

**Undertaking safe medicine administration with children:
part 1**

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Published version

PENTIN, Jayne, GREEN, Michelle and SMITH, Joanna (2016). Undertaking safe medicine administration with children: part 1. *Nursing children and young people*, 28 (6), 35-42.

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Nursing Children and Young People

Continuing Professional Development Article

Pentin J, Green M, Smith J (2016) Undertaking safe medicine administration with children Part 1: principles of effective medicines management. *Nursing Children and Young People*, 28, 6, 34-40.

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This is the first of two articles that aim to provide children's nurses with an opportunity to develop their knowledge and skills of medicines management when caring for children and young people. The second article focuses on numeracy and calculation skills, which have been identified as an important risk factor associated with medication errors in children (Manias et al 2014). This first article outlines the principles of effective medicines management including the pharmacology language required to accurately read prescriptions, the way children respond to medicines, managing risk including the concept of human error, and working in partnership with children, young people and families.

Aim and intended learning outcomes:

To outline the principles underpinning effective medicines management for children's nurses and the factors that contribute to medication error in children and young people. By completing the time out activities you will be able to:

- Describe essential pharmaceutical language required when reading prescriptions.
- Identify the differences between the way children and adults respond and react to medicines.
- List the principles of preparing and administering medicines.
- Describe ways of involving the child and family when administering medicines to children.

Medication errors can occur at any stage of the medicines process (prescribing, dispensing, preparation and administering medicines and monitoring their effects); all health professionals involved in one or more stages of the medicines process can potentially make a medication error. Health professionals, including nurses, are accountable for their own actions and professional body regulations. However, medication errors are rarely due to an isolated stage in the process, or one person, but a cascade of events that collectively result in an error occurring (Walsh et al 2005). In addition, care environments are becoming increasingly complex with faster throughput of children, increased acuity of conditions being managed in children's wards and an increase in the number of children with complex treatments and care regimes, which can add to the challenges of ensuring effective medicines management in child health settings. Although the current economic climate, driven by the twin imperatives of quality and efficiency, is impacting on the way services are delivered, safe and effective care must be underpinned by health professionals' having the skills and competencies necessary to deliver high quality care (DH, 2012, DH a and b). Medication errors are not only clinically significant but can also have an economic impact in the form of additional treatments, extended hospital stays and potential litigation (Roy et al 2005).

One of the key professional standards for nursing is to ensure patient safety, which includes dispensing and administering medicines (Nursing Midwifery Council, NMC, 2015). Although the nurses' role in relation to administering medicines is evolving, including undertaking independent prescribing, nurses are primarily responsible for preparing and administering medicines to children and young people. Nurses have an important role, as the last person in the chain, to identify and prevent potential medication errors (Alsulami et al 2014). Therefore, nurses must have a sound knowledge of the medicines they administer including therapeutic uses, normal dosage, side effects, cautions, contra indications and drug interactions (NMC 2010). Nurses must understand local policies and procedures, which must be adhered to when following prescriptions, and preparing and administering medicines. In the United Kingdom (UK) all National Health Service (NHS) organisations have a statutory responsibility, as part of their clinical governance systems, to have robust processes for monitoring and auditing medicines management processes (Harris and Taylor 2009). Now undertake Time Out 1.

TIME OUT 1

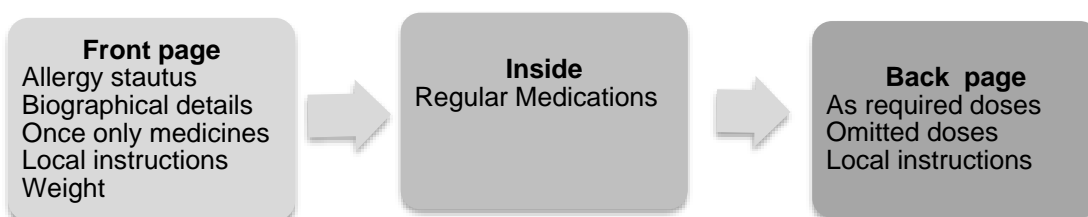
Reflect on your own practice setting:

List all of the factors you can think of that could contribute to medication errors in your clinical area.

Describe the processes in your organization and clinical area for reviewing, monitoring and evaluating medicines management practices.

