Practices to Support Safer Use of Medicines in Hospitals

Purpose
The purpose of this resource is to assist hospitals wishing to improve medicines safety by highlighting practices that may help improve the overall safety of processes involved in medicines prescribing, delivery and administration to patients. It may be used to support whole or part process redesign or for targeting risk reduction strategies to high risk areas that have been identified by examining trends using combined methods of internal monitoring that may include patient safety incident reports, prospective prescription review, retrospective case note review and clinical audit.

Background
Errors in healthcare are common and are a largely preventable cause of harm to patients\(^1\). In the UK an estimated 850,000 adverse events occur annually in NHS hospitals, affecting 10% of patients and resulting in £2 billion direct costs in additional hospital days alone, of which half may be avoidable\(^2\). There may also be great personal costs to the people involved, together with an undermining of public confidence. In a six year period between 2005 and 2010, the National Patient Safety Agency received 525,186 reports of patient safety incidents (PSI) (any unintended or unexpected incident, which could have or did lead to harm for one or more patients receiving NHS care). Of these incidents, 86,821 (16%) reported actual patient harm, 822 (0.9%) resulted in death or severe harm.\(^3\)

Approximately 80% of errors are thought to be system derived and usually result from poorly designed processes or conditions, leading people to make mistakes or fail to prevent them, rather than individual recklessness\(^4\). Errors of commission, the act of doing something incorrectly such as misreading a label, are thought, under normal circumstances that do not include stress and time pressures, to occur about 3 times in 1,000. Errors of omission, something that should have been done but was not done, in the absence of reminders, occur about 1 time in 100\(^6\).

An error or failure in process involving medicines may start a chain of events that leads ultimately to a medication administration error (MAE) or an adverse drug reaction (ADR). A MAE has been defined as a deviation from the prescriber’s medication order as written on the patient’s chart, manufacturers’ preparation/administration instructions or relevant organisation’s policies\(^5\) whereas under the EU Directive 2010/84/EU\(^6\) that came into force in July 2012, the term ‘adverse drug reaction’ (ADR) is defined as, ‘a response to a medicinal product that is noxious and unintended effects resulting not only from the authorised use of a medicinal product at normal doses, but also from medication errors and uses outside the terms of the marketing authorisation, including the misuse, off-label use and abuse of the medicinal product.’

Processes for delivering and administering medicines to patients are becoming more complex and involve multiple steps. It has been estimated that the process for fulfilling a prescription for a patients’ medication can involve up to 50 steps\(^1\), any one of which has a potential for error. To reduce the likelihood of error the number of steps must be decreased or the reliability of each step increased, or both.
As a standard process, delivering medicines to patients involves three major stages for which different staff groups have primary responsibility:

<table>
<thead>
<tr>
<th>Process stage</th>
<th>Published error rate</th>
<th>% PSIs reported to NRLS 2005-2010</th>
<th>Primarily responsible staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribing</td>
<td>7% of prescription items</td>
<td>18.5%</td>
<td>Medical &amp; Non-medical prescribers</td>
</tr>
<tr>
<td>Preparation and dispensing</td>
<td>0.02-2.7% of dispensed medicines</td>
<td>16.5%</td>
<td>Pharmacy</td>
</tr>
<tr>
<td>Administration</td>
<td>3-8% of medicines administered</td>
<td>50%</td>
<td>Nursing</td>
</tr>
</tbody>
</table>

PSI= Patient Safety Incident, NRLS = National Reporting & Learning System

Prescribing errors (PE’s) include errors made during the act of writing the prescription, and prescribing faults which relate to irrational prescribing, inappropriate prescribing, under-prescribing, over-prescribing and ineffective prescribing, arising from erroneous medical judgement or decisions concerning treatment or treatment monitoring. A systematic review of prescribing errors in hospital inpatients reported a median prescribing error rate of 7% of medication orders, 52 errors per 100 admissions and 24 errors per 1000 patient days and concluded that overall, prescribing errors are a common occurrence, affecting 7% of medication orders, 2% of patient days and 50% of hospital admissions. In terms of serious prescribing errors, one study suggested 42% arose in prescription writing and 58% originated in the prescribing decision. A further systematic review looking at causality of prescribing errors concluded that errors are usually multifactorial with several active failure and error-provoking situations often acting together to cause them.

Medicines administration is the final point for error detection before the medicine reaches the patient. It is a highly vulnerable stage of medicines delivery due to the multiple opportunities for incidents to occur and it is regarded as predominantly a nursing responsibility. The worldwide median error rate of MAEs has been reported as 19.6% of total opportunities for errors including wrong-time errors and 8% without timing errors. UK medication incident data suggests that the majority of patient harms and deaths occur at the administration stage. Omitted and delayed doses are the most common category of error reported to the NRLS. The Nursing and Midwifery Council (NMC) has set standards for safe practice in the management and administration of medicines by registered nurses, midwives and specialist community public health nurses. However, because human factors and systems weaknesses contribute to errors, safe medicines practice must also rely on the interdisciplinary efforts of the many individuals involved in the processes and the design and implementation of reliable systems throughout the whole organisation.

Whilst most efforts in error reduction are typically centred on the process during the inpatient stay, hospital discharge is a transition of care where medication discrepancies are also likely to occur and potentially cause patient harm. Errors of omission and over-prescribing have been commonly reported during transfer of care. Furthermore, it has been suggested that ADRs may occur in 12% to 17% of patients after hospital discharge. Hospital discharge/transfer of care should therefore be considered a fourth stage in the medicines process.
The primary objective of systems design for safety is to make it difficult for people to err. Mechanisms are required for recognising and correcting errors when they occur and before they reach the patient.

<table>
<thead>
<tr>
<th>Key areas where system weaknesses and failures can lead directly to medication errors(^{18});</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of information about the patient</td>
</tr>
<tr>
<td>• Lack of information about the medicine</td>
</tr>
<tr>
<td>• Communication and teamwork failures</td>
</tr>
<tr>
<td>• Unclear, look a-like or absent labels on medicines and packages, and confusing or look-alike, or sound-alike names</td>
</tr>
<tr>
<td>• Unsafe medicines standardisation, storage and distribution</td>
</tr>
<tr>
<td>• Non-standard, flawed or unsafe medicine delivery devices</td>
</tr>
<tr>
<td>• Environmental factors and staffing pattern that do not support safety</td>
</tr>
<tr>
<td>• Inadequate staff orientation, on-going education, supervision and competency validation</td>
</tr>
<tr>
<td>• Inadequate patient education about medicines and medication errors</td>
</tr>
<tr>
<td>• Lack of a supportive culture of safety, failure to learn from mistakes, and failed or absent error reduction strategies</td>
</tr>
</tbody>
</table>

The ability to understand and apply medication error research into practice has been limited by inconsistencies in study methods which have led to variability in medication error rates\(^5\). Hence, large scale information on the beneficial effects of interventions aimed at reducing harm from medication errors, although needed, is not yet available. Whilst systems-orientated interventions increase awareness of risk amongst healthcare professionals\(^{19}\), interventions aimed at improving knowledge, skills and reducing complexity may also be highly advisable. Understanding human factors and their impact on the design of systems, workflow and communication are likely to be vital in delivering change.

In this resource practices supported by published evidence are referenced, however most of the advice provided is pragmatic and based on common sense. Much is adapted from work in the United States published online by the Institute of Health Improvement [IHI Home Page](http://www.ihi.org) and in print by the American Pharmacists Association\(^{18}\).
Getting started

1. **Review the clinical governance of medication error reporting and learning.**
   Are systems in place that reflect best practice outlined in Patient Safety Alert NHS/PSA/D2014/005\(^2\) and provide the organisation with the maximum opportunity to learn from medication incidents?

   ✓ Is there a Board level Director with responsibility to oversee medication error incident reporting and learning?

   ✓ Is there a Medication Safety Officer (MSO) who supports local medication error reporting and learning and acts as the main contact for NHS England and the MHRA?

   ✓ Does a multi-disciplinary group meet regularly to:
     ✓ review medication error incident reports,
     ✓ improve reporting (internally, to the NRLS and MRHA),
     ✓ improve learning
     ✓ Implement local action to improve medication safety?

2. **Determine the priority areas**
   Identify and prioritise the most common types and causes of reported medication related clinical incidents. Be aware that voluntary incident reporting systems may for a variety of reasons grossly under-report patient safety incidents\(^2\), including both prescribing errors (PEs)\(^2\),\(^3\) and medication administration errors (MAEs)\(^4\) and can give very different findings to clinical audit or case notes review. To gain a clearer picture of medication related errors a combination of different methods is required\(^5\).

