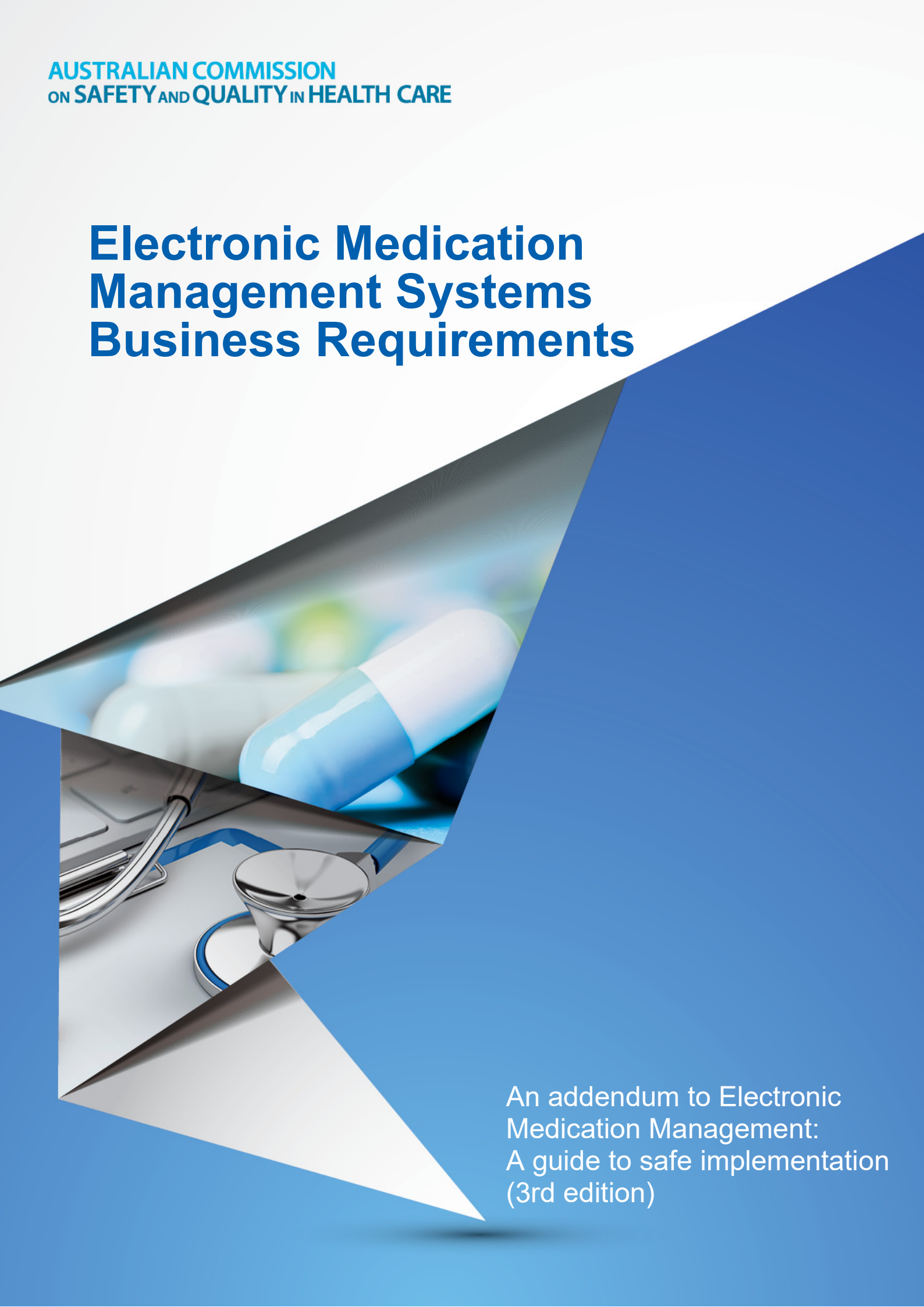


# Electronic Medication Management Systems Business Requirements



An addendum to Electronic  
Medication Management:  
A guide to safe implementation  
(3rd edition)