Accurate interpretation of prescriptions

Incomplete prescriptions and incorrect use of abbreviations contribute to the reasons medicine errors occur in children (Wong et al 2009, Ghaleb et al 2010). Therefore, reading and interpreting the prescription correctly is essential for the nurse to administer medication safely to the child or young person. Adopting a systematic approach to reading prescription charts ensures all information is considered and interpreted correctly and safely. In the absence of a standardised prescription chart in the UK, a range of formats are available, most will include:



Now undertake Time Out 2.

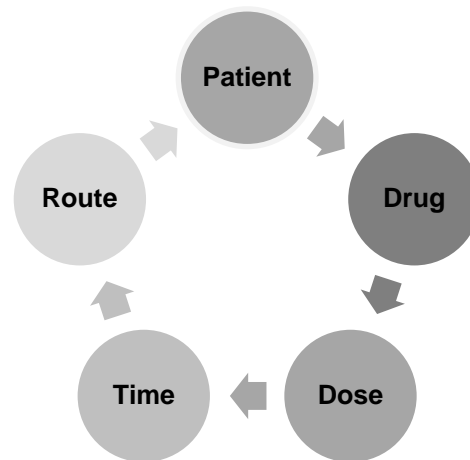
TIME OUT 2
List how systematically check a prescription chart.
Does your method ensure you check every component of the chart?
What might alert you to a potential problem with the prescription?

Developing a systematic and logical approach when checking each prescribed medicine will ensure errors are minimized (Jones 2009) (Box 1). You may find it helpful to read out loud the prescription to the person you are checking the medicine with if a seconder checked is used in your clinical area, and consider if the prescription is reasonable. Check that the prescriber has signed every medicine being administered. However, **you** need to make a clinical judgment about whether each prescribed medicines is the correct dose, format and route for the child's age and condition. Be confident and draw on your clinical experience to challenge the prescriber if there is any uncertainty about the prescription; never administer a medicine that is not clearly prescribed or where information is missing.

Box 1: Example of a drug prescription					
Work methodically through each part of the prescription starting at 1 and ending at 12					
1. Drug	2. Dose	3. Frequency		11. Time	12. Nurse signature
4. Route	5. Doctor name (print) & contact	6. Doctor Signature			
7. Date	8. Checked by pharmacist	9. Supplied pharmacy	10. Special Instructions		

Prior to preparing medication for administration ensure the child's age and weight (in kilograms) has been clearly documented on the prescription chart, and the medication prescribed is the appropriate dose, format and route for the child's age.

Many organisations adopt the '5 rights' aid memoire as part of a medication administration safety check (Jones 2009):



Pharmacology language

Pharmacology has a specific language that nurses must understand because errors can occur if information is misinterpreted. Wherever possible avoid abbreviations, although some are widely accepted such as including OD (once a day), TDS (three times a day) QDS (four times a day). Within the UK, the British National Formulary for Children (BNFC) (2015) has a list of accepted abbreviations. Now undertake Time Out 3.

TIME OUT 3

Describe the following pharmacological terms:

Therapeutic dose
Prophylactic dose
Unlicensed medicines
Off label medicines
Polypharmacy
Medicines optimisation
Medicines reconciliation

Compare your descriptions to those at the end of the article.

Uptake and adverse medicine reactions in children

Children's nurses must use their skills, knowledge and experience of caring for children and young people when administering medicines, and be able to recognise and respond to adverse effects of medication. The way in which children respond to medicines is often different to adults (Department for Education of Skills/ Department of Health 2004). Children's response to medication is influenced by a range of factors (World Health Organization 2007), including:

- Body proportions and composition (such as body fat, protein, extracellular water content) change significantly during infancy and early childhood which influence the pharmacokinetics (absorption, distribution, metabolism and excretion) of medicines and therefore the efficacy and toxicity of medicines in children.
- Organs essential for homeostasis such as the liver and kidney, relative to body weight, reach their maximum size at 1-2 years of age, and along with an increased body surface area, again relative to body weight, influence medicine pharmacokinetics in children.
- A developing gastrointestinal system, delayed gastric emptying and gut motility in infancy and early childhood can influence the rate and uptake of oral medicines.