   ✓ Review local medication safety incident reports to identify any specific patterns or trends

   ✓ Review pharmacist’s documentation of errors identified during routine prescription monitoring

   ✓ Review the results of relevant clinical audits or retrospective case note reviews

   ✓ Discuss medicines safety issues with risk management and clinical effectiveness leads to understand any information that is available on specific medication related risks

**Resources**

- Proposed strategy for reporting medication Incidents in acute hospitals [MUSLINK](#)
- Capturing and Using Pharmacy Contribution Data :A resource to share experience, systems, documentation and outcomes [MUSLINK](#)
3. **Use established tools to help identify which stage of the process to focus efforts upon**

   Apply [root cause analysis (RCA)](link) or [failure modes and effects analysis (FMEA)](link) to identify the causes of the problems so that you can be sure you are focusing your efforts on tackling the true sources of the problem and not just its symptoms. However, be aware that most errors are multifactorial and so there are likely to be several underlying causes which may need addressing.

   Use [cause and effect (fishbone) diagrams](link) to help explore all potential or real causes that result in the problem.

   Consider the implications of [patient flow](link)

4. **Refer to best practice examples outlined in following tables**

   **NOTE:**
   Many of the strategies overlap and are inter-dependent.

   Evidence suggests to maximise effectiveness a multifaceted approach is often needed.

   It is recommended that users do not read, or seek to implement, a single strategy in isolation, but read the whole document and then consider an appropriate range of strategies as required.
Index

<table>
<thead>
<tr>
<th>Stage</th>
<th>Best Practice</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Prescribing</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accurately verify medication history on admission using medicines reconciliation (MR)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Verify allergy information on admission and record it prior to medicines being prescribed</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Use standard prescription charts or electronic prescribing systems</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Develop Standard Prescribing Protocols</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Target High Risk medicines</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Ensure pharmacists verify prescriptions for accuracy and clinical appropriateness prior to dispensing and administration</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Pay particular attention to prescribing for children</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Implement a parenteral infusion safety initiative</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Check multiple clinical variables when prescribing medicines</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Use validated tools to help target inappropriate prescribing</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Improve prescriber’s knowledge through education and the use of prescribing reference materials and aids</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td><strong>Procurement/ Storage/ Prescription Verification</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implement a purchasing for safety strategy for medicines</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Implement a robust policy for safe and secure storage and handling of medicines</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Integrate pharmacy staff into clinical teams</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td><strong>Administration to patient</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confirm patient identity before administering medicines</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Involve patients as active partners in their care</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Conduct independent double checks on high risk medicines and/or dosage calculations before administration</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Identify patients with dysphagia (swallowing difficulties) as needing extra care</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Reduce interruptions and distractions to nurses during medicines administration</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Implement medication administration technologies (MATs)</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Target delayed and omitted doses</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Improve knowledge of those administering medicines by education and the use of reference materials and aids</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td><strong>Discharge and transfer of care</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Involve ward based pharmacy staff in early stages of individual patient discharge planning</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Use pharmacy staff to provide information to patients, their carers or care home staff about their medicines in preparation for discharge</td>
<td>27</td>
</tr>
</tbody>
</table>
Accurately verify medication history on admission using medicines reconciliation (MR)

**Rationale/Evidence base**

Prescribing errors occur most commonly on admission\(^1\). These errors may be transferred to prescription charts and subsequently result in errors in administration to patients. In accurate medication history taking can cause omission of treatment resulting in potential harm in more than one-third of patients taking more than four medicines\(^2\). Interventions to improve MR are likely to be a cost effective use of NHS Resource\(^27,28\).

**Tips**

- Pharmacist-led MR is likely to be the most cost effective intervention\(^26,29\).
- Consider using pharmacy technicians to support pharmacists.
- Ensure the MR process starts when the patient is admitted to the hospital, continues whenever the patient is transferred to a different level of care, and occurs again when the patient is discharged from the hospital\(^30\).
- Consider targeting patients at highest risk for an ADE, such as older people, those on high numbers of medicines and those with multiple co-morbidities \(^29\).
- Ensure the MR process involves all three ‘C’ steps: Collection (of the medication history), Clarification (ensuring that the medications and doses are appropriate), Communication (including documentation of changes in the prescription).
- Incorporate interaction with patient/carer and inspection of patient’s own drugs (PODs) into verification procedure. Do not rely solely on electronically obtained lists.
- Promote cross sector engagement to use Green Bags to encourage patients to bring their own drugs (PODs) into hospital.
- Enquire about use of non-prescription (over-the-counter) medicines, including herbal and alternative medicines.
- Ask about adherence to current medication.
- Use MR as an opportunity to educate patients about their medicines.
- Develop guides/pamphlets about the why and how of medication reconciliation for staff and patients.
- Accept that no single universal process will meet the needs of all hospital patients. Consider developing different processes based on the point of entry and the patient population.
- Determine who is responsible for the different steps of the medication reconciliation process, clearly define the parameters of their responsibility taking account of demonstrated competency and hold staff, including clinicians, in those positions accountable.
- Develop a process that makes it easy to complete MR; this may include the use of a form, but understand that a form is only a tool to help document and guide the process. Recognise that medication reconciliation is at its core is a critical thinking process.
- If a form is not being used, or not used as designed, ask the intended users why this is happening, rather than continuing to use education and training to promote compliance.
- Do not develop MR processes in committee; engage frontline staff and clinicians.
- Provide appropriate training and education for staff. Training can take the form of simulation and hands-on education. Include techniques for interviewing patients to obtain a medication list.
- Establish communication links with nursing homes and GP practices. Collaborate with long-term care and home care facilities to develop an efficient and effective process for both the hospital and facilities.

**Resources**

- Resources (UK) to support implementation of MR [MUSLINK](#)
- How to Guide: Prevent Adverse Drug Events by implementing Medication Reconciliation 2011. (USA IHI) [LINK](#)
- “How to” Guide: Keeping patient’s medicines with them: Optimising the transfer and use of medicines as patients move around organisations and between care settings [MUSLINK](#)
- Moving Medicines Safely: Implementing and sustaining a ‘Green Bag’ Scheme [MUSLINK](#)
Verify allergy & hypersensitivity information on admission and record it prior to medicines being prescribed

Rationale/Evidence base
Lack of current allergy information can lead to the prescribing and administration of a medication to which a patient is formerly known to be allergic, with a significant mortality rate. The WHO suggests 10% of all ADRs are unpredictable hypersensitivity reactions. Both under-diagnosis due to under-recording and over-diagnosis due to inappropriate use of the term "allergy" are common. Studies have reported failure to document allergies in 13% to 30% cases and incorrect record of allergy in 0.5% to 6.8% cases. Patients often self-report vague histories of medication allergies and it has been suggested that only 6-10% have actual allergies, and of these 30% can be positively confirmed. Wrongly labeling a patient as allergic to a drug may be harmful and lead to the use of less effective and more expensive alternative medicines. It has been estimated that 10% patients treated with beta lactam antibiotics will suffer ADRs which are allergic reactions, however, when patients labeled as allergic have been studied 90% of them had been wrongly diagnosed. In the US, reactions to penicillin have been reported as accounting for 75% of deaths attributable to drug allergies.

Tips
- Record information immediately on admission. Ensure allergy information follows the patient.
- Patients reviewed on admission by pharmacists were less likely to have inadequate documentation of allergies.
- Develop a standard clinical process for recording allergies that identifies which clinicians are responsible for assessing medication allergies, how the assessment is to be performed (how to distinguish clearly between allergic reactions and adverse events, including cross allergies), where the information is to be recorded and how it should be updated.
- Record 'not able to obtain' where information is unobtainable (e.g., unconscious patients); recording 'No Known Drug Allergies (NKDA) is misleading in these situations.
- Aim to have a single reliable up-to-date record of allergy information for each patient.
- Minimise the number of places where up-to-date allergies are recorded when using paper systems.
- Consider using drug charts with cut away sections for allergy documentation so that it is visible on every page.
- Make information visible at point of care to anyone prescribing or administering medicines.
- If the information cannot readily be obtained, use information from previous admissions.
- Consider including allergy information in surgical checklists.
- If patient allergy bands are in use, ensure they're readily available throughout the organisation.
- Policies on allergy bands should direct who is responsible for assessing when the band should be applied and how it is verified and updated.
- Ensure information on allergy bands is readily visible, readable and pertinent.
- Consider limiting dispensing of medicines until allergy information has been verified by a pharmacist or doctor.
- Ensure that allergy status is checked by all staff supplying medicines.
- If medicines are made available for use without a system for allergy checking, ensure a system is developed that ensure allergies are checked before medicines are administered.

