| **Key Safety Principles** | **Description** | **Examples.** |
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| **Simplify** | Reduce the number of steps, handoffs, and options without eliminating crucial redundancies

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| **Steps in process\*** | **Error probability** |
| 1 | 1% |
| 25 | 22% |
| 50 | 39% |
| 100 | 63% |

 \* each step is 99% reliable | * Use commercially available premixed solutions instead of preparing IV solutions
* Consult dosing charts instead of manually calculating infusion rates
* Limit drug choice to a single concentration
* Dispense oral and parenteral medications in the most ready-to-use form (unit-dose packages)
* Transmit orders to pharmacy electronically (via scanning or computerized prescribing)
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| **Externalise or Centralise Error­ prone Processes** | Transfer error-prone tasks to an external site or centralised area to ensure that they are completed in a distraction-free environment by those who have expertise, and that appropriate quality control steps (e.g., sterility measures, double checks) are carried out | * Use commercially prepared products
* Have pharmacy prepare all IV solutions under sterile conditions
* Use a specialised external service to prepare complicated solutions such as TPN, dialysate, cardioplegic solutions
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| **Differentiate Items** | Modify the packages and labels of medications to help distinguish them from other medications with look-alike packages or look- and sound-alike names | * Affix auxiliary labels to make medications look different or to call attention to important information
* Use colour to draw out warning labels
* Use a pen or marker to circle important information on medication labels or medication charts
* Purchase look-alike medications from different manufacturers to maximise label differences
* Use tactile clues like placing rubber bands on the vial of long-acting insulin to differentiate it from short-acting insulin
* Use tall man lettering on labels and medication charts to call out differences in look-alike drug names - HumaLOG and HumuLIN
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| **Standardise** | Create clinically sound, uniform models of care that should be adhered to when carrying out various functions related to medication use, in order to reduce variation and complexity in the processes | * Use carefully designed preprinted order sets, protocols, and clinical pathways to standardise high-risk processes and the administration of High Risk Medications
* Gain consensus among physicians who treat similar disease states and establish one standard order set for each standardised care process.
* Establish a controlled vocabulary in which the use of error-prone abbreviations, symbols, and dose expressions is prohibited.
* Standardise the sliding scale used to prescribe insulin coverage and design/use a preprinted order form
* Standardise concentration and container sizes where possible
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| **Redundancies** | Implement duplicate steps in a process to force additional checks in the system; employ more than one qualified and trained staff member to carry out specialised processes to ensure ability to perform critical functions | * Perform an independent double check for critical steps in the medication use process
* Employ automated check systems such as bar coding or the use of IV infusion pumps that alarm when a drug infusion rate exceeds safe limits
* Ask patients about medication allergies each time medication is administered
* Ask prescribers to review handwritten orders with a nurse before leaving the unit
* Cross-train selected staff to perform critical medication use functions and maintain proficiency through ongoing experiences
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| **Reminders** | Provide additional alerts or warnings to make important information highly visible so it is remembered when carrying out medication use processes | * Affix auxiliary labels to medications or add highlighted notes to medication charts to remind staff about important functions (e.g., check for pregnancy or cross allergies)
* Label IV lines
* Use checklists for complex processes
* Build reminders for special monitoring into order sets or protocols
* Set visual and audible alarms on equipment
* Build reminders into screens on automated dispensing cabinets (e.g., measure dose using dropper provided)
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| **Improve Access to****Information** | Use active, not passive, means of providing staff and patients with necessary information at the exact time when needed while performing critical tasks related to medication use | * Provide current drug reference texts or an electronic database at the point of drug administration for easy access when needed
* Provide easy access to quick drug reference tables at the point of drug administration
* Increase visibility of pharmacists in patient care units for immediate consultation when needed
* Include the medical librarian on patient rounds to follow through with dissemination of patient education materials
* Use computer order entry systems that merge patient and drug information, thus providing immediate warnings if unsafe orders are entered
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| **Limit Access or Use** | Use constraints to restrict access to certain medications or error-prone conditions; require special training or conditions for prescribing, dispensing, or administering a particular drug; require special authorisation for participation in certain critical tasks related to medication use | * Prohibit nursing (or other non-pharmacy staff) access to the pharmacy after it is closed
* Carefully select the drugs, concentrations, and quantities available in unit stock
* Remove all concentrated electrolytes from patient care areas
* Store neuromuscular blocking agents in a separate container to limit access
* Use automatic stop orders to limit the dose or duration of medication therapy
* Require special training/credentialling for use of certain High Risk Medications (e.g., chemotherapy, conscious sedation, PCA)
* Establish parameters to change IV therapy to oral therapy as soon as possible
* Minimise the variety of medication choices and dose ranges on preprinted order forms
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| **Forcing Functions and Fail-safes** | Employ procedures or equipment design features that will:• prevent something from happening until certain conditions are met; often referred to as a lock and key design (forcing function)OR• prevent malfunctioning or unintentional operation by reverting back to a predetermined safe state if a failure occurs (failsafe) | * Use oral syringes that cannot be connected to IV tubing ports
* Use medication ordering programs that cannot process an order unless key information, such as allergies and weight, has been entered
* Use automated dispensing cabinets that require pharmacy review of medication orders before access to the drug is provided
* Use infusion pumps with an automatic clamping mechanism to prevent free-flow if the tubing is removed from the pump
* Use epidural tubing without ports
* Use PCA pumps with default settings of zero, or the lowest possible concentration for the opiates used
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| **Patient Monitoring** | Assess the effects of medication through a constant feedback loop of predetermined patient parameters evaluated at set intervals | * Prospectively establish parameters (e.g., vital signs, quality of respirations, lab tests, observation, neurological signs) for monitoring patients who are receiving High Risk Medications, including:
* Concurrently monitor patients who are receiving High Risk Medications for medication effects
* Retrospectively monitor the effects of medications on groups of patients via chart audits aimed at detecting untoward drug events (e.g., insulin­ induced hypoglycemia, heparin/warfarin-induced bleeding, chemotherapy-induced leucopenia, use of an antidote to reverse oversedation)
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| **Failure Mode and Effects Analysis (FMEA)** | Convene a team to proactively identify the ways that a process or medication-related equipment can fail, why it might fail, how it might effect patients, and how it can be made safer. | * Perform a FMEA on a new High Risk Medication before allowing its use
* Perform a FMEA on a new infusion pump being considered for purchase
* Perform a FMEA on a high-risk process or sub-process related to medication use (e.g., order transcription, selecting medications from automated dispensing cabinets, patient-controlled analgesia, administration of chemotherapy)
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