In addition the child's cognitive function, stage of development and family preferences will influence the medication formulation and method of administration. Nurses must be alert to the signs and symptoms of adverse medicine reactions and respond appropriately. Understanding the way children respond to medicines enables the nurse to be alert for potential side effects of medicines and adverse responses. The nurse must develop a sound knowledge of the medicines they administer, including actual and potential side effects, drug interactions and contraindications. The use of up-to-date resources such as the BNFC (2015) should become routine practice. As experience is gained, confidence develops and you will begin to work more intuitively developing a sense 'of knowing when something is not right' (Benner et al 1996).

Adverse medication events should be reported by following local incident reporting procedures, and in the UK nationally by completing the 'yellow card' found in the BNFC or online at www.yellowcard.gov.uk. Any health professional or member of the public can report an adverse medicines event. This enables the national comprehensive database of adverse events and medication side effects to be accurately maintained.

Managing risk, errors and near misses when administering medicines

Implementing successful strategies to minimise medicines errors and managing risk requires an understanding of how and why errors occur. There is an increasing evidence base relating to medication errors. Two recent reviews of research suggest the causes of medication errors can broadly relate to the person or human factors (unsafe acts such as the misidentification of medication, lack of patient knowledge), local workforce factors (poor communication, distractions and interruptions, workplace dynamics, inadequate medicines supply and storage), and organisational factors (poorly designed protocols and systems for managing errors) (Keers 2013a and b). In relation to nursing, it has been suggested that insufficient knowledge of pharmacology, difficulty in undertaking drug calculations and lack of confidence contribute to medicine administering errors (Ofusu and Jarrett 2015). Now undertake Time Out 4. Common causes of medication error and actions that to reduce risk occurring are outlined in Box 2.

TIME OUT 4
<p>List the causes of medication errors in relation to:</p> <p>Personal or human factors Local workforce factors Organizational factors</p> <p>What actions do you think could be taken to reduce medication errors occurring? Compare your answers to the actions outlined those in Box 2</p>

BOX 2: Common causes of medication errors and ways of reducing errors (Armitage et al 2014, Ghaleb et al 2010, Jones 2009, Keers et al 2013a and b, Manias et al 2014, NMC 2010, Ofosu and Jarrett 2015, Pentin and Smith 2006, Westbrook et al 2011)		
Causes of medication errors		Actions to reduce medication errors
The person (human) factors	Patient misidentification	Ensure all required details including the child's full name, date of birth and unique identification number are documented on the prescription chart Know your local policy on positive patient identification for the conscious and unconscious child
	Incomplete documentation	Methodically check all information on the prescription, if missing information is identified or the prescription is illegible seek advice and do not give the medication
	Administration errors, such as administering a drug previously given, at the wrong time, the wrong dose or omitting a medicine without a valid reason	Ascertain whether the medicine is required; check start and finish dates and that the medicine has not already been administered Always sign the prescription chart immediately after medication administration or if the drug is omitted clearly record the reason for the omission
	Inability to accurately	Develop confidence in numeracy skills: article 2 will

undertake drug calculations	assist you developing numeracy and calculation skills Calculator use has been widely debated in practice; there is an expectation that all nurses can perform essential calculations without the use of a calculator. Good practice involves undertaking calculations without a calculator then checking answers using a calculator
Inadequate information about the patient	Review the child or young person's medical history and consider if the medicine is appropriate or still required Identify pre-administration requirements for example: whether the dose is dependent on blood results such as blood glucose levels or monitoring therapeutic drug levels; physiological parameters such as pulse rate or blood pressure; prescribing recommendations for example guidance from the microbiologist about current antibiotic recommendations Check that the dose prescribed is appropriate for the child's weight and that known allergies are recorded
Not following instructions on preparing medicines such as inappropriate crushing or breaking tablets, inaccurate reconstitution of medicines, failure to clearly label medicines	Be aware of local and national policy on crushing and mixing medicines, and consult with pharmacy where it is necessary to reconstitute oral medicines Be aware of displacement values when reconstituting powdered medications in particular intravenous medicines Clearly label any medications immediately after preparation, once prepared never leave medicines unattended
Errors in correctly identifying medicines is similar packaging and involuntary automaticity (acting on what you expect rather than what is actually prescribed)	Identify the correct drug by reading medicines labels carefully, be mindful of 'look alike' and 'sound alike' medicines, and the use of generic or brand names The use of 'tall man' lettering can help reduce errors with 'look alike' and 'sound alike' medicines and are being used by drug companies when labeling medicines for example DoBUTamine could be confused with DOPamine
Inadequate technical skills including poor aseptic non-touch technique, inability to manipulate equipment or choosing the wrong equipment	Develop the skills and confidence required to manipulate the equipment used for preparing and administering medicines; gather all equipment together before you start preparing the medicine Ensure you identify and choose the correct syringe for the purpose such as oral, intravenous or insulin use
Failure to adhere to local and national policies and professional guidelines	Follow local policy and professional guidelines when administering medicine such as the NMC Standards for Medicines Management (2010) and the Code of Professional Practice (NMC 2015)
Failure to access or make effective use of medicines information/resources	Be familiar and use up-to-date resources to gain information about the medications prescribed, such as the British National Formulary for Children (BNFC, 2015); develop a sound knowledge of the medicines you administer including cautions, contraindications, interactions and their side effects
Poor understanding of individual roles and responsibilities	Maintain personal safety throughout the procedure of administering medicines; adhere to professional and local policy in relation to second checker, which often operates in children's settings If the second checking of medicines is a local requirement both nurses are responsible for the safe administration of the medicines and the second checker must also sign that the medicine has been administered
Not challenging	Always challenge uncertainties

