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| **Electronic Medication Management – Prescribing High-Risk Medicine Guidance** |
| OFFICIAL |

This guidance document has been developed for the Victorian Department of Health (the department) in response to two Victorian Coroners' reports that identified instances where Electronic Medication Management and Electronic Medical Records systems contributed to medication misadventures:

* [Coroner’s report](https://www.coronerscourt.vic.gov.au/sites/default/files/2021-05/IanFraser_692119.pdf) < <https://www.coronerscourt.vic.gov.au/sites/default/files/2021-05/IanFraser_692119.pdf> > (February 2021) into the December 2019 death of Ian Fraser
* [Coroner’s report](https://www.coronerscourt.vic.gov.au/sites/default/files/FINDING_SALVESON.pdf) <<https://www.coronerscourt.vic.gov.au/sites/default/files/FINDING_SALVESON.pdf>> (June 2021) into the November 2019 death of Carlene Margaret Salveson

The guidance document offers recommendations for improving high-risk medication management in clinical systems, covering:

* the importance of routinely reviewing the management of high-risk medicines in clinical systems
* designing systems and strategies that is tailored to the needs of the end user
* highlights the role of continuous education to ensure proper utilisation of systems designed
* emphasises the need for strong structures and governance to effectively oversee these medicines
* provides a current summary of the strategies used in Australian hospitals

# **Background**

Electronic Medication Management (EMM) and Electronic Medical Record (EMR) systems are digital clinical systems critical for the delivery of modern healthcare. These systems enhance quality healthcare delivery by providing healthcare staff with real-time information and help to reduce preventable adverse medication events including prescribing, administration and dispensing errors.

The two Coroner's reports detail incidents where the omission and concurrent prescribing of two similar high-risk medicines within Electronic Medical Records (EMRs) and Electronic Medication Management (EMM) systems contributed to two tragic fatalities.

In response to these concerns, the Victorian Coroner recommended that the Digital Health branch of Victoria’s Department of Health collaborate with key stakeholders, including the Australian Commission on Safety and Quality in Health Care (ACSQHC), the Therapeutic Goods Administration (TGA), and health services, to review and improve the management of high-risk medicines in clinical systems.

The Digital Health branch established the eHealth High Risk Medicine Safety Advisory Group (the advisory group), including clinical and safety experts from Victoria and across Australia. This advisory group coordinated a national review of the display, prescribing and monitoring practices of high-risk medicines in clinical systems, pinpointing established best practices and identifying opportunities for consistent implementation of these improvements throughout the health system.

# **Introduction**

Health services should regularly assess how medicines are displayed, prescribed and monitored within EMM and EMR systems. To guide this effort, the advisory group commissioned a comprehensive literature review and environmental scan, conducted by the University of Sydney in 2023.

The *eHealth High Risk Medicine Safety – Rapid Literature Review and Environmental Scan report*[[1]](#footnote-2)(the report), explored how different health services approach the display, prescribing, and monitoring of high-risk medicines through EMM and EMR systems, with a goal of identifying common practices and opportunities for improvement.

The report was conducted in two parts. The first part focused on a targeted literature review, examining systematic reviews, primary studies, and grey literature. Part two of the report outlines structured interviews with stakeholders who are knowledgeable about high-risk medicine strategies in hospitals (e.g. clinical informatics staff, EMM pharmacists, Directors of Pharmacy Departments).

This document summarises findings from the report which provides an understanding of how health services in Australia display, prescribe and monitor of high-risk medicines within EMM and EMR systems. It does not cover the administration or supply processes, which remain out of scope.

Regardless of whether a health service is fully integrated with EMM and EMR systems or still expanding its digital capabilities, this guidance provides practical strategies currently used to enhance medication safety. By applying these insights, health services can strengthen their management of high-risk medicines, helping to improve patient safety outcomes across the healthcare system.

## **High-Risk Medicines**

High-Risk Medicines (HRMs) are medicines that carry a high-risk of causing significant harm if used incorrectly. The advisory group focused on HRMs because improper use can result in severe patient outcomes.