In relation to electronic prescribing systems:
- Information technology-based systems have been shown to reduce errors associated with medication allergies.
- Ideally a single field for recording allergy information should be included in software programmes so that information can populate all appropriate clinical screens.
- If possible, electronically link records of allergy information that is recorded in multiple locations so that the information is updated in all locations automatically.
- Limit over-ride operations on electronic prescribing systems.
- Include provision to over-ride alerts where clinically appropriate, but force prescriber to input the reason into the system so that multiple staff members do not need to question it.

Resources
- NICE CG 183 Drug allergy: diagnosis and management [LINK]
Use standard prescription charts or electronic prescribing systems

**Rationale/Evidence base**
Poorly designed drug charts may contribute to prescribing errors\(^1,37\). Systems that require handwritten information can be prone to error from faulty memory, careless or mistaken transcription from other documents and misinterpretation of handwriting. Varying designs of charts and the frequent movement of doctors between hospitals adds to the problem. Electronic prescribing is likely to improve patient safety\(^38,39,40,41\) and potentially provide financial benefits\(^42\). Literature on causes of errors shows some commonality with both handwritten and electronic prescribing, but there are also causes that are unique to each\(^43\).

**Tips**
- Use inpatient prescription charts that comply with national standards\(^44\) [LINK](#).
- Embed national standards into electronic prescribing systems.
- Prescribe doses at standard times of the day where possible.
- Ensure adequate support is provided to user interface design for electronic prescribing.
- Directly involve a senior pharmacist in the planning & development of electronic, or other, prescribing systems.
- Use electronic prescribing systems that link to the pharmacy computer and medication administration record.
- Prohibit the use of all abbreviations, symbols and dose expressions on prescriptions and computer screens.
- Consider adding decision support to electronic prescribing systems\(^38\).
- Develop systems than minimise or avoid the need for transcription.
- Develop strict guidance on circumstances where verbal orders are acceptable. Prohibit them for chemotherapy and Controlled Drugs. Make read-back of all spoken orders mandatory to confirm understanding.
- Provide education to prescribers on prescribing stationery and electronic prescribing systems on induction.

Develop Standard Prescribing Protocols (SPPs)

**Rationale/Evidence base**
A prescribing formulary minimises the number and variety of medicines in routine use so that staff can become familiar with them. Written protocols & guidelines based on published studies and clinical expertise of experienced clinicians help prescribers less familiar with all the intricate aspects of therapy quickly select appropriate doses, routes and other parameters when prescribing medicines. They may also reduce the risk of errors\(^45,46\) because prescribers become familiar with them, and they can serve as guidelines for care when therapy is initiated or monitored by nurses or pharmacists.

**Tips**
- Maintain an up-to-date prescribing formulary that details the medicines which are available for routine use and make it available at points of care.
- Involve clinicians in the development and approval processes for production of standardised prescribing guidelines & administration protocols, including Patient Group Directions (PGDs) and SPPs.
- Have only one administration protocol for each medication wherever possible.
- Avoid creating a system which allows clinicians to frequently customise their own protocols.
- If necessary, provide guidance on how protocols are to be adapted or specialist advice should be sought when diverse or multiple factors are present.
- Consider whether nursing or pharmacy staff can initiate and manage administration protocols.
- Aim to have written guidelines/protocols for 75% of commonly prescribed medicines\(^47\).
- Use standard dosing scales for high risk medicines such as those that require dosing based on patient weight or laboratory values. Include calculation aids where possible so that staff do not need to perform manual calculations.

**Resources**
- NICE GPG1 2012 Good Practice Guide for Developing and updating local formularies [LINK](#)
- Engaging Clinicians Resource [MUSLINK](#)
### Target High Risk medicines

(See also: Implement a parenteral infusion safety initiative, purchasing for safety strategy & delayed and omitted doses)

**Rationale/Evidence base**

High risk medicines are those that are most likely to cause significant harm to the patient, even when used as intended; typically, chemotherapy, anticoagulants, intravenous sedatives, opiates and insulin. Developing systems that focus on identification, prevention & mitigation of potential problems may reduce harm. Pay attention to medication events classed as “Never Events”:

**Tips**

- Provide readily accessible dosing charts, protocols, guidelines and check lists for high risk medicines
- Standardise infusions for potassium, insulin, heparin, morphine and vasopressors to a single concentration where possible. If a single concentration cannot be agreed standardise to as few concentrations as possible.
- Remove concentrated forms of electrolytes from patient care areas.
- Limit preparation of high risk intravenous preparations in patient care areas
- Require one nurse to set up an infusion pump and another to independently check calculations, solution, line attachment and patient before infusing high risk medicines
- Require high risk patients on high risk medications to have special monitoring
- Develop systems that identify and quickly alert staff when things might be going wrong e.g. out of range blood results, patient monitoring early warning systems
- Establish maximum doses for high risk medicines and list applicable doses on pre-printed prescriptions
- Build alerts into computer systems to warn staff if a dose exceeds safe limits
- Restrict the use of high risk medicines to designated care areas if possible.
- Match strengths of high risk medicines available in clinical areas to clinical need and use standard dosing protocols where possible
- Avoid the use of protocols that require staff to perform manual calculations
- Consider use of dose-banding for chemotherapy solutions
- Adopt protocols that allow antidotes to be administered or mitigating action to be taken without delay
- Label distal ends of all tubing if patients are receiving solutions via multiple routes
- Ensure calculation & dose selection software has been fully validated and evaluated for safety and effectiveness before implementation
- Consider involving experienced diabetic patients in performing independent checks of their insulin therapy

**Resources**

- NPSA Promoting safer use of injectable medicines resources [LINK](#)
- UKMi Product Safety Assessment Tool [LINK](#)
- Safer Administration of Insulin NPSA/2010/RRR013 [LINK](#)
- The adult patient’s passport to safer use of insulin NPSA/2011/PSA003 [LINK](#)
- Insulin safety solutions [MUSLINK](#)
- “How to” guides - Safe use of insulin: Inpatients [MUSLINK](#)
- Insulin Chart for Community Nursing [MUSLINK](#)
- IHI Reduce adverse drug events involving insulin [LINK](#)
- High dose morphine and diamorphine injections NPSA/2006/0295 [LINK](#)
- Reducing Dosing Errors with Opioid Medicines NPSA/2008/RRR05 [LINK](#)
- Risk of distress and death from inappropriate doses of naloxone in patients on long-term opioid/opiate treatment NHS/PSA/W/2014/016 [LINK](#)
- Opioid safety solutions [MUSLINK](#)
- IHI Reduce Adverse Drug Events Involving Narcotics and Sedatives [LINK](#)
- Actions that can make anticoagulant therapy safer NPSA/2007/18 [LINK](#)
- Anticoagulation safety solutions [MUSLINK](#)
- IHI Reduce Adverse Drug Events Involving Anticoagulants [LINK](#)
- Harm from using Low Molecular Weight Heparins when contraindicated [NHS/PSA/W/2015/001](LINK)
- Lithium
  - Safer Lithium Therapy [NPSA/2009/PSA005](LINK)
- Lithium safety solutions [MUSLINK](LINK)

Chemotherapy
- HSC2008/001: Updated national guidance on the safe administration of intrathecal chemotherapy [LINK](LINK)
- Oral anti-cancer medicines: risks of incorrect dosing [NPSA/2008/RRR001](LINK)
- Anti-cancer medicines [NPSA/2010/1134](LINK)
- Guide to the prevention of Chemotherapy Medication Errors [LINK](LINK)
- IHI Reduce Adverse Drug Events Involving Chemotherapy [LINK](LINK)

Potassium
- Potassium solutions: risks to patients from errors occurring during intravenous administration [NPSA Alert 2002-10-31](LINK)
- IHI Reduce Adverse Drug Events Involving Electrolytes [LINK](LINK)

Midazolam
- Reducing risk of overdose with midazolam injection in adults [NPSA 2008](LINK)
- Prevention of Harm with Buccal Midazolam [NPSA Signal 2010](LINK)
- Guidelines for nursing care in interventional radiology, 2014 [LINK](LINK)
- Safe sedation, analgesia and anaesthesia with the radiology department, 2003 [LINK](LINK)

Ensure pharmacists verify prescriptions for accuracy and clinical appropriateness prior to dispensing and administration

**Rationale/Evidence base**
Pharmacists can provide a double-check to help ensure that the prescription is unambiguous and clinically appropriate for the patient before it is dispensed or administered. Pharmacists are known to correct large numbers of prescribing errors before they reach the patient\(^1\), including discharge prescriptions\(^{13}\). FY1 Doctors have been shown to rely heavily on pharmacists to correct their mistakes\(^1,70\).