	decisions if an error is suspected	If double checking is used do not accept that someone held in esteem or in a senior position must be right
Local workforce factors	Poor communication between healthcare professionals, the child and family leading to errors in the preparation or administration process	Develop good working relationships with colleagues involved in medicine management processes in particular doctors, who are the main prescribers of medicines, and pharmacists Provide children and their families with information about the medicines they have been and that they consent to these being used.
	Distractions and interruptions	Limiting distractions is vital to reducing medicine errors but can be challenging in busy clinical environments Adopt strategies for limiting distractions such as having a designated area free from distractions for medicine preparation and follow any local recommendations to reduce interruptions
	Incorrect supply, storage or disposal of medicines and medication administration equipment	Check expiry dates, actual or potential contaminants and that the correct storage instructions have been followed Alert managers to any concerns about safe storage of medicines in your clinical area Dispose equipment correctly; follow local policy on disposal of sharps and clinical waste
	Preparing medicines in areas with poorly lighting or lacking space	A risk assessments of the clinical environment will highlight potential problems and where improvements are required, report concerns
	Inadequate maintenance of electronic equipment and training in the correct use of equipment use such as infusion pumps	Ensure local policies and procedures are maintained in relation to testing and maintaining electrical equipment, and report mechanical and technical failures Ensure you have been trained in the correct use of equipment and attend updates to maintain your competence and professional development
Organisational factors	Lack of educational programs and ongoing professional development	The nurse preparing the medication must have the right expertise/training/qualification/education, and if delegating tasks know the skills and competency of health professional delegated to administer the medicine; never give a medication you have not witnessed being prepared Provide students with the opportunity to develop skills in reading prescription charts, preparing, administering and recording medicines Ensure students only administer medicines under the direct supervision of a registered nurse
	A workplace culture that makes it difficult to challenge entrenched practice or that does not support reporting of medication adverse events, errors and near misses	As a registered nurse you have a responsibility to adhere professional codes of conduct, within the UK the NMC Code (2015) states that you must 'act without delay if you believe that there is a risk to patient safety'. This includes raising and escalating concerns and taking measures to reduce as far as possible, the likelihood of mistakes, near misses, harm and the effect of harm', if an error occurs. An open culture should be developed to encourage the reporting of medication administration incidents and a thorough investigation of the incident should be undertaken
	Inadequate systems for monitoring and auditing medicines management processes	Ensure you are aware of local risk management systems for reporting incidents and near misses, raise concerns if process are not transparent Be aware of national risk management processes in relation to medicines management

Research consistently reports the wrong time, omissions, and wrong dosage among the 3 most common reasons for medication errors (Keers et al 2013a). However, factors that influence human actions and behaviours are multifactorial, therefore when a medication error occurs a full investigation should be undertaken to identify the root cause (The National Patient Safety Agency, NPSA, 2009). Managing risk is a systematic process that enables identification, analysis, evaluation and correction of actual and potential risks to patients.

