The top ten prescribing errors in practice and how to avoid them

The Pharmaceutical Journal 21 FEB 2019

Prescribing errors are relatively common but preventable events. Most of these errors result in no harm or low-to-moderate harm; however, some result in severe harm or death. Prescribing error rates of 8.9 errors per 100 medicine orders have been observed in acute hospitals[1] and in 4.9% of all prescription items in general practice[2],[3].

This article describes the most important types of prescribing errors, medicines and situations responsible for causing death and severe harm to patients. It also provides advice on how to avoid these errors occurring. Owing to the small sample sizes used in observational studies, it is difficult to identify the full range of prescribing errors that are responsible for medication incidents or adverse event reports with outcomes of death, or severe harm and/or medical indemnity claims. Therefore, to identify the top ten prescribing errors, data from observational research[1],[2],[3], patient safety incident reports[7],[8],[9], yellow card reports[10] and medical indemnity claims[5],[6] have been used. The examples below are based on real-life events.

1. **Prescriptions for medicines were omitted or delayed**

An analysis of 64 prescribing incidents in 2017 that caused death and serious harm, and were reported to the NHS National Reporting and Learning Services[7], revealed that 24 (37.5%) of these incidents involved prescriptions for medicines that were omitted and delayed.

Example incident

A patient was discharged following an ischaemic stroke. Unfortunately, they had not been prescribed clopidogrel on discharge. This was not noticed by the prescribing doctor, the pharmacist dispensing the medication, or the nurse handing over the prescription[7].

Actions to minimise the risk

- Review medicine procedures to identify a list of critical medicines where timeliness and continuity of administration is important (e.g. anti-infectives in sepsis or adrenaline in anaphylaxis)[11],[12];
- Make changes to systems for prescribing, supply and administration of critical medicines, both within normal hours and out-of-hours, to minimise risks[11];
- Electronic prescribing and dispensing systems should be configured to aid identification of critical medicines;
- Prescribers should communicate to other healthcare professionals, the patient and carers when an urgent prescription has been written and requires dispensing and administration. Current primary care electronic prescribing systems do not allow urgent prescriptions to be highlighted to the receiving pharmacy when sent from a GP system;
- Ensure effective medicines reconciliation when patients are admitted and discharged from hospital[13];
- Ensure procedures are in place so that hospital discharge summaries are reviewed and actioned in a timely way to ensure treatment continuity.

2. **Anticoagulants**

Oral warfarin, the newer direct-acting anticoagulants, injected heparin and low-molecular-weight heparins have all been involved in reported prescribing error incidents that have caused death and serious harm[7],[8],[9].

Example incident

The last documented international normalised ratio (INR) for a patient on warfarin was noted more than a year ago. The patient failed to attend three consecutive anticoagulant appointments but their warfarin prescription continued[2].

Actions to minimise the risks

- Prescribing procedures for anticoagulants must include review of age, weight, medical and medication history, blood tests and interactions. Procedures must clarify

the healthcare professional responsible for counselling patients on newly prescribed anticoagulant therapy in individual clinical areas;

- Where GP surgeries are not responsible for ongoing INR monitoring, advice should be taken from secondary care anticoagulant clinics. If patients are noncompliant with monitoring, GPs should be advised to suspend further prescriptions for anticoagulants until monitoring is up to date. Patients should be contacted urgently if anticoagulant therapy is discontinued for this reason and the clinical consequences should be fully explained;
- Ensure procedures are in place in hospitals to identify when supplementary medicine charts (e.g. warfarin charts) are in use and to cross-check prescribing systems/formats on transfer between departments or care settings;
- As local anticoagulant procedures may differ, and warfarin may be supplied and dosed either in only one strength or multiple-strength tablets, the total dose and the number of tablets of each strength to self-administer should be clearly communicated to the patient;
- Patients must be educated about how to administer their anticoagulant medicine safely, and understand possible side effects and when to contact the clinic for further advice. They must be advised to regularly attend the anticoagulation clinic.

