor communication	Lack of training and no regular updates or courses provided	Time pressures
Medical professionals' poor handwriting or unclear prescriptions	Poor teamwork	Increase in nurses' workload

knowledgeable practitioners, who are able to use their own clinical judgement without the fear of being accused of or causing a drug error.

However, combining the 5 'Rs' with an understanding of the causes of drug errors (owing to factors in the environment, culture and performance) enables the five 'Rs' to be implemented correctly. In addition, by ensuring all multi-disciplinary teams involved in medication management are aware of combining the five 'Rs' with the knowledge of the causes of drug errors can further enhance the effectiveness of using the five 'R's approach in error prevention.

This article introduces five new 'R's to consider, which incorporate an integrated multi-disciplinary approach, supported by evidence.

Multi-disciplinary, team, and evidence-based approach

In today's complex health-care system, in which patients can access a number of health professionals, there is a need for a streamlined approach. This idea has been recognized by the National Prescribing Centre (NPC, 2012), which has developed a single competency framework for all prescribers—its ethos is that all health professionals are involved in drug administration.

The NPC framework makes it clear that the administration of drugs and the occurrence of medication errors is not the sole responsibility of nurses at the bedside; it is a team effort, in which all members work together to ensure safe practice. Reduction in medication errors is the responsibility of all those involved in the preparation of medicines the prescribing journey, from drug companies, packaging designers, doctors, pharmacists, nurses, paramedics, the patient, and policy and procedure makers (*Table 3*).

The competence framework (NPC, 2012) considers nine areas of competence, including participation in the review, the development of prescribing to optimize patient outcomes, reporting prescribing errors and near-misses, and acting upon colleagues' inappropriate prescribing using appropriate mechanisms. Yet, Durham (2015) highlights that nurses may not be aware of a near-miss event or what constitutes a medication error, implying that Sneck et al's (2015) proposal of regular medication updates may be attractive.

There is general agreement for strategies to be put in place to reduce medication errors, and these are generally specific to each professional group involved in medication management. There is a need for a multi-disciplinary approach as advocated by the NPC's (2012) prescribing competencies for clinicians. This requires an inclusive process that can be utilized by all health professionals involved in the process of drug administration, providing opportunity for reasoning and autonomy. In addition to the five 'R's, which nurses at the bedside and other health professionals can use to safely manage a drug(s) episode, five additional 'Rs' are proposed. The ten 'R's approach embraces a broader, holistic, integrative multi-disciplinary view and encompasses the NPC's guidelines.

Modifying practice: enhancing safety, reducing drug errors

The occurence of a drug error may not relate solely to human, system or environmental error, but a combination of them all. To ensure a multi-

Table 3. A medication error can occur from preparation to outcome

Stage in the drug's journey	Responsibility	Relationship to the five 'R's
Chemical preparation and drug naming	Drug companies	Drug
Packaging	Packaging companies and drug label designers	Drug, route
Prescribing and transcribing	Doctor, nurse prescriber or the nurse checking drugs	Drug, patient, time, route, dosage
Preparing (in the ward and community)	Formulation prepared by pharmacist—liquid form, tablet form or IV	Drug, dosage, route, patient
Dispensing	Pharmacist from pharmacy to ward or community setting	Drug, dosage, route, patient
Omission, failure to administer, or increase or decrease in period of time between drugs	Refusal to administer drug by health professional, or refusal to take the drug by the patient	Drug, dosage, route, patient
Administration	Nurse, doctor or non-medical professional	Drug, patient, route, dosage
Providing medication advice	Nurse, doctor or non-medical professional	Not applicable
Monitoring, outcome and response	Nurse, doctor, pharmacist or paramedic	Not applicable

IV: intravenous

professional, evidence-based and streamlined approach to reducing errors, five more rights ('R's) are put forward:

- The right to refuse (patient and nurse, including autonomy)
- Knowledge and understanding
- Right questions (including reason)
- Right response (including documentation)
- Right advice.

6. The right to refuse (patient and administrator)

The current five 'R's fail to consider the intricacies associated with administering medications in more complex settings; for example, when a patient refuses to take a prescribed medication. The patient may have a difficulty in taking the medicine (such as trouble with swallowing) or they may not perceive the need for the medication. A sixth right is implied: the right of the patient to refuse a drug.