Medication errors are often under reported, in part because there is no standard definition of what constitutes an error (Armitage and Knapman 2014). It has been suggested healthcare organisations should have greater transparency and accountability when managing errors and adverse events (DH 2013). Health professionals must be supported when reporting medication errors, which can be aided by having clear reporting procedures (Carthey and Clarke 2010). Developing a supportive culture with strong clinical nurse role models who create a positive workplace culture where practice is reviewed and evaluated, and good practice is highlighted can develop and nurture staff. Protecting patients from harm should be at the forefront of all nursing actions and an environment must be created that supports the reporting of poor practice.

Working in partnership with the child, young person and family

Health policy advocates that care delivery is patient-centred (Department for Health 2010a and b), and in the context of children, health professionals enable children and young people, as appropriate, and their families to be involved in care and care decisions (Department for Education of Skills/ Department of Health 2004). Within children's nursing involvement and patient-centred care is embodied within the philosophy of family-centred care and the partnership-in-care model. Although family centred-care has been criticised for not being embedded into every day practice (Smith et al 2015), as a philosophy family-centred care is viewed as the ideal system to structure the involvement of families in children's health care (Shields et al 2012). In the context of effective medicines management the individual child and family characteristics and needs should be taken into account and families should be engaged, listened to and empowered to be included in decisions about the child's medication (Armitage and Knapman 2014). A shift from a paternalist to a shared approach to care delivery is reflected in changes in terminology associated with medicines management; concordance focuses on the process of making decisions

about medication with children and young people, where appropriate, and their family, and that decisions incorporate their views (Haynes et al 2002). In contrast compliance implies lack of patient involvement where there is an assumption the 'patients' views are in alignment with the prescriber's recommendations.

Effective involvement enables children and young people, where appropriate, and families to express their opinions using active listening and responding to concerns to build rapport with the child and family, effective information exchange and mutual care planning (Smith et al 2015). To engage fully and knowledgeably in decisions about medication children and young people, where appropriate, and their family must be aware of the risks and benefits of medicines (Armitage and Knapman 2014). Increased medicines adherence can be achieved by the provision of to individually tailored information, reminders and reinforcement, and support from a health professional (Haynes et al 2002). The children's nurse needs to invest time and effort to engage with children and their families thinking innovatively and creatively about how to share information about the medicines prescribed, including on-line and age appropriate information resources from quality assured sources. This also includes meeting the needs of the children and families from diverse backgrounds including: children who have difficulty communicating or understanding information; families who first language is not English; and cultural differences about the use of medications. The children's nurse has a key role in ensure children and their families are taught how to administer medicines appropriately. Actively involving children, young people and families in decisions about their medications is more likely to improve medicine adherence, and assist the child develop independence, particularity in the context of long-term conditions (Armitage and Knapman 2014). For the child with long-term condition, an admission to hospital presents an ideal opportunity for a medication review, and ascertaining any concerns about the medication and its administration.

Ensuring the child, young person and family have written and verbal information about the child's medicines is essential to consolidate their knowledge and understanding. Information should include: the purpose of the medicine; actual and potential side effects; clear instruction about how much and when the medicine needs to be administered including any specific instructions such as before food; when to stop taking the medication; and if required where to seek advice about the medication. Now undertake Time Out 5.

TIME OUT 5

In your practice how are children, young person and the family involved in the management of the child's medication?

What opportunities and options do you offer younger children in relation to medicine administration?

How do you encourage and support children and young people to adhere to their prescribed medications?

Conclusion

Errors can occur at each stage of the medicines management process; ensuring the child's safety is the responsibility of each health professional involved in the process. In addition to the impact on the child and family, medication errors add to health care costs because of the potential for additional treatments, extended hospital stays and litigation. Safe and effective medicines management is an important role of the children's nurses and requires nurses to have the necessary skills and competencies necessary to deliver high quality care. Nurses are primarily responsible for preparing and administering medicines to children and young people, and in an ideal position to detect and report potential risks. Furthermore, children's nurses are ideally position to working in partnership with children, young people and their families, a requirement of effective medicines management.