For guidance on actions that can make anticoagulant therapy safer (including direct-acting anticoagulants), readers are directed to information from the Specialist Pharmacy Service[14],[15],[16],[17].

3. **Opioid analgesics**

Opioid medicines include diamorphine, morphine, codeine, fentanyl, oxycodone and methadone. More than 450 patients died after being prescribed opioid medicines unsafely at Gosport War Memorial Hospital[18]and opioid analgesics are associated with the development of tolerance and, in some cases, dependence.

Example incident

A patient was prescribed MST (morphine) 60mg twice per day for arthritic pain as an initial dose. Prior to this, the patient was using tramadol 50mg three times per day for analgesia. After taking four doses of MST, the patient was confused, hallucinating and drowsy. The patient was admitted to hospital and stayed for six days after receiving naloxone[19].

Actions to minimise the risks

- In the hospital setting, guidelines, electronic order sets and education to support appropriate dosing of opioids, especially in opioid-naive patients, should always be available;
- Patients and carers should be involved in confirming pre-admission concordance against GP records;
- When initiating opioids in primary care, discuss the risks and benefits of treatment with the patient and ensure that the quantities issued reflect the patient's average daily use to prevent stockpiling of medicines at home and possible overdose. Undertake regular reviews to ensure the treatment is appropriate and effective;
- Check dose equivalence when changing from one opioid to another or finding appropriate starting doses for opioid-naive patients. Contact the prescriber if the starting dose is too high or if the dose has increased by 50% or more from previous dose;
- Remember that underdosing may also cause harm.

National guidance on the safe prescribing and dispensing of opioid medicine is available from the National Patient Saftey Agency (NPSA; now NHS Improvement), Specialist Pharmacy Services and others[19],[20],[21].

4. **Insulin**

According to NHS Digital, almost a third of inpatients with diabetes experience a medication error during their hospital stay[22].

Example incident

A patient admitted from a nursing home was prescribed Humalog® insulin 20 units in the morning and 8 units in the evening, according to the documentation from the nursing home. This looked unusual to the pharmacist, who checked with the nursing home and confirmed that the prescription should have been for Humalog Mix25™ (25% quick-acting insulin and 75% intermediate-acting insulin). The patient had been given the wrong prescription, resulting in hypoglycaemia, which was reversed with intravenous dextrose[9]*.*

Actions to minimise the risks

- When insulin is prescribed, dispensed or administered, healthcare professionals should cross-reference available information to confirm the correct identity of insulin products[23];
- Inpatients with diabetes are less likely to have medication errors if electronic patient records or electronic prescribing are used. Diabetes UK has produced guidance on improving insulin safety in hospitals[24],[25];
- In primary care, patients with diabetes should have regular reviews, including discussions on any changes in their insulin treatment. Requests for a change in prescribed insulins should be confirmed with the diabetes clinic to check this is intentional, and with the patient to ensure they are aware that a different insulin is about to be prescribed and know how to use the new insulin safely;
- When dispensing, pharmacists should confirm that the patient is expecting to change to a new insulin following a clinical review of their diabetes. Patients should be shown what is being dispensed to verify that the insulin being supplied is what they are expecting[23];
- In the hospital setting, guidance for prescribing, preparing and obtaining appropriate intravenous insulin infusions for both hyperkalaemia and diabetes (continuous intravenous insulin infusions) should be produced or made available. Ready-to-administer formulations should be considered and clinical guidelines should align with prescribing templates and drug error-reduction software on pumps[26].

  The European Medicines Agency has issued guidance on prevention of medication errors with high-strength insulins[27].

5. **Nonsteroidal anti-inflammatory drugs**

Nonsteroidal anti-inflammatory drugs (NSAIDs) are responsible for 30% of hospital admissions for ADRs, mainly owing to bleeding, heart attack, stroke and kidney damage[28].

