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Reducing medication errors in nursing practice

NS776 Cloete L (2015) Reducing medication errors in nursing practice.

Nursing Standard. 29, 20, 50-59. Date of submission: August 19 2014; date of acceptance: October 13 2014.

Abstract

Medication errors remain one of the most common causes of unintended harm to patients. They contribute to adverse events that compromise patient safety and result in a large financial burden to the health service. The prevention of medication errors, which can happen at every stage of the medication preparation and distribution process, is essential to maintain a safe healthcare system. One third of the errors that harm patients occur during the nurse administration phase: administering medication to patients is therefore a high-risk activity. This article highlights factors that contribute to medication errors, including the safety culture of institutions. It also discusses factors that relate specifically to nurses, such as patient acuity and nursing workload, the distractions and interruptions that can occur during medication administration, the complexity of some medication calculations and administration methods, and the failure of nurses to adhere to policies or guidelines.

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Keywords

Drug calculations, medication errors, nursing systems, patient safety

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Aims and intended learning outcomes

This article provides insight into factors that contribute to medication administration errors and that can result in poor patient safety outcomes. After reading this article and completing the time out activities you should be able to:

- ▶ List potential risks that contribute to medication errors.
- ▶ Explain how a number of unrelated risks, when allowed to coexist, may result in adverse events in the delivery of health care.
- ▶ Discuss ways to limit risks of medication errors in your practice team.
- ▶ Reflect on contributions that could be made towards the development of a safe reporting environment for fostering the growth of knowledge and achieving strategies that minimise the potential for medication errors.
- ▶ Create a list of resources that promote active involvement in the prevention of medication errors and contribute to safe practice.

Introduction

Medication errors remain one of the most common causes of harm to patients (Roughhead *et al* 2013). A medication error is defined as a preventable event related to medication which results in 'a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient' (Ferner and Aronson 2006). The medication treatment process includes all aspects of medication handling (Aronson 2009, National Coordinating Council for Medication Error Reporting and Prevention 2014).

A review of medication error incidents reported between 2005 and 2010 to the National Reporting and Learning Service indicated that 526,186 such incidents had occurred in England and Wales over this period (Cousins *et al* 2012) (Table 1). A total of 86,821 (16%) of these incidents caused actual patient harm, of which 822 (0.95%) resulted in death or severe harm (Cousins *et al* 2012). The cost to the NHS of hospital admissions related to medication errors in 2007 was £770 million and between 1995 and 2007 £5 million was spent on litigation costs (Frontier Economics 2014). In the UK, one third of medication errors occurring in general medical practices related to prescribing errors. Many of these were the result of poor communication, particularly with regard to the prescription of antibiotics to which patients are known to be allergic (National Patient Safety Agency (NPSA) 2007).

Medication errors contribute to adverse events that compromise patient safety and place a large financial burden on health systems (Roughead *et al* 2013). In addition to the financial costs, individual patients and their significant others are affected physically, emotionally and psychologically when errors occur (Deans 2005). Therefore,

the prevention of medication errors is essential to maintaining a safe healthcare system (Roughead *et al* 2013).

Medication processes are complex in nature, involving multiple interactions, and are high-risk activities (Nursing and Midwifery Council (NMC) 2010). Although errors occur at every stage of the medication preparation and distribution process (Aspden *et al* 2006, McBride-Henry and Foureur 2006, Maricle *et al* 2007, Biron *et al* 2009), one third of those that harm patients are attributed to the administration phase (Leape *et al* 1995). Most medication administrators are nurses and, therefore, when errors occur, nurses are often deemed accountable (Burke 2005). Medication administrators can provide a safeguard against errors made at any of the previous stages, however, and are thought to intercept around 86% of errors made by prescribers or pharmacists (Leape *et al* 1995). Therefore, nurses provide a safety defence against medication errors but, at the same time, have the potential to place patients at risk (Pape *et al* 2005).

This article discusses types of medication errors and the contributing factors that occur in clinical practice. It then concentrates on specific problems that nurses can encounter in the administration process.