Time Out 3 - pharmacological terms explained

Therapeutic dose: the dose required to have the desired treatment effect or achieve a specific outcome

Prophylactic dose: medication dose used to prevent a disease from occurring for example children with recurrent urine infections are often prescribed low dose trimethoprim

Unlicensed medicine: a medicine that does not currently have marketing authorisation and is not expected to gain a license in the immediate future. The medicine may be in development and a license is only granted once the manufacturer has demonstrated that the medicine is safe and effective

Off label medicine: a medicine with an existing license but the prescriber wishes to use the medicines outside its usual use, for example to treat a different condition, prescribing a different dose or route than recommended or different patient group

Polypharmacy: the use of multiple medicines often for individuals with complex conditions or multiple conditions and is linked to medicines optimisation

Medicines optimisation: refers to ensuring patients receive the right medicines, at the right time to achieve the desired treatment effects according to the best available evidence and considers patient lifestyle and preferences

Medicine reconciliation: is the process of creating an accurate record of a patient's current medication, and comparing the patients required medication with the medication they are taking. For example a medicines review following a hospital or acute illness can be useful if medications have changed, which needs to be clearly communicated to the patient.

Resources

Armitage G, Knapman H (2014) *Medicines Management Toolkit Together for Short Lives*, 2nd edition. Bristol, Together for Short Lives.
http://www.togetherforshortlives.org.uk/professionals/resources/4602_medicines_management_toolkit

British National Formulary for Children (2015) Paediatric Formulary Committee London, BMJ Group, Pharmaceutical Press and Royal College of Paediatrics and Child Health Publications. <http://www.bnf.org>

Harris S, Taylor S (2009) *Clinical Governance in Drug Treatment: A Good Practice Guide for Providers and Commissioners*. London, National Treatment Agency.
<http://www.nta.nhs.uk/uploads/clinicalgovernance0709.pdf>

References

- Armitage G, Knapman H (2014) *Medicines Management Toolkit Together for Short Lives*, 2nd edition. Bristol, Together for Short Lives.
- Alsulami Z, Choonara I, Conroy S (2014) Nurses knowledge about the double checking process for medicines administration. *Nursing Children and Young People*. 26, 9, 21-26.
- Benner P, Tanner CA, Chesla CA (1996) *Expert practice*. In Benner P et al (eds.) *Expertise in nursing practice, caring, clinical judgment and ethics*. New York, Springer Publishing Company.
- British National Formulary for Children (2015) Paediatric Formulary Committee London*, BMJ Group, Pharmaceutical Press and Royal College of Paediatrics and Child Health Publications.
- Carthey J, Clarke J (2010) Patient Safety First: Implementing human factors in healthcare 'how to guide'. www.patientsafetyfirst.nhs.uk.
- Department of Health (2012) *World Class Education and Training, for World Class Healthcare*. London. DH.
- Department of Health (2010a) *Equity and excellence: liberating the NHS*. London. SO.
- Department of Health (2010b) *Caring For Our Future: reforming care and support*. London, SO.
- Department for Education of Skills/ Department of Health (2004) *National Service framework for Children, Young People and Maternity Services: Medicines for Children*. London, SO.
- Department of Health (2013) *Berwick review into patient safety: A promise to learn – A commitment to Act. Improving the safety of patients in England*. National Advisory Group on the safety of patients in England. London, SO.
- Ghaleb MA, Barber N, Franklin BD, Wong ICK (2010) The incidence and nature of prescribing and medicines administration errors in paediatric inpatients. *Archive of Disease in Childhood*. 95, 2, 113-8.
- Harris S, Taylor S (2009) *Clinical Governance in Drug Treatment: A Good Practice Guide for Providers and Commissioners*. London, National Treatment Agency.
- Haynes R, McDonald H, Garg A, Montague P (2002) Interventions for helping patients to follow prescriptions for medications. The Cochrane Database of Systematic Reviews, 2, CD000011.
- Jones SW (2009) Reducing medication administration errors in nursing practice. *Nursing Standard*. 23, 50, 40-46.
- Keers RN, Williams SD, Cooke J, Ashcroft DM (2013a) Causes of Medication Administration Errors in Hospitals: a Systematic Review of Quantitative and Qualitative Evidence. *Drug Safety*. 36, 1045-1067.
- Keers RN, Williams SD, Cooke J, Ashcroft DM (2013b) Prevalence and Nature of Medication Administration Errors in Health Care Settings: A Systematic Review of Direct Observational Evidence. *The Annals of Pharmacotherapy*. 47, 237-256.
- National Patient Safety Agency (2009) *Safety in Doses: Improving the use of medicines in the NHS: Learning from National Reporting 2007*. London, NPSA.
- Nursing and Midwifery Council (2015) *The Code Professional standards of practice and behaviour*. London, NMC.