In the Australian acute healthcare sector, these medicines are commonly classified using the ‘[APINCHS](https://www.safetyandquality.gov.au/our-work/medication-safety/high-risk-medicines/apinchs-classification-high-risk-medicines)’ acronym <<https://www.safetyandquality.gov.au/our-work/medicines-safety-and-quality/high-risk-medicines/apinchs-classification-high-risk-medicines>>.

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| **A** | Antimicrobials (e.g., aminoglycosides such as gentamicin, tobramycin, amikacin, vancomycin and amphotericin) |
| **P** | Potassium and other electrolytes (e.g., injections of concentrated potassium, magnesium, calcium, hypertonic sodium chloride) |
| **I** | Insulin |
| **N** | Narcotics (opioids) and other sedatives (e.g., hydromorphone, oxycodone, morphine, fentanyl, and related sedatives such as benzodiazepines) |
| **C** | Chemotherapeutic agents |
| **H** | Heparin and other anticoagulants (e.g., heparin, low molecular weight heparins, warfarin, direct oral anticoagulants) |
| **S** | Systems (e.g., medication safety systems, including independent double checks, standardised clinical order tools, and medication charts) |

The report was centred around the "APINCH" acronym for high-risk medicines, which does not include "Systems." Therefore, this document will also follow that framework.

# **Recommendations**

To ensure the safe management of High-Risk Medicines (HRMs), it is essential for health services to take a proactive and systematic approach. The National Safety and Quality Health Service (NSQHS) Standard on [Medication Safety](https://www.safetyandquality.gov.au/standards/nsqhs-standards/medication-safety-standard) <<https://www.safetyandquality.gov.au/standards/nsqhs-standards/medication-safety-standard>> mandates that health services identify HRMs used within their organisation and take appropriate actions to ensure they are stored, prescribed, dispensed, and administered safely. As part of the standard, it is a requirement to review, measure and assess the effectiveness and performance of medication management strategies and practices, with clinical systems often serving as key tools for these strategies.

Enhancing the safety of HRMs within clinical software is a complex task that typically requires the implementation of multiple strategies. The Australian Commission on Safety and Quality in Health Care (ACSQHC) emphasises that a single risk-reduction strategy is rarely enough to prevent patient harm related to HRMs. Therefore, it is crucial for health services to assess how different strategies can be effectively integrated to work cohesively within their clinicians’ workflow.

The *eHealth High Risk Medicine Safety – Rapid Literature Review and Environmental Scan report*1(the report) highlights a variety of strategies employed by health services across Australia. While the report identifies many effective strategies, it notes that few have been thoroughly evaluated, making it challenging to recommend specific approaches. Instead, the report offers health services the opportunity to review existing strategies and consider implementing those that are most appropriate for their organisation.

The report makes the following recommendations for hospitals:

* Ensure that features are well-designed and align with user workflows to increase acceptance and effective use of strategies.
* Adopt a user-centred approach in the development and implementation of strategies.
* Implement clear and effective communication and dissemination strategies when introducing a new strategy.
* Exercise caution when implementing new strategies, as there is limited robust evidence, particularly from comparative studies, on their effectiveness in reducing adverse events.
* Conduct initial piloting before scaling up strategies, and have mechanisms in place, such as feedback loops, for ongoing monitoring and evaluation.

The following provides a summary of the key strategies used for each high-risk medicine included in the ‘APINCH’ acronym. For more information, it is recommended to review the report.