The right to refuse can also incorporate the right of a nurse to refuse to administer a prescribed drug, as nurses should not thoughtlessly obey 'orders'. If the prescription has been incorrectly written, the prescription is ambiguous, or the nurse doubts the legitimacy of the prescription, the nurse has a right not to give or administer the drug to the patient.

However, problems can arise here—if a nurse omits or fails to administer a drug or does not give it at the correct time, these incidences can constitute a medication error, and the nurse is placed in a difficult position. If nurses refuse to administer a drug on the grounds that the prescription is inappropriately written, or if an inappropriate preparation is to be given, this may also constitute a drug error.

According to the NMC (2015), medicine administration should be evidence-based, so nurses can refuse or omit a drug, referring to sound evidence-based practice, yet can still be accused of a drug error. For example, the refusal of potassium supplements on the grounds that the patient's potassium level is too high (by checking daily blood results) or the refusal of digoxin, as the apex and redial pulses were below 60 beats per minute. These issues question the policies and procedures, which may fail to represent the nurses as autonomous and knowledgeable practitioners, who are able to use their own clinical judgement in such situations without the fear of being accused of a drug error. With the increase in independent prescribing by disciplines other than in the medical profession, nurses may find themselves administering drugs prescribed by non-medical prescribers (pharmacists, physiotherapists and other nurses, for example), which may add to the complex nature of patient management and the right to refuse.

7. Right knowledge and understanding

The seventh 'R' regards in-depth knowledge and understanding of (*Table 4*):

- The naming of a drug
- How the body affects the drug (pharmacokinetics)
- How the drug affects the body (pharmacodynamics)
- Side-effects of drugs

Table 4. Knowledge and understanding of pharmacology required for safe drug administration

Principles	Knowledge	Understanding
Nomenclature classification of drugs	■ Therapeutic use ■ Mode of action ■ Molecular structure	■ To cure, suppress or prevent disease ■ How a drug exerts its effect on the body ■ Knowledge of molecular structure and the drug's similarity to other drugs, which usually have similar action
Naming of drugs	■ Chemical name ■ A generic name ■ A trade name	■ Chemical names are sometimes used (glycerin trinitrate, for example) ■ Generic names are decided when a drug can be used (for NHS prescribing) [AQ: This is a little unclear. Please explain this] ■ Given by the company
Pharmaceutics	■ Preparation of a drug into convenient form for administration, and the formulation of drugs ■ Drugs are administered by mouth via the gut or parenteral (all other routes)	The aims of administration of a drug are to: ■ Establish optimal concentration at the target site ■ Maintain optimal concentration for the required period of time ■ Minimize adverse drug reactions owing to general distribution
Pharmacokinetics	■ What the body does to the drug ■ The passage of a drug through the body	*Absorption*—the method of administration, how the drug gets across a cell membrane, before entering the systemic circulation *Distribution*—the drug then has to travel through the body from site of insertion to site of action *Metabolism*—the drug arrives at its destination and has to be metabolized: ■ This occurs in the liver, where the drug is transformed into substances that are easier to excrete ■ The first-pass metabolism process inactivates some drugs, which are absorbed in the gastrointestinal tract and directly pass into the blood stream, to the liver *Excretion*—occurs by the kidneys via urine: ■ When a patient has some form of renal impairment drug dosage needs to be reduced ■ In some instances, frequent blood samples may be required (for digoxin and gentamicin, for example) ■ Excretion can also occur in the faeces, lungs and skin
Pharmacodynamics	■ What the drug does to the body, including both therapeutic and adverse side-effects of the drug ■ Many drugs cause their effects by combining with receptors, and each responds to a different chemical or hormone	*Agonist drugs*, which interact with a receptor mimicking the effect of a natural mediator *Partial agonist drugs*, whose maximal response falls short of the full response *Antagonists* block the effect of the natural mediator at a receptor to prevent an effect *Selective*, but not specific, drugs (which act on more than one receptor and produce side-effects, which lead to dry mouth, blurred vision, constipation and drowsiness) *Inhibiting* enzymes in the body
Adverse effects and drug toxicity	■ No drug is 100% safe ■ All drugs have side-effects and these are usually predictable and dose-related	Drug toxicity can occur, and the drug may be allowed to build up in the system. Other drugs the patient may be taking have to be taken into account (polypharmacy). Drugs are more toxic in: ■ The very elderly and the very young ■ Patients with underlying pathologies