- Nursing and Midwifery Council (2010) *Standards for Medicines Management*. London, NMC.
- Manias E, Kinney S, Cranswick N, William A (2014) Medication errors in hospitalised children. *Journal of Paediatric and Child Health*. 50, 71-77.
- Ofosu R, Jarrett P (2015) Reducing nurse medication administration errors. *Nursing Times*. 111, 20, 12-14.
- Pentin J, Smith J (2006) Drug calculations; are they safer with or without a calculator? *British Journal of Nursing*. 15, 14, 778-781.
- Roy V, Gupta P, Srivastava S (2005) Medication errors: causes and prevention *Health Administrator*. XIX, 1, 60-64.
- Smith J, Cheater F, Bekker H, Chatwin J, (2015) Involving Parents in Managing Their Child's Long-Term Condition-A Concept Synthesis of Family-Centered Care and Partnership-in-Care. *Journal of Pediatric Nursing*, 30, 1, 143-59.
- Shields L, Zhou H, Pratt J, Taylor M, Hunter J, Pascoe E (2012) *Family-centred care for hospitalised children aged 0-12 years*. Cochrane Database Systematic Reviews. Issue 2.
- Walsh KE, Kaushal R, Chessare (2005) How to avoid paediatric medication errors: a users guide to the literature. *Archives of Disease in Childhood*. 90, 698 -702.
- Westbrook J, Rob M, Woods A, Parry D (2011) Errors in the administration of intravenous medications in hospital and the role of correct procedures and nurse experience. *British Medical Journal Quality and Safety*. 20, 1027-1034.
- Wong L, Wong LY, Cranswick NE (2009) Minimising medication errors in children. *Archives of Disease in Childhood*. 94,161-164
- World Health Organization (2007) Promoting safety of medicines for children. France, World Health Organization.

Test your knowledge

1. A medication error is defined as?
 - a) A patient being given the wrong drug
 - b) The medicine dose being incorrectly calculated
 - c) The medicine is incorrectly prescribed
 - d) There is no standard definition

2. Why are nurses in an ideal position to identify medication errors?
 - a) They have more understanding about children than other health professionals
 - b) They are often the last person in the medication administration chain enabling them to identify and prevent potential medication errors
 - c) More nurse are able to undertake independent prescribing
 - d) Nurses always adhere to policies and procedures when preparing and administering medicines

3. In what order should medication administration charts be checked
 - a) Patient details followed by regular medication page
 - b) Systematically check every component of a prescription chart
 - c) Allergies, weight followed by regular medication page
 - d) Patient details and local instructions

4. Medication errors have been found to relate to
 - a) Distractions and interruptions
 - b) Not making use of resources such as the BNFC
 - c) Person, workforce and organisational factors
 - d) Inadequate implementation of policies and guidelines

5. Student nurses must
 - a) Only administer medicines under the direct supervision of a registered nurse
 - b) Not undertake any aspect of medicines preparation
 - c) Only observe medicines being prepared and administered
 - d) Never administer controlled drugs

6. Pharmacokinetics of medicines in children is influenced by
 - a) Body proportions and development of organs and systems
 - b) Hormonal changes in adolescence
 - c) Decreased body surface area related to weight
 - d) The strength and toxicity of the medicine administered

7. Before administering a medicine, it is important to review
 - a) Patient medical history
 - b) Any pre-administration requirements
 - c) Prescribing recommendations
 - d) All of the above

8. Which of the following is NOT a human factor in medication errors
 - a) Incorrectly storing medicines
 - b) Misidentification of the patient
 - c) Not signing the prescription chart following medication administration
 - d) Inadequate procedures for reporting of adverse events in the healthcare organisation

9. If an adverse drug event occurs
 - a) It must be reported using local and national reporting procedures
 - b) The yellow card system must be used
 - c) It must be documented in the patient notes
 - d) The nurse will be referred to the NMC

10. Medicine adherence is likely to be improved if
 - a) Only written instructions are provided to the child and family
 - b) Nurses monitor that patients are taking their medication as prescribed
 - c) Children and families are actively involved in decisions about their medications
 - d) It is explained how and when medicines should be taken

Answers: 1d, 2b, 3b, 4c, 5a, 6a, 7d, 8d, 9a, 10c