## **Antimicrobials**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Tallman lettering (4\*) | Using selective capitalisation (e.g., cefaLEXin and cefaZOLin) to help distinguish between similar sounding or looking antimicrobial names. This reduces errors in selecting the wrong medication. |

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| **Management** | **Additional information** |
| Alerts (14\*) | Providing prescribing prompts for considerations, such as recommended administration rates, antimicrobial usage restrictions, infection control, IV to oral switching, and detecting renal impairment. |
| Forcing functions (14\*) | Mandatory fields for documentation such as indication, approval number or forcing clinicians to indicate if the patient has normal renal function before antimicrobial prescribing or administration. |
| Predefined order instructions (13\*) | Use of predefined orders that guide prescribers by specifying details such as dose, route, and frequency. |

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| **Monitoring** | **Additional information** |
| Dashboards (7\*) and Reports (6\*) | Tools used by Antimicrobial Stewardship (AMS) teams to track antimicrobial usage, identify trends, and support targeted interventions. |

The use of management strategies contributed to reduced antimicrobial prescribing and improved appropriateness of use, which were associated with positive clinical outcomes (such as reduced length of stay). However, there was also evidence that some strategies were either bypassed or abandoned by users. This highlights the importance of working with stakeholders, so the design of clinical decision support tools is integrated with workflows.

## **Potassium and other electrolytes**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Uppercase text (7\*)  | Electrolytes (e.g., POTASSIUM) are capitalised to enhance visibility and reduce selection errors. |
| Order options (7\*) | Commonly used orders are placed at the top of selection lists, making ordering easier for clinicians. |
| Special instructions (5\*) | Using labels (e.g., HYPERTONIC, CONCENTRATED) to accompany high-risk formulations to provide specific handling or dosage guidance. |

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| **Management** | **Additional information** |
| Restricted to senior clinicians or ICU settings (31\*) | Limits the prescribing rights of high-dose electrolytes to senior clinicians or ICU settings to minimise risks. |
| Predefined order instructions (12\*) | Use of predefined orders that guide prescribers by specifying details such as dose, route, and frequency. |
| Alerts (6\*) | Providing prescribing prompts for considerations, such as warnings for maximum dose rates and reminders to dilute specific formulations. |

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| **Monitoring** | **Additional information** |
| Reports (32\*) | Provides data on electrolyte usage patterns, supporting safe prescribing practices. |

No formal evaluations of these strategies were identified during interviews or in the literature review. The grey literature review identified recommendations to undertaking cardiac monitoring when prescribing and administering potassium, but this strategy was not identified in the structured interviews.

## **Insulin**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Displays brand, formulation, and concentration (11\*) | Displays brand, formulation, and concentration details to ensure accurate selection and avoid confusion. |

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| **Management** | **Additional information** |
| Forcing functions (20\*) | Mandatory fields for documentation such as dose, form, and relevant lab values (e.g. blood glucose) before insulin prescribing and administration. |
| Clinical order tools (15\*) | Predefined orders grouped together for specific clinical purposes to assist in appropriate prescribing of insulin. |
| Alerts (14\*) | Providing prescribing prompts for consideration, such as to confirm accurate dosing, detect maximum doses, and prevent duplicate orders. |

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| **Monitoring** | **Additional information** |
| Dashboards | Tracks insulin use and blood glucose trends, supporting safe administration and oversight. |

A small number of international evaluations of clinical order tools and alerts demonstrated their effectiveness in improving glycemic control. The requirement for forced entry of information, as supported by grey literature, prompted the review and documentation of blood glucose levels before administration. However, there were no formal evaluations conducted in Australia, and the local improvements reported were primarily anecdotal.

## **Narcotics, opioids and other sedatives**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Text visible on screen (15\*) | Including additional text, such as displaying both generic and brand names and adding a “high risk medicine” label. |

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| **Management** | **Additional information** |
| Alerts (25\*) | Providing prescribing prompts for consideration, such as prompts that notify prescribers of maximum dose limits, duplication risks, and potential issues with opioid-naïve patients. |
| Clinical order tools (22\*) | Predefined orders grouped together for specific clinical purposes to assist in appropriate prescribing of narcotics, opioids, and sedatives. |

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| **Monitoring** | **Additional information** |
| Dashboards (6\*) and Reports (2\*) | Provides data on narcotics, opioids, and sedatives usage, supporting safe prescribing practices. |

The grey literature review highlighted several recommendations to reduce duplication and ensure accurate dosing. These recommendations align with the practices currently used by health services to prevent duplication and overdosing. Although no systematic reviews were identified, a few Australian primary studies were noted, one focused on making a combination laxative predefined order instructions visible when prescribing opioids, and another addressed the completion or update of an opioid management plan.