Table 4. Continued

Principles	Knowledge	Understanding
Poisoning and overdose can be intentional, accidental, iatrogenic or through criminal intent	Specific antidotes are available for few poisons or drugs. The general principles of a drug overdose are: ■ Diagnosis (timing, limiting the period for ingestion of the drug) ■ Assessment (ABCDE, investigations and drug levels) ■ Resuscitation and drug manipulation	Drug manipulation attempts to: ■ Decrease absorption of the drug by administering an emetic, giving a gastric lavage, an absorbent (such as activated charcoal), or a cathartic (such as magnesium citrate or magnesium sulphate) ■ Increase excretion by forced diuresis (diuretics), producing an alkalosis through hyperventilation, or administration of sodium bicarbonate, or commencing haemodialysis ■ Administration of the specific overdose antidote for paracetamol (Parvolex), narcotic (naloxone, also known as Narcan), heparin (protamine sulphate) and warfarin (vitamin K)
Drug interactions	This is when two or more drugs are given at the same time and exert their effects independently or may interact with one another. A drug's action may be: ■ Suppressed ■ Rendered completely inactive ■ Increased ■ An antagonism of one drug by another ■ Some other effect Combinations of drugs need to be carefully considered to avoid drug interactions	All interactions need to be reported and are due to pharmacokinetic or pharmacodynamics interactions Pharmacokinetic interactions can affect drug absorption leading to ineffective therapy through: ■ An antagonism for one drug by another or the affect of the metabolism of another; for example, in the liver, leading to an increased risk of toxicity or affecting renal excretion ■ There can be competition for excretion in renal tubules leading to delay in excretion with the possible risk of toxicity Pharmacodynamic interactions through: ■ Competition of drugs at receptor sites ■ Changes in protein binding, which increases the free drug in plasma and so increasing the action of the drug on the body ■ There can also be interaction between drugs acting on the same physiological system (diuretics, for example)

ABCDE: airway, breathing, circulation, disability and exposure

■ Drug toxicity
■ Interactions
■ Poisoning.

This knowledge should include how to prepare and store medicines in line with local policy and knowledge of appropriate monitoring before medicines are administered (blood tests to check for drug levels and kidney function, for example).

Additionally, a large number of health-care assistants (HCAs) are employed in today's health-care system, and some can administer medicines; HCAs should have the same level of knowledge and understanding as other health professionals, such as how the medicine works, interactions with other medicines and potential side-effects. Qualified nurses and prescribers (whether they are nurses, doctors, pharmacists or allied health professionals) have a duty to ensure the staff delegated to administer medicines have sufficient knowledge to undertake the task safely.

8. Right questions being asked

The eighth 'R' involves considering whether the drug is appropriate in relation to the condition being treated, but also for the patient. For example, has the correct prescription, with clear unambiguous instructions, been written up? Dosing schedules, formulation and the exact nature of the condition being treated ('is the drug being given for the right reason(s)?') should also be considered. Concordance can be improved by considering the frequency of dosing and specific timings of drug administration. For example, a slow-release preparation may be given less frequently and may also cause fewer side-effects. Is the formulation the most appropriate for the patient? The very young and elderly may require liquid preparations for ease of swallowing, as crushing of drugs should not be the norm. Is the drug being used appropriately or is it to treat a side-effect of a medication the patient is already taking that could be dealt with by considering another group of drugs?