Example incident

The patient was admitted via the emergency department and was being investigated for cancer and vasculitis. They received high-dose oral prednisolone, high-dose intravenous methylprednisolone, aspirin 75mg, and then aspirin 300mg and ibuprofen 400mg three times per day. The patient was seen by many doctors and pharmacists, but no gastric protection was prescribed until after the patient had

undergone surgery for a perforated ulcer. The patient was admitted to the intensive therapy unit where they deteriorated and died[7].

Actions to minimise the risks

- The simplest and most effective way to reduce risk from NSAIDs is to avoid their use in older people and those at higher risk by prescribing an alternative whenever possible. The National Institute for Health and Care Excellence (NICE) recommends using paracetamol, a topical NSAID or opioid analgesics, depending on the person's individual risk factors for adverse effects, for pain relief in older people[29];
- When use of NSAIDs cannot be avoided, they should be prescribed at the lowest effective dose for the shortest possible duration[29];
- Gastroprotection using a proton pump inhibitor is indicated when there is an increased risk of gastrointestinal adverse effects (e.g. in older people or in patients who require long-term treatment)[29],[30];
- More frequent review and monitoring for adverse effects is required in patients taking long-term NSAIDs[29];
- IT systems using 'trigger tools' are capable of systematically identifying patients of older ages who are at high risk of bleeding and cardiovascular disease to allow clinical review[30].

6. **Drugs that require regular blood test monitoring**

A variety of drugs, including angiotensin-converting enzyme inhibitors, clozapine, digoxin, gentamicin, lithium, loop diuretics, clozapine, methotrexate and mirtazapine, require regular blood test monitoring.

Example incident

An 80-year-old patient receiving long-term ACE inhibitors and a loop diuretic to treat hypertension did not receive any urea and electrolyte monitoring in the previous 15 months and was at risk of impaired kidney function[30].

Actions to minimise the risks

- A drug-monitoring plan should be documented when first prescribing the medicine. Blood tests should be undertaken according to the plan, the results reviewed and the prescription modified when required. For newly initiated long-term medicines, guidance on drug monitoring should be included in GP letters and/or shared care guidelines should be used;
- Set up patient 'recalls' in GP systems for when blood tests are due. Medicines should not be reauthorised beyond these dates. Further information can be added as prescription notes detailing monitoring requirements and can act as a prompt for colleagues when issuing prescriptions;
- Community pharmacy teams should check that patients who have been prescribed medicines that require monitoring are actually receiving the necessary monitoring.

  For guidance on monitoring medicines in general practice, see the Specialist Pharmacy Service's suggestions for drug monitoring in adults in primary care[31] and the NPSA for the safer use of some individual medicines[32],[33].

7. **Known allergy to medicine, including antibiotics**

Each year, patients with known and documented allergies to medicines are exposed to them and suffer preventable adverse events[7],[9]. Adverse reactions to penicillin have been reported in up to 5.0% of individuals on a given course of treatment[34].

Example incident

The patient was prescribed trimethoprim. They collapsed and arrested shortly afterwards. The arrest included entering into a ventricular fibrillation rhythm, which required defibrillation. The prescription stated that the patient was allergic to Septrin® (Aspen) and penicillin. Anaphylactic shock was given as a probable diagnosis[8].

Actions to minimise the risks

- NICE guidelines state that drug allergy status should be documented in medical records (including community pharmacy patient medication records) as soon as possible using defined terms: 'drug allergy', 'none known' or 'unable to ascertain'[35]. Blank entries in the allergy field have no meaning;
- If a drug allergy is present, record all of the following: the drug's name; the signs, symptoms and severity of the reaction; and the date when the reaction occurred.

Prescriptions (paper or electronic) used in any healthcare setting should also include drug allergy information[35];

- Allergy status should be checked before a new medicine is prescribed, dispensed or administered by a healthcare professional. When patients attend medicine reviews, it is essential that their allergy status is confirmed and updated. The patient should be informed of what has been documented in their records, so they are able to recall all the necessary information, including the name of the drug and the nature of the allergy.