## **Chemotherapy**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Displays clear on-screen text to indicate cytotoxic medicines (9\*) | Clearly marked as cytotoxic with handling instructions to reduce staff exposure risks. |

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| **Management** | **Additional information** |
| Predefined order instructions (7\*) | Use of predefined orders that guide prescribers by specifying details such as dose, route, and frequency. |
| Alerts (6\*) | Providing prescribing prompts for considerations, such as handling instructions, local policies, and parameter reminders (e.g., weight, height) for precise dosing. |
| Clinical order tools (6\*) | Predefined orders grouped together for specific clinical purposes to assist in appropriate prescribing of chemotherapy. |
| Limited users (2\*) | Limits the chemotherapy management to selected doctors, nurses and pharmacists. |

The grey literature review identified various presentation and management strategies, including the use of alerts, the development of protocols, and user authorisation systems. While one review explored strategies for chemotherapeutic medicines, it did not report any evaluation outcomes. There was one Australian study which described the use of clinical order tools for chemotherapy, but no evaluation of this strategy was performed.

## **Heparin and other anticoagulants**

**Most common strategies**

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| **Presentation** | **Additional information** |
| Text visible on screen (8\*) | Including additional text, such as displaying both generic and brand names and adding an “anticoagulant” label. |

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| **Management** | **Additional information** |
| Alerts (28\*) | Providing prescribing prompts for considerations, such as Venous thromboembolism (VTE) risk assessment reminders, duplication warnings, and medication reorder reminders for patients already on anticoagulants. |
| Clinical order tools (18\*) | Predefined orders grouped together for specific clinical purposes to assist in appropriate prescribing of heparin and other anticoagulants. |
| Forcing function (10\*) | Mandatory fields for documentation for indications (e.g., treatment vs. prophylaxis), target INR/APTT levels, and therapy duration for comprehensive safety. |

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| **Monitoring** | **Additional information** |
| Dashboard (6\*) | Provides data on heparin and other anticoagulants usage, supporting safe prescribing practices. |

Formal evaluations of these strategies were not widely reported. However, one Australian study assessed the impact of patient-specific alerts on the appropriateness of warfarin prescribing at discharge and found that these alerts improved the accuracy of warfarin prescriptions.

# **Local Governance**

The report does not provide specific recommendations on local governance for EMM systems however, the [Electronic Medication Management Systems – A Guide to Safe Implementation](https://www.safetyandquality.gov.au/our-work/medication-safety/electronic-medication-management/electronic-medication-management-systems-guide-safe-implementation) <<https://www.safetyandquality.gov.au/our-work/medicines-safety-and-quality/electronic-medication-management/electronic-medication-management-systems-guide-safe-implementation>>by the Australian Commission on Safety and Quality in Health Care offers guidance. The following information has been adapted from their advice, and you are encouraged to refer to the full document for further details.

EMM systems require ongoing oversight, updates, and enhancements. Governance of EMM systems should be overseen by the health service’s medicines or clinical governance committee (e.g. Medication Safety Committee or Drug and Therapeutics Committee, to ensure the system aligns with clinical priorities.

A dedicated subgroup may be necessary to oversee the detailed management of the EMM system. This subgroup should report regularly to the governance committee to ensure clinical oversight and legitimacy in decision-making.

## **EMM Governance subgroup**

The EMM governance subgroup oversees the management of the EMM system and should operate in close collaboration with the governance committee.