**Tips**
- Where possible (and except in emergencies), have pharmacists review prescriptions for accuracy and appropriateness, including those for medicines held as stock on wards, before they are administered to patients.
- Have pharmacists check prescriptions for individual medicines against the full drug chart/electronic medication record before dispensing.
- Pharmacists should visibly record when they have seen a prescription and assessed it as clinically appropriate for the patient\(^{52}\).
Pay particular attention to prescribing for children
(See also: Implement a parenteral infusion safety initiative)

Rationale/Evidence base
The Department of Health has recognised that children are a particularly challenging group of patients for safe use of medicines. Medication calculation and dosing errors in children have been frequently reported, many with devastating consequences. In the UK medication errors occur on up to 13% of inpatient paediatric prescription charts. Rates of medication related harm are approx. 3 times greater in children than adults. Many formulations used for children are designed for use in adults; few drugs are commercially available in suitable dosage forms for children. Unlicensed and off label medicine use is common.

Tips
- Most potential adverse drug events reported in children are dosing errors and errors involving the intravenous route of drug administration.
- Insist that prescribers indicate the age & current weight of the child on the prescription to enable pharmacist and nurse verification.
- Ensure all staff are appropriately trained in prescribing, preparing and administering doses to children.
- Be alert to the potential for confusing ‘mg’ and ‘ml’ with liquid preparations. Restrict prescribing to ‘mg’ to prevent errors.
- Provide the child’s parent or caregiver with both verbal and written information about the medicine and side effects and encourage them to report any unexpected effects.
- Provide consistent brands of product where possible to avoid confusion over different strengths and (for unlicensed medicines in particular) to avoid possible variations in bioequivalence.
- When purchasing, consider concentrations of excipients (e.g. alcohol) which may be harmful to children, and select appropriate size vials to avoid 10-100 times overdose.
- Double checking, intelligent infusion pumps and centralised intravenous additives services may reduce calculation errors, particularly if implemented together.
- Computer aided prescribing may also reduce prescribing errors in children.
- Ensure calculation & dose selection software has been fully validated and evaluated for safety and effectiveness before implementation.

Resources
- Meds IQ-sharing QI resources for paediatric medication safety [LINK]
- Prevention of over infusion of intravenous fluid and medicines in neonates NPSA/2010/RRR015 [LINK]
- Intravenous morphine administration on neonatal units NPSA Signal 2011 [LINK]
- Monitoring plasma sodium levels in babies NPSA Signal 2011 [LINK]
- Overdose of intravenous paracetamol in infants and children NPSA Signal 2010 [LINK]
- Safer use of intravenous gentamicin for neonates NPSA 2010 [LINK]
- Review of patient safety for children and young people NPSA 2009 [LINK]
- Reducing the risk of hyponatraemia when administering intravenous infusions to children NPSA/2007/22 [LINK]
### Implement a parenteral infusion safety initiative which focuses on standardisation of dosing, infusion solutions and use of medication safety technology. (See also Implement a purchasing for safety strategy for medicines)

#### Rationale/Evidence base

A meta-analysis of UK studies suggests overall adult MAEs are five times more likely in intravenous (IV) doses compared to other doses.\(^{57}\) A meta-analysis of UK studies suggests adult MAEs are overall five times more likely in intravenous (IV) doses compared to other doses. A systematic review of international studies concluded wrong time, administration rate and preparation errors were among the 3 most common MAE subcategories observed in IV administration.\(^{5}\) Solutions, particularly those for parenteral administration, must be prepared accurately to ensure that the correct dose is administered to the patient. The risk of error increases when complex calculations and multiple solutions are involved.\(^{58}\) Errors in the preparation of intravenous drug solutions prepared on critical care units\(^{59,60,61}\) in anaesthesiology\(^{62,63}\) and in non-clinical environments\(^{64}\) have been reported and the accuracy is likely to decrease as concentrations get smaller for example with smaller children. IV safety initiatives have been shown to reduce errors, in particular avert overdoses.\(^{65}\) When several different strengths of medicines are available, it is easy to dispense or administer a different strength than was ordered. The risk of harm is likely to be higher with parenteral solutions. Standardisation allows prescribers to become familiar with safe practice. Controlling doses administered by altering the flow rate set can reduce the need for multiple strengths of solutions. Using standard dosing charts that list the appropriate flow rates to set for the prescribed dose helps staff quickly identify the correct flow rate without having to recall information from memory or perform a calculation.

Using licensed, commercially produced ready-to-administer (R2A) or ready-to-use (R2U) solutions reduces the possibility of an adverse drug event due to a mixing error and also saves time for pharmacy and nursing staff. Where licensed, commercially produced products are not available, preparing R2A or R2U solutions in the pharmacy may decrease the chance of errors, because the fewer workers involved, the easier it is to maintain competency and consistent practice. People working in the pharmacy may encounter fewer distractions and interruptions than those in most patient care units. It is safer to manipulate medicines that may pose a hazard to the handler, e.g. cytotoxic medicines, within a carefully controlled environment with documented & auditable procedures. However, R2A and R2U solutions aseptically prepared in-house by pharmacy will be unlicensed. The use of unlicensed medicines may pose increased risks to safety; their use must be subject to robust governance to ensure the net potential safety risks associated with their use are reduced.

Infusion devices with programming safeguards may help prevent programming errors if there are sufficient supplies, which are properly maintained, and used correctly.

#### Tips

- Establish robust processes and procedures with multidisciplinary oversight to manage the selection and use of devices and solutions for parenteral administration.
- Ensure all devices and intravenous solutions are “risk-assessed” with multidisciplinary oversight for inherent safety before purchase & being introduced for use.
- Standardise each medication to just one strength of solution, or as few as possible, to decrease the risk of selecting the wrong one.
- Clinicians should work with the pharmacy in determining the strength that should be available.
- Store only the standard strength on each unit or patient care area.
- If possible, select one standard solution for each medicine for use throughout the organisation, so that only one dosing chart is needed.
- Consider using standard solutions with dose banding for chemotherapy if possible.\(^{50}\)
- Standardising drug prescribing nomenclature is good practice for all medicines, but is particularly relevant for high risk IVs (for example, agreeing to always use the term potassium chloride, not KCl, K, Pot Chloride, or others).
- Ensure that the concentrations, dose units, and nomenclature used on prescriptions, dosing charts, smart pumps, pharmacy computer system, and the electronic medical records are consistent.
- Avoid the use of non-standard doses by removing them as choices from order sheets, computer screens and locations.
- Ensure standard dosing charts are available at point of care.
- Consider using electronic infusion rate calculators, but ensure they have been fully validated and evaluated for safety and effectiveness before implementation.
✓ Limit choice of medicines, where possible, to those which can be procured from reputable, licensed, commercial sources.
✓ Where this is not possible consider commissioning from a licensed "specials" manufacturer.
✓ Consider prioritising the importance of in-house aseptic preparation in pharmacy for high risk parenteral solutions which are not commercially available, but note that these will be unlicensed and must be subjected to robust governance to ensure the net potential safety risks associated with their use are reduced.
✓ Where possible, limit choice of intravenous solutions to those requiring minimal manipulation before administration.
✓ Limit the choice/availability of infusion pumps to promote staff proficiency in use
✓ Where possible use only one model of pump to avoid confusion and programming errors.
✓ Establish a system to control the supply and maintenance of an adequate number of pumps.
✓ Where possible restrict or prohibit use of infusion pumps without free-flow protection
✓ Choose pumps with lock-out features to prevent tapering by the patient or their relatives
✓ Establish criteria for patient selection and monitoring for patient controlled analgesia (PCA). Ensure patients are educated on the use of these devices and that procedures guard against PCA ‘by proxy’ (well-meaning administration by family members or healthcare professionals)
✓ Train staff adequately in the use of all new and existing devices and ensure competency has been demonstrated before allowing independent use
✓ Label All Distal Ports and Tubing on All Lines
✓ Use intravenous solution tubing that is not interchangeable with other tubing such enteral or epidural tubing
✓ Implement systems to ensure that all cannulae and extensions are flushed with solution that do not contain anaesthetic drugs before the patient leaves recovery or the department where the procedure/investigation was undertaken

If “smart” pump technology is used:
✓ Seek agreement from all relevant clinicians on the proper upper and lower hard and soft dose limits.
✓ Monitor overrides of alerts to assess if the alerts have been properly configured or if additional quality intervention is required.
✓ Be sure the “smart” feature is able to be used in all parts of the hospital. If the pump is set up volumetrically in the operating room but the "smart" feature is used in the ICU, an error may occur if the pump is not properly reprogrammed.
✓ Be sure there are upper and lower dose limits for bolus doses, when applicable.
✓ Identify a procedure for the staff to follow in the event a drug must be given which is either not in the library or when its concentration is not standard.
✓ Consider using “smart” technology for syringe pumps as well as large volume infusion devices

**Resources**
- Promoting safer use of injectable medicines NPSA/2007/20 [LINK]
- Epidural injections and infusions NPSA/2007/21 [LINK]
- Design for patient safety: A guide to the design of electronic infusion devices NPSA 2010 [LINK]
- Design for patient safety: a guide to the labelling and packaging of injectable medicines NPSA 2008 [LINK]
- Proceedings from the ISMP Summit on the Use of Smart Infusion Pumps: Guidelines For Safe Implementation and Use 2009 [LINK]
- How to implement dose banding of chemotherapy Toolkit 2008 [LINK]
- Syringe Driver safety solutions [MUSLINK]
- UKMi Product Safety Assessment Tool [LINK]
### Check multiple clinical variables when prescribing medicines

**Rationale/Evidence base**
When selecting medicines and dosages, prescribers must check multiple variables such as age, weight, and renal function. With high-risk medicines, other laboratory results or the serum levels of the medicine are also important.