TABLE 1

Patient safety incident and medication incident reports (2005-2010)*

Healthcare sector	Total number of incident reports	Number of medication incident reports	Medication incidents as a percentage of total incident reports
Acute/general hospital	3,921,212	394,951	10.07
Mental health service	754,812	48,951	6.49
Community nursing, medical and therapy service, including community hospital	542,323	48,594	8.96
Learning disabilities service	155,914	8,154	5.23
General practice	22,587	5,358	23.72
Community pharmacy	19,696	19,245	97.71
Ambulance service	18,415	712	3.87
Community and general dental service	2,560	133	5.20
Community optometry/optician service	82	4	4.88
Not stated	398	84	21.11
Total	5,437,999	526,186	9.68

*Recorded by the National Reporting Learning Service for each healthcare sector in England and Wales. (Cousins *et al* 2012)

Errors and contributing factors

The types of errors that can occur are listed in Box 1 (Lassetter and Warnick 2003, McBride-Henry and Foureur 2006, Biron *et al* 2009). The two most common medication errors are incorrect time of administration and medication omission for no acceptable clinical reason (Barker *et al* 2002).

Complete time out activity 1

Various studies have identified factors that contribute to medication errors; these are broadly classified as patient, system and personal factors (Grandell-Niemi *et al* 2003, Greenfield 2007, Mrayyan *et al* 2007, Wright 2007). Patient factors relate to the characteristics or attributes of patients that place them at risk of experiencing a medication error (World Health Organization (WHO) 2009a) (Box 2).

Complete time out activity 2

System and personal factors, respectively, relate to institutional and individual practitioner characteristics that contribute to the relative risk of medication errors. System factors include the safety culture of an organisation, management and leadership, workplace communication and workplace policies and procedures. Examples include addressing the educational needs of staff (including agency nurses) and having accessible, succinct, step-by-step guidelines and protocols for the operation of equipment. Personal factors include the cognitive ability and skill, situational awareness, decision-making ability and personal resources (including

responses to stress and fatigue) of individual practitioners (WHO 2009b).

The system approach, while acknowledging the individual practitioner's role in, and responsibility for, errors, recognises that many medication errors could be prevented by greater attention being placed on the system and less on apportioning blame to individuals (Reason 1990, Biron *et al* 2009). Nurses, however, should continue to reflect critically on the potential for improving their own practice. The following sections will discuss the system and personal factors that may result in medication errors.

Organisational safety culture

A safety culture in healthcare systems comprises enlightened leadership, teamwork and a patient-centred approach to care (Sammer *et al* 2010). Organisations involved in highly complex, technological processes demand a failure-free operational standard from their staff. Frankel *et al* (2006) summarise the attributes necessary to achieve this as 'mindfulness'. Such attributes include:

- ▶ An awareness of the possibility of failure.
- ▶ Respect for all colleagues.
- ▶ An ability to adjust and remodel plans in unforeseen circumstances.
- ▶ An ability to accommodate the bigger picture, while maintaining focus on an isolated task.

While a culture of safety is partially determined by organisational structure and leadership,

BOX 2

Patient factors that increase the risk of medication errors

Multiple medication use:

- ▶ Complex disease process.
- ▶ Multiple medical problems.
- ▶ More than one prescribing doctor.

Poor communication:

- ▶ Children and babies.
- ▶ Confused or unconscious state.
- ▶ Language difficulties.

Passive involvement:

- ▶ Culturally determined passive relationship towards health professionals.
- ▶ Lack of interest in being informed about health and medications.

Complicated drug calculation requirement:

- ▶ Titrated medications.
- ▶ Weight-based medications (children and babies).

(World Health Organization 2009a)

BOX 1

Types of medication error

- ▶ Wrong time of administration or delayed administration.
- ▶ Medication omission without acceptable clinical reason.
- ▶ Unauthorised medication administration.
- ▶ Wrong dose administered.
- ▶ Extra unauthorised dose administered.
- ▶ Medication administered via incorrect route.
- ▶ Medication administered at the incorrect rate.
- ▶ Medication administered in incompatible fluid or in conjunction with another incompatible medication.
- ▶ Medication calculation error.
- ▶ Medication administered to the incorrect patient.
- ▶ Allergy-related error.

(Lassetter and Warnick 2003, McBride-Henry and Foureur 2006, Biron *et al* 2009)



1 A patient's intravenous antibiotic is delayed by two hours because the patient was away from the ward undergoing an investigative procedure. Would this delay constitute a medication error? Discuss this with a colleague or describe strategies that could be employed to prevent such an occurrence.