Responsibilities of the governance committee should include:2

* Ensuring that regulatory obligations are enforced
* Approving all changes to EMM system configuration before the changes are introduced
* Approving all communication materials associated with EMM changes
* Approving the EMM audit work program
* Approving the EMM innovation work program
* Advising the executive about changes to the EMM system or the EMM workflow

Responsibilities of the EMM governance subgroup should include:2

* Defining the EMM reporting metrics and target measures that will be used to monitor how the EMM system is being used by the health service organisation
* Prioritising and recommending to the governance committee the annual EMM system work programs for audit, innovation and data analytics
* Monitoring delivery of the approved work programs and reporting work program status to the governance committee
* Reviewing EMM data quality reports, and EMM risk and issue registers
* Approving all EMM investigative work and improvements, including recommendations on their sequence during implementation
* Recommending any changes to EMM work programs and EMM workflow
* Reviewing all EMM communication materials associated with EMM changes, and all EMM training materials

The EMM governance subgroup should consist of key stakeholders who possess both expertise and a strong interest in Electronic Medication Management and medication safety.

Suggested membership includes:2

* A member of the executive
* One or more members of the governance committee, to ensure continuity
* Senior clinical staff including prescribers, pharmacists and nurses
* Medication safety pharmacist or a safety and quality representative
* The manager of the EMM support team
* A member of the clinical informatics team

## **User input and communication**

The report highlighted that users found some clinical decision support (CDS) tools were disruptive to workflows or caused delays, leading to instances where these tools were bypassed. This highlights the need for well-designed EMM systems that integrate with clinical workflows to encourage usage. A user-centred design approach, involving users in the co-design of CDS tools and EMM features more broadly, can help ensure these systems meet clinical needs and are more likely to be used effectively.

Additionally, the report identified that many users were unaware of existing CDS strategies, leading to low adoption rates. To address this, health services should implement ongoing and refresher training, tailored to staff roles and ensure that all training materials and programs are approved by local governance groups. Clear communication channels should be established to relay updates on CDS tools, system changes, and workflow adjustments. Regular reviews of communication and training materials are necessary to maintain user engagement and optimise system use.

**Continuous improvement**

A continuous quality improvement process should be embedded in the health service’s culture. A structured improvement methodology, such as the Plan–Do–Check–Act (PDCA) cycle, should be used to systematically implement and assess changes.

Annual improvement plans should be developed in coordination with EMM governance and monitored by the governance committee. These plans leverage the data generated by EMM systems to evaluate key areas, such as alert effectiveness, order set usage, and adherence to policies.

Key data points to review include:

* The number and type of alerts triggered, along with clinician actions and responses
* Usage frequency of clinical order tools and other clinical decision support (CDS) features
* Adherence to health service policies and protocols
* Compliance with data entry requirements for forcing functions and mandatory fields

Regular analysis of this data supports ongoing system refinement, optimises clinical workflows, and reduces alert fatigue. In addition, feedback from users, whether through surveys, forms, or staff sessions, should inform system adjustments to meet changing needs.

By adhering to these governance and best practice guidelines, health services can effectively manage and continually improve their EMM systems, ensuring their role in safe, efficient clinical decision-making.

# **Conclusion**

Health services must consistently review how high-risk medicines are managed within their clinical software, as they carry a greater risk of significant patient harm or death if misused or used in error. This document offers health services the opportunity to evaluate their current practices and explore improvements for managing high-risk medicines in clinical systems. It is based on the findings of the [*eHealth High Risk Medicine Safety – Rapid Literature Review and Environmental Scan report*](https://www.health.vic.gov.au/publications/electronic-medication-management-prescribing-high-risk-medicine-guidance)< https://www.health.vic.gov.au/publications/electronic-medication-management-prescribing-high-risk-medicine-guidance>, which outlines numerous strategies for presenting, managing, and monitoring these medicines in EMM/EMR systems. For detailed information, please refer to the report.

To receive this document in another format, phone the National Relay Service 13 36 77 if required, or email National Initiatives <myhealthrecord@health.vic.gov.au>.

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Available on the [Electronic Medication Management – prescribing high-risk medicine guidance page](https://www.health.vic.gov.au/publications/electronic-medication-management-prescribing-high-risk-medicine-guidance)< <https://www.health.vic.gov.au/publications/electronic-medication-management-prescribing-high-risk-medicine-guidance>

1. [↑](#footnote-ref-2)