**Tips**
- Ensure the availability of electronic access to laboratory results
- Organise this patient information so that the variables are readily accessible to prescribers.
- Avoid designing systems that require prescribers to perform lengthy searches through patient records or computer programs to find what they need.
- With electronic prescribing systems, the information should appear directly on the prescribing screen or through a quick link.

### Use validated tools to help target inappropriate prescribing.

**Rationale/Evidence base**
Identifying and avoiding the use of potentially inappropriate and high risk drugs may be a simple and effective strategy in reducing medication-related problems and ADEs in older adults. Trigger tools for identifying and measuring the rate of ADEs over time may be useful in targeting events that are more likely to result in harm to patients.

**Tips**
- Ensure older people are routinely & comprehensively assessed for declining clinical function
- Consider using tools for
  - medication reviews
  - assessing the success of prescribing initiatives
  - staff training purposes
- Avoid using medicines as global triggers which have a high false positive predictive correlation: Naloxone, Vitamin K and Calcium Resonium generally give high positive predictive correlation
- Proton pump inhibitors (in particular IV) may be an effective predictor of NSAID or aspirin induced GI bleeds
- Consider using electronic prescribing systems to generate daily trigger reports for targeting action by pharmacists.

**Resources**
- Published tools for use in older people:
  - Beers criteria
  - STOPP and START
  - Medication Appropriate Index (MAI)
  - ARMOR
- Published critical review of tools
- Health Foundation Report: Global Trigger tools LINK
- Poly-pharmacy in older people: Evidence update MUSLINK
- Guideline to help reviewing anticholinergic medicines in patients at risk of falls

---
# Improve prescriber’s knowledge through education and the use of prescribing reference materials and aids

## Rationale/Evidence base
Lack of knowledge and information have been cited as causes of errors\(^1,72\). Errors in dose selection are one of the most common causes of error \(^3\). Memory can be unreliable, especially when people are busy or distracted. Prescribers and those dispensing or administering medicines may need to check or confirm information. The easier the information is to access, the more likely it is to be used. Understanding the complex interaction between prescribers and their work environment (human factors) is important in making improvements \(^38\). Prescribers appreciate timely feedback of errors \(^74\). Education is an important part of the process to improve knowledge and reduce skills-based errors \(^75\). However, there is little published evidence on the best way to deliver it. Limited evidence suggests that focused education improves prescribing performance \(^38,76\), but on-going education & training/feedback is required to achieve a sustained benefit \(^77,78\).

## Tips
- Include education and training on safe prescribing and handling of medicines for new staff on induction
- Ensure prescribing reference materials and on-line aids are available in all areas where medicines are prescribed, dispensed or administered.
- Multiple copies should be available in large units
- Ensure reference materials are current and updated.
- Consider using electronic portable devices to increase access to information
- Consider adding decision support to electronic prescribing systems \(^38\)
- Consider using designated prescribing areas with a no interruptions policy
- Introduce prescribing or ‘considerative’ checklists on ward rounds \(^79\) to minimise omissions
- Consider availability of access to specialist Clinical Pharmacists, Medicines Information Pharmacists and on-call pharmacists, particularly to assist with managing the highly complex or atypical cases.
- Train prescribers in taking accurate medication histories
- Emphasise the concept of harm from unintended medication errors during training to all prescribers
- Consider use of prescribing tests
- Consider introducing a familiarisation period for newly registered prescribers during which they have prescribing OSCEs (Objective Structured Clinical Examination) and a lecture on prescribing hazards prior to commencing their job.
- Consider 1:1 supervised prescribing for 1\(^st\) week of prescribers newly employed in a clinical area
- Provide genuine supervision for new prescribers during their first year that allows them to discuss problems and seek advice in a non-judgemental way
- Provide immediate 1:1 feedback and correction of errors to individuals
- Provide regular feedback to the team in the form of quality markers of prescribing relevant to their area of clinical practice
- Consider giving prescribers protected time to update and reflect on their prescribing practices at annual dedicated training events
- Appoint a prescribing champion with responsibility for overseeing improvements in prescribing practice
- Design shift patterns and rotas for medical staff that minimise the potential for prescribers to become stressed and fatigued and allow time for education and training \(^80\)

## Resources
- GMC Good practice in prescribing and managing medicines and devices [LINK](https://www.gmc-uk.org/guidance/good_practice_in_prescribing_and_managing_medicines_and_devices)
- The Competent Prescriber: 12 core competencies for safe prescribing [LINK](https://www.gov.uk/government/publications/the-competent-prescriber-12-core-competencies-for-safe-prescribing)
- Bookmarks for better care & post ward round checklist: Dr Gordon Caldwell [LINK](https://www.bmj.com/content/343/bmj.i3505)
Implement a purchasing for safety strategy for medicines
(See also Implement a parenteral infusion safety initiative)

**Rationale/Evidence base**
Pharmacy staff assume a duty of care when supplying a medicine which includes ensuring that the procurement process allows only medicines that are of a suitable quality and are well designed for use are provided to patients. It is also essential that the procurement process assesses the capabilities of the upstream supply chain to ensure products are genuine, correctly stored and available when required.

The use of unlicensed medicines may pose increased risks to safety; their use must be subject to robust governance to ensure the net potential safety risks associated with their use are reduced. The design of some medicine delivery systems may inadvertently facilitate rather than preclude medication errors; the safety of medicine delivery devices must also be carefully assessed before purchase.

The NPSA has recommended that organisations implement a purchasing for safety policy which promotes the procurement of injectable medicines with inherent safety features because manipulating medicines “in house” to produce solutions for parenteral administration can be prone to errors 48

**Tips**
- Ensure all medicinal products and devices are “risk-assessed” for inherent safety before being introduced for use, taking into consideration all aspects of the device or medicines’ potential use. This should form part of the formulary application process for the introduction of new medicines.
- Apply the same “risk assessment” to any changes related to existing medicines (e.g. change in supplier or packaging) or response to a medicine shortage.
- The “risk assessment” should consider; product quality, its’ design & use, labelling & packaging, source of product, internal & external supply chain and include assessments undertaken by NHS Pharmacy Quality Assurance on Commercial Medicines Unit (CMU) contract lines and high risk products.
- Ensure effective governance is applied to managing medicines shortages to minimise risk to patients.
- Limit choice of products, where possible, to those which are Ready-to-Administer (R2A) or Ready-to-Use (R2U) with an MHRA product (or device) license and can be procured from reputable, licensed, commercial sources.
- Where this is not possible consider commissioning R2A or R2U from a licensed “specials” manufacturer.
- Procure all unlicensed products under a bespoke procedure for unlicensed medicines that takes into account the increased safety risks.
- Where possible, limit choice of products to those requiring minimal manipulation before administration.
- Use specially designed oral syringes to administer oral solutions to prevent inadvertent connection to a parenteral line.
- Store oral syringes separately from other syringes, to prevent the chance of them being selected in error.
- Receive and store procured medicines in pharmacy, in accordance with relevant professional guidance and legislation.

**Resources**
- UKMi Product Safety Assessment Tool [LINK](#)
Implement a robust policy for safe and secure storage and handling of medicines

Rationale/Evidence base
Safe and secure storage of medicines is fundamental to medicines safety in preventing errors and incidents associated with misappropriation, miss-selection and deterioration of medicines. Policies must comply with current legislative and best practice guidance and NHSLA risk management standards and adherence should be audited at regular intervals.