Table 5. The ten 'R's for safe multidisciplinary drug administration

To reduce distractions, consider protected time, the use of a bright tabard or the use of a visual reminder (such as 'do not disturb'), communicating to others that you are not to be interrupted			Before administration
The ten 'R's		**Consider the following:**	
1	Right patient	■ Has this patient been prescribed the drug? ■ Has the patient's name band been checked? Is there a clear patient identifier? ■ Does the patient know they are receiving the drug and why?	Before administration
2	Right drug	■ Do you know where to obtain the drug? Are all drugs in one location and are they clearly labelled? ■ Is this the drug that has been prescribed? Is there a drug with a similar name? ■ If appropriate, has the drug been checked by another nurse or health professional?	During preparation
3	Right dosage	■ Is the dose appropriate or usual for the drug being prescribed? ■ If appropriate, has the dose or calculation been checked by another nurse or health professional?	
4	Right time	■ Has the time gap between each drug administration been adequate, sufficient, too short or too long?	
5	Right route	■ Is the route appropriate for the drug being prescribed?	
6	Right to refuse (patient and nurse)	■ Are you able to exercise your clinical judgement and refuse to give or omit the drug? Do you have a rationale for this and are you able to demonstrate or explain this to others? ■ Do you know what action to take if the patient refuses the prescribed medication? ■ Can you identify the barriers to medication administration and identify suitable approaches to address them (dysphagia or confusion, for example)?	Immediately before administration
7	Right knowledge	■ Do you know what monitoring is required prior to administration? ■ Do you know how to prepare and administer the medication in line with local policies? ■ Do you know the preferences of the patient? ■ Do you understand the pharmacokinetics, pharmacodynamics, action, possible interactions, side-effects, expected positive outcome(s), and/or the possible occurrence of adverse effects (toxicity), or overdose of the drug(s) you are administering? ■ Do you understand the law related to the particular drug(s)?	
8	Right questions or challenges	■ Is this the right prescription, appropriate drug(s) for the patient's condition(s)? Is the prescription written correctly and clearly, with clear unambiguous instructions? ■ Can the writing be easily read? ■ Can you communicate with other professionals if needed? ■ Is there access to available resources (drug formularies and/or product information leaflets)?	
9	Right advice	■ Does the patient know about the drug? If not, can you give the patient advice/details/information about this/these medication(s)?	After administration
10	Right response or outcome	■ Do you know the expected response/outcomes of the drug? ■ Do you know how to observe/check for allergic reactions, drug interaction(s), side-effects and call for assistance? ■ Do you know how and when to complete records of administration in line with local policy and document any changes?	

Owing to the aging population, many patients find themselves on multiple drugs, which may expose them to adverse effects from interactions. Polypharmacy can be appropriate (when a patient is being treated for more than one long-term condition, for example), but it may be inappropriate if a patient is taking medicines to treat the side-effects of other medications, or several drugs with similar actions. The potential for drug interactions is 6% when taking two different drugs, 50% when taking five different drugs and 100% when taking eight or more drugs (Crouch and Chapelhow, 2008).

A further consideration is that the patient may see many different clinicians, whom consider the patient in relation to a specific condition. The person administering the medication may identify duplicate medications or potential interactions. This may occur particularly at the interface between secondary and primary care when a patient is discharged home with an altered medication regimen that is not immediately implemented. Pharmacists, doctors, and, increasingly, non-medical prescribers, are all in a position to undertake medication reviews to identify potential errors and to stop medicines when they are no longer required.

Another area of challenge is in intravenous (IV) drug administration, and gauging when to stop IV and commence oral administration in response to the level of seriousness of the patient's condition. If the route (IV, for example) is no longer appropriate, the nurse has the right to refuse to administer the drug and request that the drug be changed to the oral formation of the same drug. Health professionals should not be afraid to question other members of staff and prescribers, however senior, if they suspect that a medicine is not appropriate for a patient.

9. Right advice

The ninth 'R' suggests that all health professionals who prescribe or administer a drug should be able to provide advice about its actions, indications, side-effects, the importance of taking the drug at the correct time and the expected outcome of the drug(s). A patient should be informed by the nurse, and should understand the medication and side-effects. The nurse can also work towards obtaining insight into patient preferences and their health beliefs in relation to taking their medication.

Berry et al (2006) identify five top information-giving priorities in nurse prescribing:

- Possible side-effects
- What the medicine does
- How it works
- Probability of the medicine's effectiveness
- The risks of not taking the medicine
- How medicines will interact with each other.

This paper proposes that all health professionals have a responsibility to communicate these essential pieces of information to contribute to the therapeutic relationship between the clinician and patient, and to improve medication adherence.

10. Right response

The tenth 'R' relates to the review of the patient. Is the outcome as expected? For example, has a course of antibiotics resolved or is it resolving the infection? The right response is also concerned with providing monitoring of the drug to establish the continuing effect of the drug (reduced blood pressure and heart rate, and improved air entry and lung sounds, for example). Importantly, this 'R' is also concerned with the safety of using the drug in the individual patient. Has any harm come to the patient (allergy, adverse effect, drug interaction, or side-effects, for example)?