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# Contents

<b>1. Introduction</b>	<b>2</b>		
1.1 How to use the Requirements	<b>Error!</b>		
		<b>Bookmark not defined.</b>	
<b>2. Requirements for the Australian context</b>	<b>4</b>		
2.1 State and territory legislation	4		
2.2 Australian Government legislation	5		
2.3 National infrastructure and standards	6		
2.4 National Safety and Quality Health Service Standards	8		
<b>3. General EMM requirements</b>	<b>10</b>		
3.1 EMM principles	10		
3.2 Audit, access and synchronisation	11		
3.3 Patient identification	11		
3.4 Allergies and adverse drug reactions	12		
3.5 Continuous medication management	13		
3.6 Medication-related clinical information	14		
3.7 Medication reconciliation	15		
3.7.1 General requirements	15		
3.7.2 On entry to the organisation	16		
3.7.3 On discharge from the organisation	16		
3.7.4 Transfer	17		
3.7.5 Safety features of the printed national standard medication chart	17		
<b>4. Prescribing medicines</b>	<b>18</b>		
4.1 Prescriber workflow	18		
4.2 General prescribing	20		
4.3 Changes to medication orders	24		
4.4 PRN medicines	24		
4.5 Medicines with complex instructions	25		
4.6 High-risk medicines	25		
4.7 Variable-dose medicines	26		
4.8 Conditional dosing	27		
4.9 Infusions	28		
4.10 Antimicrobial medicines	29		
		4.11 Controlled medicines	29
		<b>5. Clinical decision support</b>	<b>30</b>
		<b>6. Pharmacist review</b>	<b>34</b>
		6.1 Supply and interface with dispensing systems	35
		<b>7. Medical administration</b>	<b>36</b>
		7.1 Before administering medicines	36
		7.2 Medication administration workflow	37
		7.3 Medication administration	40
		<b>8. Discharge medicines</b>	<b>42</b>
		<b>9. Electronic medication information exchange</b>	<b>44</b>
		9.1 Medication safety if there are multiple EMM systems	44
		9.2 Support for medication reconciliation	45
		<b>10. Specialty-specific EMM requirements</b>	<b>46</b>
		10.1 Chemotherapy	46
		10.2 Paediatrics	48
		10.3 Anaesthetics and intensive care units	50
		10.4 Emergency department, including resuscitation	50
		10.5 Renal dialysis	51
		<b>11. Support for business as usual</b>	<b>52</b>
		<b>Appendix Information sources</b>	<b>53</b>
		<b>References</b>	<b>54</b>

# 1

## Introduction

The *Electronic Medication Management Business Requirements* (the Requirements) are an annexe to *Electronic Medication Management Systems: A guide to safe implementation* (third edition), published by the Australian Commission on Safety and Quality in Health Care (the Commission) in 2017.

The Requirements aim to support hospitals and health service organisations to procure and assess electronic medication management (EMM) systems.

The Requirements were brought together from published and unpublished information sources (see Appendix), and validated by an expert panel. The Commission has incorporated other EMM business requirements arising from the Australian context, including medication safety priorities, technical standards and national infrastructure initiatives.

The Requirements begin with the Australian context, and cover:

- State and territory legislation
- Australian Government legislation
- The National Safety and Quality Health Service (NSQHS) Standards
- National infrastructure and standards
- Prescription exchange services.

State and territory legislation is considered with respect to the specific requirements of poisons legislation – for example, requirements for prescription signatures – and the implications for electronic signatures and the management of controlled medicines.

Australian Government legislation is considered with respect to the Pharmaceutical Benefits Scheme (PBS) – in particular, the goal of supporting PBS workflow and access to Special Access Scheme medicines via the Therapeutic Goods Administration. Australian Government privacy principles are also considered.

The NSQHS Standards include specific requirements relating to medication safety, and preventing and controlling healthcare-associated infections. Medication information is an important element of several other national standards. The Requirements provide an opportunity for hospitals to improve how their EMM systems contribute to meeting national standards.