Tips

- Establish audit trails and governance processes to underpin the safe storage and handling of medicines.
- Limit the range and number of medicines available to reduce the chance of selection errors (especially those with similar names and/or packaging) that could lead to supply or administration errors.
- Implement checking procedures to reduce the risk of drug-name, drug strength and quantity confusions.
- Consider using additional warning labels to alert staff to look-alike or sound-alike medicines, particularly if they have serious adverse effects.
- Minimise the availability of multiple strengths of the same medicine where possible.
- Consider storing high risk medicines in pharmacy until needed or secure and restrict access if stored on wards.
- Limit the range of stock medicines on patient care areas to those that are often needed quickly or in emergencies and keep stock levels minimal.
- Dispense medicines in pharmacy according to realistic timeframes for urgent, stat and routine medicines.
- Implement reliable systems for delivering medication from pharmacy to wards to eliminate the need for some medicines to be stored on wards.
- Review use of stock medicines periodically to ensure they meet current needs for the patient population.
- Implement systems and processes that ensure discontinued non-ward stock medicines are removed from wards quickly.
- Implement "Patients Own Drugs" policies that include guidance for nursing staff to assess suitability of patients’ own medicines when pharmacy staff are unavailable.
- Store oral medicines in their original dispensed packaging until administered at the bedside to prevent problems of identification.
- Disallow “borrowing” of medicines from individual patient supplies.
- Consider using warning labels to alert staff to unusual strengths or precautions.
- Ensure that name and strength of medicine is the most prominent feature on pharmacy produced labels.
- Ensure pharmacy produced labels are easy to read and understand.
- Ensure computerised systems alert users to possible confusion of look-alike or sound-alike medicines when they can be called up by name.
- Ensure medicines needed urgently outside core pharmacy service hours can be obtained in a reasonable timescale.
- Implement evidence based, best practice guidance on maintenance of cold chain storage.
- Implement best practice guidance on the disposal of all medicinal products.

Resources

- Standards for Providers 2014/15: Security Management- standard 3.7 (NHS Protect) [LINK]
- Professional Standards for Hospital Pharmacy RPS 2014 [LINK]
- CQC Essential standards 2011 [LINK]
- CQC Provider handbooks [LINK]
- CQC Monitoring hospitals [LINK]
- Review Tool to assess compliance CQC standards [MUSLINK]
### Integrate pharmacy staff into clinical teams

<table>
<thead>
<tr>
<th>Rationale/Evidence base</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When pharmacy staff are integrated into clinical teams they are a greater resource to nurses, doctors, and patients than when they're in the pharmacy department. Pharmacists and technicians can assist with new prescriptions, intervene immediately, answer questions, educate patients and staff, and help in many ways to help reduce the risk of medication errors.</strong> Active interventions such as prescription review and patient monitoring have been shown to be more effective at detecting errors and potential adverse effects than retrospective monitoring [10]. Clinical pharmacists are able to review patients’ medication to ensure they are clinically appropriate and to optimise their outcomes from their medication [79]. Clinical Pharmacists have been shown to reduce medication errors and shorten length of hospital stay [81,82].</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Integrate pharmacist prescribers into relevant care pathways across the organisation, for example in accident and emergency, on admissions wards, in specialist clinics and outreach services [52].</td>
</tr>
<tr>
<td>✓ Assign pharmacists to as few wards as staffing resources will allow so they can effectively perform as many duties as possible in the time available.</td>
</tr>
<tr>
<td>✓ Prioritise areas or patient groups that are judged to be high risk</td>
</tr>
<tr>
<td>✓ Prioritise pharmacist time to assist with tasks judged to be high risk</td>
</tr>
<tr>
<td>✓ Consider having pharmacists triage high risk patients (such as those with renal failure, over 75 years, on multiple medicines) for prescription review</td>
</tr>
<tr>
<td>✓ Use tools such as a “pharmacist early warning system (PhEWS) to help categorise risk [83].</td>
</tr>
<tr>
<td>✓ Ensure pharmacists are able to review as many new prescriptions as possible in the time available</td>
</tr>
<tr>
<td>✓ Carefully consider knowledge, skill-mix and grade of staff needed for each task</td>
</tr>
<tr>
<td>✓ Consider using technicians for medicines reconciliation, patient education and dispensing for discharge [84].</td>
</tr>
<tr>
<td>✓ Consider using pharmacy assistants for supplying routine medication &amp; dispensing for discharge</td>
</tr>
<tr>
<td>✓ Include pharmacists in all activities aimed at improving medicines safety</td>
</tr>
<tr>
<td>✓ Record and analyse pharmacists contributions &amp; interventions and share any learning with clinical teams and the whole organisation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Prioritising pharmaceutical care at ward level <a href="#">MUSLINK</a></td>
</tr>
<tr>
<td>✓ Capturing and Using Pharmacy Contribution Data : A resource to share experience, systems, documentation and outcomes <a href="#">MUSLINK</a></td>
</tr>
<tr>
<td>✓ A bite-sized learning resource for development of pharmacy staff in the workplace: Identifying and reporting medication safety incidents <a href="#">MUSLINK</a></td>
</tr>
</tbody>
</table>
### Confirm patient identity before administering medicines

**Rationale/Evidence base**
Ensuring the right medicine is administered to the right patient is the cornerstone of medication safety.\(^1\)

**Tips**
- Take the drug chart/electronic medication administration record to the bedside during medicines administration
- Use two unique identifiers (or bar-coding technology) to confirm patient identity

### Involve patients as active partners in their care by educating them about the safe use of medicines and involving them in administering their own medicines

**Rationale/Evidence base**
Patients should have the highest motivation in making sure that their medications are administered correctly and on time. Observant and informed patients and their families may prevent errors occurring. Self-administration schemes may be popular with, and empower, some patients.\(^5\)

**Tips**
- Teach patients how to actively participate in proper identification before accepting medication and how to avoid errors
- Encourage patients to ask questions about their medicines
- Fully investigate and resolve all patient’s questions or concerns about their medicines before administering them.
- Involve carefully selected patients in administering their own medicines. Careful patient selection is paramount to improving safety; poor patient selection may lead to increased errors and decreased safety.
- Ensure the organisation has a written policy in place that describes how patients will be selected and monitored for self-administration.
- Ensure there’s a good recording system in place to accurately capture information about doses that patients have administered themselves.
- Consider having patients maintain their own medication administration record
- Involve patients in medication checks e.g. experienced diabetics and insulin checks
- Target patients with diseases such as Parkinson’s Disease, Diabetes, Epilepsy and Asthma who can become very ill if they do not get their medicines on time

**Resources**
- Toolkit for the Self-Administration of Medicines (SAM) in Hospital NHS Education for Scotland [LINK](#)
Conduct independent double checks on high risk medicines and/or dosage calculations before administration

**Rationale/Evidence base**
Whilst the evidence supporting the effectiveness of double checking is conflicting, some medicines have a higher risk than others of causing severe adverse drug events and the need for dosage calculation introduces further risk of error. Double checks in such circumstances may help ensure that the prescription and medicine are correct before administration. Double checks may reduce errors in the paediatric or anaesthesia setting.

**Tips**
- Consider limiting the number of medicines needing double-checks so the requirement does not become burdensome or slow down patient care activities.
- Consider double checks for some medicines only when unusual doses are ordered, which may be when the risk is greatest.
- Clearly define the roles of each checker, the checking process & encourage critical appraisal throughout.
- Double checks are only effective if two clinical staff members perform them independently, at different times and before the medicine is administered.
- Ensure that the prescription, medication and patient are in the same place so that they may be checked against one another.
- In some scenarios patients and relatives may be involved as an extra check, but should not be a substitute for an independent double check by a qualified healthcare professional.

Identify patients with dysphagia (swallowing difficulties) as needing extra care

**Rationale/Evidence base**
Administration of medicines to patients with dysphagia is complex and potentially more error prone because of the need to match the formulation of the medicine to the swallowing ability of the patient. Administration errors occur more frequently in patients with dysphagia than those with normal swallowing ability.

**Tips**
- Develop systems that promote close communication between doctor, speech & language therapist (if involved with swallowing assessment), nurse and pharmacist regarding patient’s swallowing ability.
- Develop IT solutions that alert clinical staff including pharmacists to patient’s swallowing ability.
- Involve pharmacists in determining the optimum formulation of medicines for individual patients with dysphagia.
- The risk of medication administration errors is higher for patients with dysphagia who have enteral tubes compared to those without tubes.
- Consider using licensed liquid formulations when available rather than crushing tablets.
- Crushing tablets may not provide the whole dose or affect how the medicine works.
- Adverse events have been reported when sustained release preparations have been crushed.
- Patients with dysphagia may be prone to chewing tablets and capsules and so care should be taken with sustained release preparations.
- In some cases administering solid doses with semi-solid food to allow bolus formation may result in a safer swallow than administering liquids.
- Develop systems that alert clinical staff to medicines that should not be crushed or administered via feeding tubes.
- Particular care is needed when discharging patients.