2 Reflecting on your practice, can you remember a circumstance where any of the patient factors given in Box 2 could have contributed to a medication error? Consider the strategies that could be used to minimise the risk of an incident for each factor.

the unit manager plays a significant role in the effective implementation of the safety culture in a nursing team (Mayo and Duncan 2004, Ulanimo *et al* 2007, Valentin *et al* 2009). Until recently, nurses have focused on their individual actions in efforts to promote safety and prevent harm to patients (Mayo and Duncan 2004, Ulanimo *et al* 2007, Valentin *et al* 2009). While this remains good practice, nurses should also evaluate the way they function in teams to ensure that the collective systems and processes of practice are safe and to support and educate inexperienced colleagues (Mayo and Duncan 2004, Ulanimo *et al* 2007, Valentin *et al* 2009).

An emotionally unsafe environment (that is, one led by managers who believe in demonstrating power and control over employees, who do not recognise individual needs or who are intimidating), along with fear of discipline, can inhibit the reporting of errors by nurses (Mayo and Duncan 2004, Ulanimo *et al* 2007, Valentin *et al* 2009). In a study of 983 nurses, 76.9% thought that medication errors were unreported because of fear of a negative reaction from the unit manager (Mayo and Duncan 2004). Organisations that aim to understand fully the factors, systems and processes that lead to medication errors and to identify error minimisation strategies need staff to feel free to voice concerns in a safe environment, and admit to errors and the need for development (Frankel *et al* 2006).

Effective communication is a key element of the safety culture in an organisation, particularly the communication between and within multidisciplinary teams in relation to medication processes (Savvato and Efstratios 2014). Nurses are directly involved in preventing errors at administration level and are often integral to prompting prescriptions, advising on dosages during the prescription writing phase, informing pharmacy about incorrectly dispensed medication, detecting errors and taking corrective action in medication preparation before administration (Popescu *et al* 2011).

Inexperienced nurses are particularly vulnerable to errors associated with miscommunication, because of low levels of anticipation or awareness of the potential for error. They are therefore less likely than their experienced colleagues to seek clarification either through verbal communication with colleagues or from written information (Kazaoka *et al* 2007, Savvato and Efstratios 2014). Experience promotes anticipation and early detection of errors (Seki and Yamazaki

2006). Therefore, ensuring an adequate skill mix on shifts may help prevent medication errors (Tang *et al* 2007).

Communicating with and educating patients about their medications during the administration process can result in individuals being better informed about and more involved with their medicines, thereby improving the quality and safety of medication administration (Popescu *et al* 2011). This may be particularly the case in community settings, such as in a patient's home, where the most common reason for medication errors relates to administration. Therefore, helping patients to understand and manage medication administration safely can contribute to reducing errors (NPSA 2007).

Complete time out activity 3

Interruptions and distractions

Higher medication error rates are associated with greater levels of interruptions during medication administration (Westbrook *et al* 2010). Indeed, interruptions at this stage are one of the main contributing factors to errors (Mayo and Duncan 2004, Deans 2005, Hopp *et al* 2005, Ulanimo *et al* 2007, Westbrook *et al* 2010, Ozkan *et al* 2011). In this context, interruptions are defined as a halt in the primary activity being performed – medicine administration – to carry out a secondary task, resulting in nurses having to manage a number of tasks simultaneously (Mrayyan *et al* 2007, Petrova 2010, Ozkan *et al* 2011). Distractions, such as noise, can be ignored or processed concurrently with the primary task; however, they may also contribute to errors and act as a precursor to an interruption (McFarlane and Latorella 2002).

Medication administration includes components of both skill-based and knowledge-based task requirements. Skill-based tasks require attention to be focused on the activity being performed, to ensure successful completion (Reason 1990). Interruptions that divert attention can hamper skill-based performance (Reason 1990), while knowledge-based tasks rely on conscious analytical processes that can be disturbed by competing demands for cognitive resources, fatigue and distractions such as noise (Wickens and Hollands 2000).

When a number of patient activities occur simultaneously, nurses are involved in complex decision making to prioritise activities. Many competing activities have the potential to result in distractions and interruptions that can



3 List any strategies that foster a safe reporting environment in your workplace. How could you personally contribute towards implementing them?

interfere with a primary task and may contribute to errors. Nurses are often required to choose between attending to, ignoring and delaying attending to distractions when undertaking medication administration, which may result in the nurse anticipating potential distractions, prioritising one task over another or delegating a secondary task (Popescu *et al* 2011).