8. **Drug interactions**

Drug interactions can reduce the efficacy of a drug or increase the adverse effects of a drug. Pharmacists and healthcare professionals need to recognise and understand which drug interactions can result in significant patient harm.

Example incident

The patient had a cardiac arrest with unclear aetiology, leading to admission to intensive care. A digoxin blood level was taken as the patient was on a high dose while on clarithromycin. Results showed digoxin toxicity. A review of past prescriptions show that the patient has been receiving in total the equivalent of several loading doses of digoxin, which ultimately led to this toxic level. In addition, the patient was on antibiotics known to change digoxin levels[7].

Actions to minimise the risks

- Prescribing procedures should be reviewed to ensure they describe how medicine interactions are screened, by the prescriber and others, using specified information resources[36],[37];
- Electronic prescribing systems and community pharmacy patient medication record systems may provide alerts of interactions; however, medicines that have been prescribed in hospital, for clinical trials, for home care service or purchased over the counter may not be included in interaction checking. It is important that any medicines the patient is taking are documented in these systems so that electronic and/or manual checks can be performed.

  NICE and the *BNF* have produced guidance on clinically significant drug interactions, which includes the level of severity of the interaction (i.e. severe, moderate, mild and unknown) and the level of evidence (i.e. study, anecdotal or theoretical)[36],[37].

9. **Loading doses**

Loading doses are complex to prescribe because they require multiple-step calculations using information about the patient, their medicine and any frequent changes of dose, or frequency of administration. Loading doses may be miscalculated, additional doses continued in error, maintenance and loading doses prescribed at the same time, or loading or maintenance doses may not be prescribed[38].

Example incident

The patient was discharged from a cardiology clinic with 200mg amiodarone three-times daily for one week, after which it would then be reduced to 200mg once daily. This was clearly written in the clinic letter. When readmitted, the patient was still on the loading dose of amiodarone. This was not noticed by the GP or pharmacist[38].

Actions to minimise the risks

- Ensure effective communication regarding loading dose and subsequent maintenance dose regimens when prescribing, dispensing or administering critical medicines. This should include handover of patients between healthcare organisations. Tools such as loading dose worksheets, loading dose prescription charts, handover and clinical protocols, and patient-held information should be considered[38];
- In hospital, always check previous charts or treatment pathways after transfer. Emergency departments, interventional radiology and anaesthetics should be supported with clear procedures on documentation of medicines for inpatients;
- If there are any changes to loading doses after discharge from secondary care, patient understanding should be checked via face-to-face reviews or a phone call to ensure they can use their new medicines safely. This can be delegated to pharmacy teams within the general practice to follow up on;
- When dispensing prescriptions for medicines with loading doses, query with prescribers when unexpectedly high doses are prescribed or higher-than-normal doses are continued.

  National guidance is available on reducing harms from errors with loading doses of intravenous phenytoin[39].

10. **Oxygen**

Oxygen should be regarded as a drug. It is prescribed for hypoxaemic patients to increase alveolar oxygen tension and decrease the work of breathing. The concentration of oxygen required depends on the condition being treated; the administration of an inappropriate concentration of oxygen can have serious or even fatal consequences[40].

Example incident

A patient was admitted with an acute episode of COPD and type 2 respiratory failure. The COPD admission treatment bundle was not used. Although it was clearly documented in the notes that the patient's target saturation range should be kept at 88–92%, oxygen was not prescribed. The patient was given 3L of uncontrolled oxygen throughout the night, with blood saturation recorded at 97–98% with no attempt to down-titrate their oxygen. When further reviewed, the patient was obtunded (altered level of consciousness) and in extremis. A blood gas was taken immediately, which showed pH 7.166 and arterial carbon dioxide of 13kPa[7].