**Resources**
- Crushing tablets or opening capsules in a care home setting [LINK](#)
### Reduce interruptions and distractions to nurses during medicines administration

**Rationale/Evidence base**
If nurses are distracted or interrupted during medicines administration rounds they are more likely to make errors\(^ {92,93}\). Evidence suggests medication administration is the most interrupted nursing activity, especially in the room where medicines are prepared. The most frequent interruption is short duration, face to face interaction with other nursing staff for patient management purposes \(^ {86} \). Interruptions have been reported in 53% of all administrations \(^ {91} \).

**Tips**
- Open space medication preparation areas may promote interruptions \(^ {90} \).
- Creating a ‘no-interruption zone’ around an open space medication preparation area on an ICU using red signage may reduce interruptions\(^ {94} \).
- Administration of medicines from a wall mounted cupboard in a patient’s room may result in fewer interruptions compared to administration from a conventional trolley\(^ {95} \).
- Having nurses wearing visual signs (tabards/sashes) when they administer medicines indicating “medicines round in progress” may reduce the number of interruptions\(^ {96,97,98,99,100} \).
- Concerns raised in the national press suggesting that tabards with the words “do not disturb” may make nurses less accessible to patients who are vulnerable and in need of urgent care has resulted in some hospitals revising the wording to ‘Medicines round in progress’.
- Disposable red aprons may be a more practical alternative to the use of reusable tabards or sashes\(^ {101} \).
- Consider combining visual signs with a multifactorial approach to reduce interruptions that includes behaviour modification, staff education, checklists and signage to increase effectiveness \(^ {99} \).
- Inform patients and staff of strategies to manage interruptions to increase awareness and reinforce messages to guard against complacency.
- Train nurses to risk assess and manage interruptions and distractions more effectively.
- Train other staff to divert interruptions and distractions from the nurse administering medicines.
- Consider designating a nurse not involved in medication administration as “key-holder”.
- Design medication/treatment rooms/areas based on safety and human engineering principles\(^ {102} \).
## Implement medication administration technologies (MATs)

### Rationale/Evidence base
MATs are intended to improve patient safety by streamlining care, identifying, preventing and mitigating MAIs and ADEs. However some of the evidence is equivocal. Most is centred around demonstrating reduction in error rates in the short term rather than measuring effect on ADEs and patient safety as a whole. More theoretically driven research is needed to determine which MATs should be implemented and in which ways to gain optimum effect.

Examples include:
- Ward based automated dispensing machines (ADMs)
- Computer-generated medication administration records (MARs)
- Bar code medication administration (BCMA)
- Smart IV pumps (see also Implementing an intravenous safety initiative)
- MATs integrated with electronic prescribing systems

### Tips
- Engage staff in evaluating the impact a new system is likely to have on their workflow and time and support them through implementation.
- Record all medications administered into the computerised system so the information is accessible to all clinical personnel who may need to see it.
- Limit over-ride options to prevent staff being able to work around the system and thus reduce its benefit.
- A computerised MAR should ideally interface with pharmacy system, computerised prescribing system, and admission-discharge-transfer systems.
- Print the MARs periodically and keep the printouts as backups in case the computer system breaks down. Store them in a central location so no one uses them when the computer system is working.
- If using bar coding when administering medications, link the information directly to the MAR if possible.
- Provide staff with handheld electronic devices (personal digital assistants) or mobile or bedside computers so they can enter information into the MAR from the point of care, rather than travelling back to a central station to do it.
- ADMs may have a number of limitations beyond opioids and emergency supplies due to financial and space considerations.
- Be responsive to new or different types of errors that may arise due to the introduction of new technologies.
Target delayed and omitted doses

**Rationale/Evidence base**

Delayed & omitted doses are one of the most common causes of medication incidents reported to the NPSA. This is particularly relevant for time-sensitive medicines because of their potential to result in patient harm. Although there may be rational reasons for omitting doses in some cases, patients with diseases such as Parkinson’s Disease, diabetes, asthma who do not get their medication on time can become very ill and need to spend more time in hospital. A study in paediatric intensive care patients suggested over 50% of omissions had the potential for severe or moderate harm. All the severe harm omissions involved the intravenous route.

**Tips**

- Draw up a list of critical medicines which should not be delayed or omitted.
- Design drug charts and electronic MARs to require hard coded reasons to be stated for all omitted doses.
- Review ward stock levels to ensure there is an adequate quantity & range of stock available.
- Provide aids to help staff locate supplies not held as stock.
- Consider including critical medicines in surgical checklists.
- Consider using electronic methods for prescribing and administration to reduce delays in supplying medicines that could lead to omitted doses.
- Carry out frequent checks to ensure patients have received what they have been prescribed and need. In particular when patients are moved from one ward to another, or they are returned to the ward after treatment.
- Consider prescribing first doses (in particular antibiotics or other high risk medicines) as ‘stat’ orders.
- Interrogate electronic MARs to provide detailed analysis of decisions made at point of administration.
- Prioritise dispensing and delivery of medicines in order to minimise the risks of omitted and delayed doses of high risk critical medicines.
- Review systems for accessing critical medicines out of hours.
- Using Pharmacy staff to support nurses on medication rounds may reduce the rate of missed doses.
- Assessing the capability of third party providers such as medicine homecare services before new patients or new services are commenced.
- Ensure that patients are aware of how and when to contact third party and/or hospitals in the event that supplies of medicine/products run low after an expected delivery has not occurred.

**Resources**

- Omitted & delayed doses safety solutions: [MUSLINK](#)
- Tools to monitor the incidence of omitted medicines: [MUSLINK](#)
- How to Guides: to monitor and reduce omitted medicines: [MUSLINK](#)
- Tool to support local implementation of NPSA RRR009(UKMi): [LINK](#)
- ISMP Acute Care Guidelines for Timely Administration of Scheduled Medications: [LINK](#)
- Caring for your patient with Parkinson’s Booklet: [LINK](#)
- Patient Safety Alert: Minimising risks of omitted and delayed medicines for patients receiving homecare services: [LINK](#)
**Improve knowledge of those administering medicines by education and the use of reference materials and aids**

<table>
<thead>
<tr>
<th><strong>Rationale/Evidence base</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Despite the increasing recognition of the significance of learning from errors and that education is an important part of the process to improve knowledge and reduce skills-based errors, there is little published evidence on the best way to deliver this training for nurses. Most published studies have focussed on improving accuracy with medication calculations. Interactive online modules and simulation-based learning have been shown to improve knowledge &amp; reduce errors in the short term. Memory can be unreliable, especially when people are busy or distracted. People administering medicines may need to check or confirm information. The easier the information is to access, the more likely it is to be used.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Tips</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Ensure reference materials are available in all areas where medicines are administered and that hard copied are up-to-date.</td>
<td></td>
</tr>
<tr>
<td>✓ Multiple copies should be available in large units</td>
<td></td>
</tr>
<tr>
<td>✓ Ensure reference materials are current and updated.</td>
<td></td>
</tr>
<tr>
<td>✓ Use designated areas for preparing medicines for parenteral administration with a no interruptions policy</td>
<td></td>
</tr>
<tr>
<td>✓ Consider using electronic and portable devices to increase access to information.</td>
<td></td>
</tr>
<tr>
<td>✓ Provide education on safe medicines administration to new staff on induction</td>
<td></td>
</tr>
<tr>
<td>✓ Consider use of safe administration tests</td>
<td></td>
</tr>
<tr>
<td>✓ Consider 1:1 supervised administration for 1st week of new employment in a clinical area</td>
<td></td>
</tr>
<tr>
<td>✓ Provide immediate 1:1 feedback and correction of errors to individuals</td>
<td></td>
</tr>
<tr>
<td>✓ Provide regular feedback of administration errors to the team and individuals</td>
<td></td>
</tr>
<tr>
<td>✓ Provide nurses with protected time to reflect and improve their knowledge and practice in administering medicines</td>
<td></td>
</tr>
<tr>
<td>✓ Require pharmacy to attach alerts to non-formulary medicines when they are dispensed to highlight any special precautions to nurses</td>
<td></td>
</tr>
<tr>
<td>✓ Require new nurses to spend time in pharmacy to learn about the dispensing processes.</td>
<td></td>
</tr>
<tr>
<td>✓ Require new pharmacists and technicians to spend time on patient care areas to observe a medication round so they become familiar with medicine administration processes.</td>
<td></td>
</tr>
</tbody>
</table>
**Involveward based pharmacy staff in early stages of individual patient discharge planning**

**Rationale/Evidence base**
Accurate medicines reconciliation at discharge and communication with post-discharge providers are important steps in reducing post-discharge health-care utilisation. If pharmacy staff are involved at an early stage they have more opportunity to speak to patients about their medication, arrange for accurate & timely supplies to be provided and communicate with post-discharge providers if necessary. This prevents delays in discharge due to supply of medicines. It also reduces the risk of a patient being discharged without medication, or with incorrect medication, or not understanding how to take their medicines correctly.