The most common source of interruption is from another nurse requiring face-to-face communication (Hedberg and Larsson 2004, Spencer *et al* 2004, Alvarez and Coiera 2005, Popescu *et al* 2011). Such interruptions frequently occur during direct patient care activities, and the activity interrupted most often is that of medication administration (Hedberg and Larsson 2004). Common locations for interruptions to occur are medication rooms and open spaces where nurses may be viewed as being more accessible (Hedberg and Larsson 2004, Bennett *et al* 2006). Areas that allow for conversation result in higher levels of distraction and interruption (Popescu *et al* 2011).

Other sources of distraction and interruption include patients (Hedberg and Larsson 2004, Lyons *et al* 2007), technical sources (for example, alarms) and operational failure (for example, the unavailability of a medication or infusion device required for medicine administration) (Hedberg and Larsson 2004, Tucker and Spear 2006). Operational failure regularly results in drugs being omitted or administered late (Popescu *et al* 2011).

Minimising the frequency of interruptions may limit the number of medication errors. The NPSA (2012) recommends that institutions develop policies and procedures to minimise interruptions during administration of medicines. Solutions to minimising interruptions include: the creation of interruption-free zones of work (thus limiting casual conversations in certain work areas), wearing 'Do not disturb' safety vests or armbands and using 'Do not disturb' signs to indicate the need for interruption-free work (Pape *et al* 2005, Biron *et al* 2009). Other suggestions include the allocation of specific times during shifts when nurses can administer medication free from clerical interruptions and postponing non-urgent patient care tasks (Savvato and Efstratios 2014).

Any intervention that leads to fewer distractions could ultimately enable nurses to focus more on the task that they are performing, complete the task in good time

and create less work-related stress and greater job satisfaction (Pape *et al* 2005).

Therefore, nurses should learn to recognise the potential for making errors during medication administration and take active steps to avoid distractions and interruptions (Palese *et al* 2009). They should learn to recognise when it is appropriate to be interrupted – for example, to attend to a patient alarm or a patient whose condition is deteriorating – and when it is preferable to defer the interruption – for example, responding to clerical enquiries. This requires exercising critical thinking and making appropriate clinical judgements, which are fundamental responsibilities of the professional nurse (Jones and Treiber 2010). Nurses should also be made aware of their potential to distract and interrupt other nurses and work towards minimising such occurrences.

Complete time out activity 4

Shift length, patient acuity and workload

Research suggests that the number of hours nurses work, length of shifts, patient acuity and high workloads result in nurse fatigue (Suzuki *et al* 2005, Ulanimo *et al* 2007). Nurses who engage frequently in competing activities as a result of high workloads and the acute nature of patients' conditions are more likely to experience distractions and interruptions, focus poorly on work-related activities and potentially make more errors (Tang *et al* 2007, Hewitt 2010).

The likelihood of errors has been found to be three times higher when staff work 12.5 or more hours in a shift (Rogers *et al* 2004), and nurses are two and a half times more likely to suffer burnout and job dissatisfaction when regularly working shifts of ten hours or longer (Stimpfel *et al* 2012).

While employers are bound by statutory requirements and organisational policies to limit shift length and hours of work per week, it remains the responsibility of individual practitioners to practise within these boundaries to remain safe (NMC 2010, Fair Work Ombudsman 2014, Royal College of Nursing 2014).

Compared with day workers working regular hours, those working shifts, especially at night, have a significantly higher risk of accidents and near-miss events. This is the result of lower alertness and a greater tendency to experience drowsiness, both of which affect



4 Consider what activities can be sources of interruption during medication administration. Describe strategies that could be used to reduce the frequency of such interruptions. Outline a number of strategies that could result in fewer distractions for other nurses.

cognitive function (Barger *et al* 2009). Staff sleeping during the daytime can optimise sleep time by avoiding exposure to bright light and stimulants, keeping the room dark and using earplugs. Before starting a night shift, staff can increase their wakefulness by exposing themselves to bright light; they can also make use of short occasional nap periods when on breaks (Barger *et al* 2009, Rajaratnam *et al* 2013).