The right response, again, is the responsibility of all health professionals involved with medicines management. This includes the documentation of medicines prescribed and administered, a review of the patient and their response to the medicine. All should form an integral part of the written record to provide continuity of care across the team caring for the patient. In addition, the right response is about recording and notifying relevant parties about adverse drug reactions or interactions, so that documentation can be updated in relation to allergy status if appropriate.

In relation to public health, it is also necessary to inform the Medicines and Healthcare products Regulatory Agency (MHRA) of significant adverse affects to drugs through the Yellow Card system (Joint Formulary Committee, 2015). Finally, the right response is concerned with 'safety netting'—nurses, doctors and other prescribing and non-prescribing professionals should explain to a patient what they should do if progress is not as expected with their medicines and what action they should take. This information should also be recorded in the patient's notes.

Discussion

The standardized five 'R's, advocated by the NMC (2006; 2007), are adequate for nurses to incorporate into their care at the bedside to facilitate safe administration of medication. However, the NPC framework (2012) makes it clear that the responsibility for managing the environment in which drug administration takes place, and reducing the possibility of drug errors, is a multi-disciplinary concern. Therefore, there is a requirement for all health professionals to employ a broader, holistic understanding of medication management, as no single health professional group is responsible for all drug errors.

A drug error can occur at any stage of the drug's journey from preparation and prescription to outcome (*Table 3*). Elliott and Liu (2010) suggest that only a small proportion (between 26 and 38%) of errors are nursing-related. Therefore, a majority (between 62 and 74%) of medication errors are due to other factors.

All doctors, and prescribing and non-prescribing professionals including nurses, must aim to provide safe medication administration, which is based on evidence of the purpose of the prescribed drug(s), what the body does to the drug and the action of the drug on the body. The NMC (2015) advises on nurses should only prescribe, advise about or provide treatment or medicines if they have enough knowledge about the person's health and are sure that the treatment or medicine serves the person's health needs. In addition, a nurse must

make sure that the advice given takes into account other care the person is receiving; thus, drug administration is a holistic episode of care.

This paper takes a multi-professional approach to drug administration and the prevention of drug errors, and recommends the 10 'Rs' as a benchmark to multi-professional safe drug administration (*Table 5*). It includes considerations to follow before the drug round, during preparation, immediately before administration and afterwards. These considerations are flexible and encompass the need to include professionals' thinking during medication administration.

Lawton and Parker (1999), and Eisenhauer et al (2007), recognized that administering drugs extends beyond protocols, policies or checklists, which are considered not to be useful, as they restrict the professional's ability to make autonomous decisions. The inclusion of discretion in medication administration, as in the 10 'R's approach, values the complex thought processes required, which can be beneficial to prescribing and non-prescribing professionals and patients, to ensure safe practice is maintained.

Visual reminders have been used as a means to guide medication administration (Pape et al, 2005). Hospitals, community health care, GPs, ambulance services, and pharmacies can display the ten 'R's as a benchmark to good practice of safe drug administration' (*Table 5*) as a prompt, to encourage compliance with the 'R's and improve the safety of medication administration.

Conclusion

Part of the nurse's role is the administering of drugs, which should be carried out in compliance with the five 'R's. It is increasingly common for experienced, suitably qualified nurses and allied health professionals to prescribe drugs too, but the journey from chemical preparation to prescribing, to administering, to determining outcome is complex, fraught with dangers, and a drug error could be due to more than just the wrong drug being prescribed or the wrong dose being calculated. Understanding of nomenclature, pharmaceutics, pharmacokinetics, pharmacodynamics, therapeutics are essential for all involved. Thus, no health professional should administer a drug if they do not know what it is for, are not able to explain it to the patient, do not understand the outcome of its administration or are unable to notice the side-effects. Drug administration is not a simple task; it demands clinical judgement before and during preparation, immediately before administration and afterwards.

This paper puts forward a proposal to merge the five 'R's with the knowledge of the causes of drug errors, to broaden perspectives to the idea of medication management as a muli-professional, evidence-based endeavour. This involves merging the understanding of the causes of errors, and the strategies to reduce them accumulated so far, with the original five 'R's, with consideration to a further five 'R's, to give a ten 'R's approach. The ten 'R's can serve all disciplines involved in medication episodes and provide a benchmark for good practice that is based on sound knowledge and evidence.