**Tips**
- Develop discharge planning & communication systems that are accessible to pharmacy staff to ensure arrangements for the prescription and supply of medicines are in place in advance of the patient being discharged.
- Encourage ward staff to seek the advice of a pharmacist if patients have been admitted with a medicines related problem or there are concerns about their ability to safely use and take medicines.
- Allow pharmacy staff time to carry out full and complete medicines reconciliation on discharge & communicate with post-discharge providers and community pharmacists if necessary.
- Prioritise dispensing and delivery of discharge medicines in order to prevent delayed discharge.
- Ensure discharge summaries contain sufficient information about patients with complex needs to facilitate any subsequent medical management that may be required immediately or soon after discharge.
- Develop medicines discharge checklists for nurses managing the discharge to use at times when pharmacy staff are not accessible.

---

**Use pharmacy staff to provide information to patients, their carers or care home staff about their medicines in preparation for discharge**

**Rationale/Evidence base**
Incomplete documentation at discharge in relation to medicines is common and it is likely that these gaps contribute to preventable ADEs and readmissions to hospital. Discharge counselling may offer a final point in the pathway to detect and correct medication errors in dispensing, labelling or patient understanding. Pharmacy staff have unique knowledge about medicines and are well placed to consult with patients about their medication while they are in hospital and to help them plan how to manage their medicines on discharge. As public bodies hospitals (and pharmacists) have an “equality duty” which necessitates making reasonable adjustments for people, eligible under the Equality Act 2010, to enable them to manage their medicines. Pharmacist medication review, patient counselling and telephone follow up have been associated with a lower rate of preventable ADEs after discharge. In the US, discharge counselling by pharmacists has been shown to be cost effective and estimated to be cost saving in over 48% of cases. High risk older people may especially benefit. Hospital-based medicines information helplines have been shown to benefit patients and highlight areas where inadequate information has been given to them.

**Tips**
- Identify patients on complex regimens or those at high risk of non-adherence and begin education early in the stay. Do not wait until discharge to begin education about complex medication regimens.
- Use a coaching approach which may include tools from motivational interviewing, cognitive behavioural therapy and other psychological models to explore patient’s beliefs about their medicines to encourage and improve adherence.
- Ask patients what they want to know about their medicines in order to target the information you give them according to their needs then provide them and their carers with important printed information about their medicines, particularly if they are error-prone or high risk (e.g. anticoagulants, insulin, chemotherapy, opioids, methotrexate).
- Provide material that uses lay terminology, especially for high risk medicines.
- Ask patients how they think their medicines will help them and address any concerns they raise.
- Provide medicines with labelling that takes into account the diversity of patients accessing medicines, for example, age and disability.
Work with community pharmacists to ensure that reasonable adjustments necessary to enable people eligible under the Equality Act 2010 to manage their medicines e.g. Multi-compartment Compliance Aids (MCAs) are maintained and continued on discharge.

Ensure patients know when and who to call with any concerns about their medication post-discharge.

Implement Patient information helplines that conform to National standards\textsuperscript{137}

Incorporate repeat demonstrations and patient recall into patient consultations

Make it routine for patients being discharged on 5 or more medicines to receive a discharge consultation with pharmacy staff

Encourage patients to keep a written record of all their prescription and non-prescription medicines, herbal products etc, and to show this to all healthcare professional at every consultation.

Encourage patients to take their discharge letters to their community pharmacist for continuity of care

Encourage patients started on a new medicine which is eligible for the New Medicines Service (NMS) to contact their Community Pharmacist for follow up.

Gaining verbal consent from the patient for the hospital pharmacist to telephone the community pharmacist and ask them to telephone the patient at home one week after discharge to offer the NMS may improve uptake of the service \textsuperscript{138}

Encourage suitable patients to seek discharge medicine use reviews (MURs) with their community pharmacist.

Consider using NMS/MUR referral letters, information leaflets or cards which describe the services and encourages patients to contact their community pharmacist.

Consider using referral to NMS/MUR services as a means of signposting for lifestyle, smoking cessation and weight management advice.

Record details of NMS/MUR referrals on discharge summaries

Involve pharmacists in designing systems that require accurate information about the patient’s medicines to be transferred to the healthcare professional(s) taking over care of the patient at the time of transfer to a Community Hospital or Care Home, and arrangements to be in place to ensure a continued supply of medicines for the patient\textsuperscript{79}

\textbf{Resources}

- NICE CG76 2009 Medicines Adherence [LINK]
- Resources to improve transfer of care [MUSLINK]
- Resources to support patient experience & adherence [MUSLINK]
- Supporting older people to manage their medicines in the community including the use of multi-compartment compliance aids (MCAs) [MUSLINK]
- New Medicines Service information & resources [LINK]
- Royal Pharmaceutical Society. Keeping patients safe when they transfer between care providers – getting the medicines right [LINK]
- Royal Pharmaceutical Society. Medicines Optimisation: Helping patients to make the most of medicines [LINK]
- Medicines optimisation: the safe and effective use of medicines to enable the best possible outcomes NICE NG5 [LINK]
- Medicines Helpline for Hospital Patients: National Standard [LINK]

\textbf{Further Reading}

Focus on Safe Medication Practices. Melanie J Rantucci, Christine Stewart, Ian Stewart. 2009 Lippincott Williams & Wilkins


ISBN 978-1-58212-092-8

\textbf{References}

Practices to Support Safer Use of Medicines in Hospitals Vs.2.1 Aug14; reviewed July 15 (JW)


15. Huynh C et al. Medicines reconciliation at the point of hospital discharge for children. Arch Dis Child 2012;97(5);e7-8


46 Mitchell KA et al. Standardised TPN order form reduces staff time and potential for error. Nutrition 1009:6(6):457-460
50 Ward C. Dose-banded and outsourcing IV chemotherapy-a strategy to balance demand and capacity. Clinical Pharmacist 2013;5:29-31
54 Ghaleb et al. The incidence & nature of prescribing & medication administration errors in paediatric inpatients. Arch Dis Child 2010;95:113-118
56 McLeod MC et al. Methodological variations and their effects on reported medication error rates. Quality and Safety in Health Care 2013;22:278-289
62 Adapa RM et al. Errors during the preparation of drug infusions: a randomized controlled trial. British Journal of Anaesthesia 2012;109(5);729–34
63 Parshuram CS et al. Systematic evaluation of infusions during the preparation of intravenous medication CMAJ 2008;178(1):42–49
71 Chaudhry N. Using a "MAP" to steer patients away from medicines-related falls. Clinical Pharmacist 2013;5:119-121

Practices to Support Safer Use of Medicines in Hospitals Vs.2.1Aug14; reviewed July15 (JW)
The possibility of perfect prescriptions? Drug & Therapeutics Bulletin September 2012;50(9):98
Herring R et al. Quality and safety at the point of care: how long should a ward round take? Clinical Medicine 2011, Vol 11, No 1: 20–2

Kaboli PJ et al. Clinical Pharmacists and Inpatient Medical Care. Arch Int Med 2006; 166(9):955-964
Morrison C. Improving patient safety through changing a clinical pharmacy service. The Pharmaceutical Journal 2014:292;426-7

Ladds S. Clinical pharmacy services can be reshaped using a team approach. Clinical Pharmacist. 2012;4:333-334
Evley R et al. Confirming the drugs administered during anaesthesia: a feasibility study in the pilot National Health Services sites, UK. British Journal of Anaesthesia 2010;105(3):289-96
Biron AD et al. Work interruptions and their contribution to medication administration errors: An evidence review. Viewpoints on Evidence-Based Nursing 2009; 2(6): 70-86
Anthony K et al. No interruptions please: Impact of a No Interruption Zone on medication intensive care units. Crit Care Nurse 2010;30:21-29
Eradiri et al (Poster): Nurses wearing tabards improves safety in administering medicines. Colchester University Hospital.
Tabener-Stokes A, Magness C. Seeing red: The effectiveness of drug tabards in reducing interruptions during the drug administration process. Int Care Med 2011;37:S432
Relihan E et al. The impact of a set of interventions to reduce interruptions and distractions to nurses during medication administration. Qual Saf Health Care 2010;19:1475
Prusch AE. Integrating technology to improve medication administration. Am J Health Syst Pharm 2011;68:835-824