Access to information and guidelines

A number of international studies have found that nurses prefer to approach colleagues for information to aid decision making rather than to access evidence-based resources from reliable databases (Thompson *et al* 2001, Estabrooks *et al* 2003, Pravikoff *et al* 2005, Kosteniuk *et al* 2006). Reasons for this include convenience and time efficiency, a perceived lack of computer skills and low confidence levels when using online records that require search word and phrase selection (Thompson *et al* 2004, Dee and Stanley 2005).

A lack of convenient access to policies and guidelines for medication administration is likely to result in poor information-seeking habits, which may contribute in turn to medication errors (O'Leary and Mhaolrúnaigh 2012). A lack of information, training and preparation with regard to using infusion devices can contribute to errors (Mayo and Duncan 2004, Ulanimo *et al* 2007, Jones and Treiber 2010).

Environmental factors

Environmental characteristics that can lead to problems during administration of medications include poor lighting, high noise levels, restricted storage space resulting in cluttered work surfaces, poor layout of medication rooms, a lack of space for preparing and charting medications, and in particular a lack of privacy in medication rooms. Each of these factors can be associated with a higher incidence of fatigue, stress, distraction and interruptions (Mahmood *et al* 2011, Savvato and Efstratios 2014). Environmental factors, therefore, should be considered when planning strategies to minimise medication errors (Savvato and Efstratios 2014).

Drug calculation and administration

Studies have shown that nurses have poor drug calculation skills, which could account for

10-20% of medication errors (Wright 2004, 2005). In addition, it has been reported for more than four decades that nursing students have difficulty with mathematical tasks such as unit conversions, dosage calculations and fluid monitoring (Bindler and Bayne 1984, Worrell and Hodson 1989, Sandwell and Carson 2005).

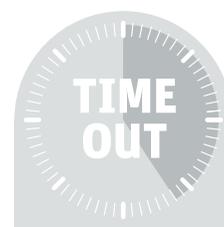
Two skills have been identified as necessary for accurate drug calculation: first, basic mathematical and computational aptitude, and, second, the ability to understand clinical information well enough to formulate correctly a suitable mathematical problem to calculate drug dosage (Wright 2007). According to Vagliardo and Schmittau (2008), it is important for practitioners to have a clear understanding of mathematics to be able to estimate, to correctly interpret graphs, proportions, ratios and tables, and to be resourceful in problem solving; good mathematical understanding means not being dependent on a calculator.

There appears to be a significant correlation between a positive attitude towards mathematics, self-efficacy (the belief in one's own ability to complete tasks and reach goals) and performance, with feelings of self-efficacy being a stronger predictor of performance than attitude to mathematics (Hackett and Betz 1989, Ma and Kishor 1997, Nicolaidou and Philippou 2003). Mathematical-related anxiety is correlated inversely to self-efficacy for complex mathematical tasks, where drug calculations are perceived as difficult (Walsh 2008). Therefore, nurses may be likely to perform less well on complex drug calculations as a result not only of the complexity of a task but also the level of their perceived self-efficacy in relation to undertaking the calculation. Levels of confidence and self-efficacy in completing basic and complex tasks can improve with mathematical practice (Walsh 2008).

Complete time out activity 5

Understanding and reporting errors

It is important to ascertain how errors occur, and this is primarily achieved through adequate reporting (Hewitt 2010). The first step in planning strategies to reduce errors is to obtain a clear understanding of what constitutes an error (McBride-Henry and Foureur 2006). A mixed-methods study on medication errors in a district general hospital in south west England found that there was confusion among nurses as to what constituted a medication error and



5 On a scale of one to ten, rate your mathematical ability. Find a good source (online or paper) of drug calculation practice questions to assess your calculation skills.

which incidents should be reported to a physician or nurse manager (Gladstone 1995). For example, less than 20% of the 81 nurses who responded to a questionnaire identified the following as medication errors:

- ▶ A patient having missed an antibiotic dose due to the fact that he was away from the ward for three hours.
- ▶ A dose of medication delayed by 45-60 minutes.
- ▶ An dose of nebulised medication at 2am omitted because the patient was sleeping.

Raising awareness among nurses by disseminating information about factors that are likely to increase the possibility of errors and what constitutes an error may be useful in improving nurse vigilance (Savvato and Efstratios 2014).