Agency for Healthcare Research and Quality (2014) Hospital survey on patient safety culture: 2014 user comparative database report. www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/hospital/2014/ (accessed 14 July 2015)

Armitage G (2008) How do we reduce drug errors? *Nursing Times* www.nursingtimes.net/how-do-we-reduce-drug-errors/524579.article (accessed 14 July 2015)

Barber P, ed (2013) *Medicine Management for Nurses: Case Book.* McGraw-Hill Education, Maidenhead

Bates D (2007) Preventing medication errors: A summary. *Am J Health Syst Pharm* **64**(14 Suppl 9): S3–9

Bates DW (2000) Using information technology to reduce rates of medication errors in hospitals. *BMJ* **320**(7237): 788–91

Berry D, Courtenay M, Bersellini E (2006) Attitudes towards, and information needs in relation to supplementary nurse prescribing in the UK: *J Clin Nurs* **15**(1): 22–8

Joint Formulary Committee (2015) *British National Formulary* (online). London: BMJ Group and Pharmacuetical Press. http://tinyurl.com/ou27t5p (accessed 14 July 2015)

Choo J, Hutchinson A, Bucknall T (2010) Nurses' role in medication safety. *J Nurs Manage* **18**(7): 853-861. doi: 10.1111/j.1365-2834.2010.01164.x

Crouch S, Chapplehow C (2008) *Medicines Management: A Nursing Perspective.* Pearson Education, Harlow

Eisenhauer LA, Hurley AC, Dolan N (2007) Nurses' reported thinking during medication administration. J Nurs Scholarsh **39**(1): 82–7. doi: 10.1111/j.1547-5069.2007.00148.x

Elliott M, Liu Y (2010) The nine rights of medication administration: An overview. *Br J Nurs* **19**(5): 300–5

Durham B (2015) The nurse's role in medication safety. *Nursing* **45**(4): 1–4

Fowler SB, Sohler P, Zarillo DF (2009) Bar-code technology for medication administration: Medication errors and nurse satisfaction. *Medsurg Nurs* **18**(2): 103–9

Fry MM, Dacey C (2007) Factors contributing to incidents in medicine administration: Part 2. *Br J Nurs* **16**(11): 676–81

Hitchen L (2008) Frequent interruptions linked to drug errors. *BMJ* **336**(7654): 1155. doi: 10.1136/bmj.39584.477951.DB

Institute for Healthcare Communication (2011) Impact of communication in healthcare. http://healthcarecomm.org/about-us/impact-of-communication-in-healthcare (accessed 14 July 2015)

Jones SW (2009) Reducing medication administration errors in nursing practice. *Nurs Stand* **23**(50): 40–6

Lawton R, Parker D (1999) Procedures and the professional: The case of the British NHS. *Soc Sci Med* **48**(3): 353–61

National Patients Safety Agency (2007) Safety in doses: Medication safety incidents in the NHS. www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=61392 (accessed 14 July 2015)

National Prescribing Centre (2012) A single competency framework for all prescribers. http://tinyurl.com/o3a2ta8 (accessed 14 July 2015)

Nursing and Midwifery Council (2006) Standards of proficiency for nurse and midwife prescribers. http://bit.ly/1PAs49y (accessed 14 July 2015)

Nursing and Midwifery Council (2007) Standards for medicines management. www.nmc.org.uk/globalassets/siteDocuments/NMC-Publications/NMC-Standards-for-medicines-management.pdf (accessed 14 July 2015)

Nursing and Midwifery Council (2015) The Code: Professional standards of practice and behaviour for nurses and midwives. www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/revised-new-nmc-code.pdf (accessed 14 July 2015)

Pape TM, Guerra DM, Muzquiz M (2005) Innovative approaches to reducing nurses' distractions during medication administration. *J Contin Educ Nurs* **36**(3): 108–16

Reason J (1990) *Human error.* Cambridge University Press, Cambridge

Sneck S, Isola A, Saarnio R (2015) Nurses' perception of verification of medication competence. *Journal of Nursing Education and Practice* **5**(6): 114–22. doi: 10.5430/jnep.v5n6p114