Actions to minimise the risks

- Oxygen should be prescribed to achieve a target saturation of 94–98% for most acutely ill patients or an 88–92% patient-specific target range for those at risk of hypercapnic respiratory failure. The target saturation should be written (or ringed) on the drug chart, or entered in an electronic prescribing system[40],[41];
- Best practice is to prescribe a target range for all hospital patients at the time of admission so that appropriate oxygen therapy can be started in the event of unexpected clinical deterioration with hypoxaemia and to ensure that the oximetry section of the early-warning scale can be adjusted appropriately[42];
- In the hospital, intervention should always be made when patients are seen receiving oxygen without a prescription. Patient Group Directions may be a reasonable option for initiation and short-term management of an emergency but should include a clear referral step to a medical or non-medical prescriber.

References:

[1] Dornan T, Ashcroft D, Heathfield H *et al*. Final report: An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study. 2009. Available at: https://www.gmc-uk.org/-/media/documents/FINAL_Report_prevalence_and_causes_of_prescribing_errors.pdf_28935150.pdf(accessed February 2019)

[2] Avery T, Barber N, Ghaleb M *et al*. Investigating the prevalence and causes of prescribing errors in general practice: The PRACtICe study. 2012. Available at: https://www.gmc-uk.org/-/media/about/investigatingtheprevalenceandcausesofprescribingerrorsingeneralpracticethepracticestudyreoprtmay2012.pdf?la=en&hash=62C1821CA5CCC5A4868B86A83FEDE14283686C29 (accessed February 2019)

[3] Avery AJ, Galeb M, Barber N *et al*. The prevalence and nature of prescribing and monitoring errors in English general practice: a retrospective case note review. *Br J Gen Pract*2013;63(613):e543–e553. doi: 10.3399/bjgp13X670679

[4] Elliott RA, Camacho E, Campbell F *et al*. Burden of medication errors in the NHS in England: Rapid evidence synthesis and economic analysis of the prevalence and burden of medication error in the UK. 2018. Available at: http://www.eepru.org.uk/wp-content/uploads/2018/02/eepru-report-medication-error-feb-2018.pdf (accessed February 2019)

[5] NHS Resolution. Response to a freedom of information request for prescribing error claims data. 26 November 2018

[6] Wratton C. Prescription errors. 2016. Available at: https://mdujournal.themdu.com/issue-archive/issue-5/prescription-errors (accessed February 2019)

[7] NHS Improvement. Response to freedom of information request for prescribing error incidents reported to the National Reporting and Learning Service for 2017. 23 November 2018

[8] National Patient Safety Agency. Safety in doses. Improving the use of medicine in the NHS. 2009. Available at: https://webarchive.nationalarchives.gov.uk/20171030132153/http://www.nrls.npsa.nhs.uk/resources/patient-safety-topics/medication-safety/?entryid45=61625&p=2 (accessed February 2019)

[9] National Patient Safety Agency. Safety in doses. 2007. Available at: https://webarchive.nationalarchives.gov.uk/20171030132153/http://www.nrls.npsa.nhs.uk/resources/patient-safety-topics/medication-safety/?entryid45=61625&p=2 (accessed February 2019)

[10] Medicines and Healthcare products Regulatory Agency. Response to freedom of information request for prescribing error incidents reported for 2017. 28 November 2018

[11] National Patient Safety Agency. Rapid response report. Reducing harm from omitted and delayed medicines in hospitals in 2010. 2010. Available at: https://www.sps.nhs.uk/articles/npsa-alert-reducing-harm-from-omitted-and-delayed-medicines-in-hospital-2010 (accessed February 2019)

[12] Specialist Pharmacy Service. Reducing harm from missed or omitted and delayed medicines in hospital. Tools to support local implementation. 2018. Available at: https://www.sps.nhs.uk/articles/npsa-rapid-response-report-reducing-harm-from-omitted-and-delayed-medicines-in-hospital-a-tool-to-support-local-implementation (accessed February 2019)