Failure to follow policy or guidelines

One of the more common personal contributors to medication error is a failure to adhere to professional and institutional policies or guidelines (NMC 2010), in particular a failure to check the 'five rights' (right patient, right medication, right dose, right route, right time) (Tang *et al* 2007, Ulanimo *et al* 2007). Neglecting these checks has been shown to contribute to medication errors (Pape *et al* 2005, Fogarty and McKeon 2006).

Failure to check identity bands was found by Westbrook *et al* (2010) to be the most common deviation from procedural policy. Failure to watch patients take medication and signing charts before medication was consumed were also common. Reasons given for deviations from policy were mostly to save time. Such findings demonstrate a lack of insight into the necessity to check a medication chart against a patient's identity band. It has been suggested that nurses may not value the practice of checking name bands or that the practice loses importance when the nurse is no longer being supervised (Hewitt 2010, Jones and Treiber 2010).

It could be argued that nurses, having worked previous shifts and having attended to the same patients, would correctly identify a patient by sight. However, not implementing the process of checking identity bands prevents nurses ensuring that a medication chart belongs to the correct patient.

Nurse managers must ensure that guidelines and policies are available and accessible, and encourage their implementation. Creating suitable additional defence barriers (for

example, double checks for high-risk situations such as paediatric medications, unusual prescriptions, similar names or packaging) could minimise errors; however, it has also been noted that single checks can result in fewer nurse interactions and thus fewer distractions (Biron *et al* 2009, Popescu *et al* 2011, Savvato and Efstratios 2014).

Preventing confusion

Confusion relating to poor prescriber handwriting on medication charts can lead to administration and pharmacy errors (Mayo and Duncan 2004, Fry and Dacey 2007, Ulanimo *et al* 2007). The Care Quality Commission has expressed concern about the illegibility of doctors' handwriting, stating that staff find some handwriting difficult to decipher, posing a high risk to patient safety (Evenstad 2014).

Several studies in hospitals have shown that medication error rates are substantially reduced with computer order entry programs – the process of entering medication or physician orders electronically instead of on paper charts (Potts *et al* 2004, Holdsworth *et al* 2007, Radley *et al* 2013). While using computer-based systems may not be possible in all institutions, it remains incumbent on prescribers to ensure their prescriptions are legible and on nurses not to administer medication from an illegible or confusing chart.

Similarly, by ensuring medication charts are clearly legible, and performing adequate checks, errors resulting from confusion relating to similar drug names and packages, as well as the misinterpretation of abbreviations, letters and numerals, may be prevented (Lassetter and Warnick 2003, Mayo and Duncan 2004, Fry and Dacey 2007, Ulanimo *et al* 2007).

Complete time out activity 6

Conclusion

Medication errors result from a combination of factors that often appear trivial or insignificant in isolation, but when compounded may lead to adverse events. To improve nurses' knowledge of how individual factors contribute to errors and help them develop effective strategies to prevent errors occurring, it is important that institutions reward and encourage leaders who demonstrate characteristics of mindfulness on all levels.



6 Read the scenario described in the case study in Box 3. Outline what steps Paige should take to ensure that her patients receive the required intravenous medication correctly. Describe some institutional practices that could assist in preventing medication errors in the scenario.

BOX 3

Case study

Paige is a newly qualified nurse who has been seconded to a busy surgical ward to help as a result of staff shortages. When reviewing the charts of patients allocated to her care, she realises that she has a number of intravenous (IV) antibiotic infusions to administer. She is unfamiliar with the operation of the IV pumps used on the ward.

She makes an attempt to find someone who can help show her how they are set. Everyone seems occupied, but she eventually finds a registered nurse team member who is willing to help her. The nurse hands her a manual and, then, in a rushed manner, briefly explains how the pump is operated. Paige is still unsure about how the pump is set, but the nurse has no time to answer questions and suggests that Paige just reads the manual.

A safe reporting environment that encourages staff engagement to identify contributory factors as well as possible solutions must also be fostered. Extensive organisational resources are required to enhance communication, to reduce confusion, to improve knowledge, skill and compliance with policies, guidelines and standards, and to ensure that staff members are less pressurised. Nurses and other healthcare providers can contribute individually to patient safety by accessing available resources that will improve their awareness and knowledge of medication errors, encourage them to engage in effective communication with one another and their patients, and foster a safe reporting environment that will enable all staff to learn from safety incidents if and when they occur **NS**

Complete time out activity 7



7 Now that you have completed the article, you might like to write a reflective account. Guidelines to help you are on page 62.

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