[13] Cadman B, Wright D, Bale A *et al*. Pharmacist provided medicines reconciliation within 24 hours of admission and on discharge: A randomised controlled pilot study. *BMJ Open*2017;7(3):e013647. doi: 10.1136/bmjopen-2016-013647

[14] Specialist Pharmacy Service. Anticoagulant therapy resource to support: patient safety alert 18: actions that can make anticoagulant therapy safer. 2018. Available at: https://www.sps.nhs.uk/wp-content/uploads/2011/08/Implementing-Patient-Safety-Alert-18-anticoagulant-therapy-resource-May-2018.pdf (accessed February 2019)

[15] Specialist Pharmacy Service. Community pharmacy oral anticoagulant safety audit. 2017. Available at: https://www.sps.nhs.uk/wp-content/uploads/2017/09/Oral-anticoagulant-safety-audit-Sept-2017-vs1a.pdf (accessed February 2019)

[16] Specialist Pharmacy Service. New practice guide for DOACs in renal impairment. 2018. Available at: https://www.bjpcn.com/browse/have-you-heard/item/2252-new-practice-guide-for-doacs-in-renal-impairment.html (accessed February 2019)

[17] Specialist Pharmacy Service. Protocol for appropriate prescribing of direct acting oral anticoagulants (DOACs) and management of haemorrhage in surgical patients. Available at: https://www.sps.nhs.uk/wp-content/uploads/2018/02/PH035-Direct-Acting-Oral-Anticoagulants-DOAC-v3-Dec-16-8-1s1.2.d-2s1.1.d.pdf (accessed February 2019)

[18] The Gosport Independent Panel. Gosport War Memorial Hospital: The report of the Gosport Independent Panel. 2018. Available at: https://www.gosportpanel.independent.gov.uk/media/documents/070618_CCS207_CCS03183220761_Gosport_Inquiry_Whole_Document.pdf(accessed February 2019)

[19] National Patient Safety Agency. Rapid response report. Reducing dosing errors with opioid medicines. 2008. Available at: https://www.sps.nhs.uk/wp-content/uploads/2018/02/NRLS-1066-Opioid-Medicines-RRR-2008-07-04-v1.pdf (accessed February 2019)

[20] Cousins D, Gerrett D & Warner B. A review of controlled drug incidents reported to the NRLS over seven years. *Pharm J* 2013;291:647. doi: 10.1211/PJ.2013.11132045 (accessed February 2019)

[21] Specialist Pharmacy Services. What are the equivalent doses of oral morphine to other oral opioids when used as analgesics in adult palliative care? 2018. Available at: https://www.sps.nhs.uk/articles/what-are-the-equivalent-doses-of-oral-morphine-to-other-oral-opioids-when-used-as-analgesics-in-adult-palliative-care-2/ (accessed February 2019)

[22] The National Diabetes Inpatient Audit Team. National Diabetes Inpatient Audit (NaDIA) — 2017. 2018. Available at: https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017 (accessed February 2019)

[23] National Patient Safety Agency. Patient safety alert. The adult patient's passport to safer use of insulin. 2011. Available at: https://www.sps.nhs.uk/articles/npsa-alert-the-adult-patients-passport-to-safer-use-of-insulin-2011/ (accessed February 2019)

[24] Diabetes UK. Improving insulin safety in hospitals. 2017. Available at: https://www.diabetes.org.uk/resources-s3/2017-10/InsulinSafety.pdf (accessed February 2019)

[25] Diabetes UK. Improve the management of inpatients on insulin. 2017. Available at: https://www.diabetes.org.uk/resources-s3/2017-10/Improve%20the%20management%20of%20inpatients%20on%20insulin%20final_0.pdf(accessed February 2019)

[26] NHS Improvement. Patient safety alert. Resources to support safe and timely management of hyperkalaemia (high level of potassium in the blood). 2018. Available at: https://improvement.nhs.uk/documents/3121/Patient_Safety_Alert_-_Resources_to_support_safe_management_of_hyperkalaemia.pdf (accessed February 2019)

[27] European Medicines Agency. Guidance on prevention of medication errors with high-strength insulins. 2015. Available at: https://www.ema.europa.eu/documents/medication-error/insulins-high-strength-guidance-prevention-medication-errors_en.pdf (accessed February 2019)

[28] Pirmohamed M, James S, Meakin S *et al*. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18,820 patients. *BMJ* 2004;329(7456):15–19. doi: 10.1136/bmj.329.7456.15

[29] National Institute for Health and Care Excellence. Clinical Knowledge Summaries: NSAIDs — prescribing issues. 2018. Available at: https://cks.nice.org.uk/nsaids-prescribing-issues#!scenario (accessed February 2019)

[30] Avery AJ, Rodgers S, Cantrill JA *et al.* A pharmacist-led information technology intervention for medication errors (PINCER): a multicentre, cluster randomised, controlled trial and cost-effectiveness analysis. *Lancet* 2012;379(9823):1310–1319. doi: 10.1016/S0140-6736(11)61817-5

[31] Specialist Pharmacy Service. Suggestions for drug monitoring in adults in primary care. 2017. Available at: https://www.sps.nhs.uk/wp-content/uploads/2017/12/Drug-monitoring-2017.pdf (accessed February 2019)

[32] National Patient Safety Agency. Patient safety alert. Safer lithium therapy. 2009. Available at: https://www.sps.nhs.uk/articles/npsa-alert-safer-lithium-therapy-2009 (accessed February 2019)

[33] National Patient Safety Agency. Patient safety alert. Improving guidance on oral methotrexate guidance. 2006. Available at: https://www.sps.nhs.uk/articles/npsa-alert-improving-compliance-with-oral-methotrexate-guidelines-2006/ (accessed February 2019)

[34] Jethwa S. Penicillin allergy: identification and management. *Pharm J* 2015;295(7878):185–187. doi: 10.1211/PJ.2015.20069170

[35] National Institute for Health and Care Excellence. Drug allergy: diagnosis and management. Clinical guideline [CG183]. 2014. Available at: https://www.nice.org.uk/guidance/cg183(accessed February 2019)

[36] National Institute for Health and Care Excellence & The British National Formulary. General interaction information. 2017. Available at: https://bnf.nice.org.uk/interaction/introduction.html(accessed February 2019)

[37] National Institute for Health and Care Excellence & The British National Formulary. Drug Interactions. Available at: https://bnf.nice.org.uk/interaction (accessed February 2019)

[38] National Patient Safety Agency. Patient safety alert. Preventing fatalities from medication loading doses. 2010. Available at: https://www.sps.nhs.uk/articles/ npsa-alert-preventing-fatalities-from-medication-loading-doses-2010 (accessed February 2019)

[39] NHS England. Patient Safety Alert. Risk of death and severe harm from error with injectable phenytoin. 2016. Available at: https://improvement.nhs.uk/documents/496/Patient_Safety_Alert_-_Risk_of_error_with_injectable_phenytoin_v2.pdf (accessed February 2019)

[40] National Institute for Health and Care Excellence. Treatment summary: Oxygen. Available at: https://bnf.nice.org.uk/treatment-summary/oxygen.html (accessed February 2019)

[41] National Patient Safety Agency. Rapid response report. Oxygen safety in hospitals. 2009. Available at: https://www.sps.nhs.uk/articles/archived-sept-2015-rrr006-oxygen-safety-in-hospitals-d-npsa-d-september-2009 (accessed February 2019)

[42] O'Driscoll BR, Howard LS, Earis J & Mak V; on behalf of the British Thoracic Society Emergency Oxygen Guideline Development Group. Guideline for oxygen use in adults in healthcare and emergency settings. *BMJ Open* 2016;4(1):e000170. doi: 10.1136/bmjresp-2016-000170

Citation: *The Pharmaceutical Journal*, February 2019, Vol 302, No 7922, online | DOI: 10.1211/PJ.2019.20206123