Other Commission publications considered in the Requirements include:

- National Guidelines for On-Screen Display of Clinical Medicines Information<sup>1</sup>
- National Guidelines for On-Screen Presentation of Discharge Summaries.<sup>2</sup>

The Australian Digital Health Agency and the Australian Government have developed several terminology and technology infrastructure services that have important implications for EMM system requirements, including:

- Secure messaging
- Electronic transfer of prescriptions
- The My Health Record system
- The Healthcare Identifiers Service
- SNOMED CT-AU (for allergies) and the Australian Medicines Terminology.

Prescription exchange services should also be considered for non-admitted patients and discharge prescriptions.



Section 2 of the Requirements covers the business requirements arising from the Australian context.

Sections 3 to 8 consider EMM capabilities that are applicable to all health services, irrespective of their EMM implementation scope. These include prescribing, decision support, pharmacist review, medication supply and administration, and EMM workflow.

Section 9 of the Requirements considers how different EMM systems operate and the implications of these differences, and how medication safety can be addressed at the boundaries or interface of EMM systems.

Section 10 of the Requirements considers specialty-specific medicines. Their use will depend on the scope of a health service organisation's EMM implementation. The specialties considered are:

- Chemotherapy
- Paediatrics
- Anaesthetics and intensive care units
- Emergency departments, including resuscitation
- Renal dialysis.

Section 11 considers how EMM systems should support continuous quality improvement, including auditing and reporting. It also considers the technical and non-functional requirements of EMM systems, including support for business continuity in the event of an EMM system failure.

Some of the business requirements may not reflect the current capabilities of EMM solutions operating in Australian hospitals at the time of publication.

## 1.1 How to use the Requirements

The Requirements should be used to develop tender documentation.

Health service organisations using the Requirements should critically review them when deciding which are relevant to the organisation's proposed EMM scope, and identify any mandatory requirements. When doing this, they should be mindful of the capabilities and limitations of solutions operating in the Australian market. They should also consider the risks, benefits and costs of working collaboratively with EMM suppliers to enhance the capabilities of the preferred EMM system to improve medication safety.

Health service organisations should also incorporate organisation-specific requirements, including:

- Any technical and performance requirements that need to be applied locally
- Descriptions of any systems that will need to interoperate with the EMM system locally, including patient administration systems, diagnostic result systems, automated dispensing cabinets and robotics
- Details of the clinical services that are in scope for the EMM implementation
- The volume of data that the EMM system is expected to support, including the
  - expected number of users of the EMM system
  - organisation throughput by episode type (for example, inpatients, and ambulatory and emergency attendances)
  - number of formulary medicines
  - number of medicines that are individually dispensed
- Implementation and training requirements
- Contractual requirements.

# 2

# Requirements for the Australian context

This section considers issues that are specific to the Australian context:

- State and territory legislation
- Australian Government legislation
- National infrastructure and standards
- The National Safety and Quality Health Service (NSQHS) Standards.

## 2.1 State and territory legislation

The electronic medication management (EMM) system must support state or territory legislation for the prescribing, supply and administration of medicines, including the following requirements:

- Each EMM system user must be assigned individual access credentials, which must be secured by at least one method of authentication that identifies the user as authorised under the EMM system
- EMM user access to EMM functions is constrained to the user's role, as defined by legislation in the state or territory in which the EMM system operates; only those with authorised roles are able to prescribe, review, dispense and administer medicines
- All medication orders and changes to them are auditable and attributable to the person(s) who made the changes
- The EMM system presents medication orders in such a way that the EMM system user can be confident of their validity and currency
- The EMM system supports verbal medication orders and co-signatures, as defined by legislation in the state or territory in which the EMM system operates
- The EMM system displays enough patient identification details to ensure that the EMM system user can verify the identity of the patient for each prescribing, dispensing and administration activity
- The EMM system should ensure that the quantity of medicine prescribed is exchanged with other systems in a way that prevents accidental or intentional dispensing of more than the quantity prescribed (for example, by ensuring end-to-end electronic transaction of medication orders between the EMM system, dispensing systems and any third-party systems, such as prescription exchange services)
- The EMM system should ensure that orders for controlled medications – for example, Schedule 8 medicines and some Schedule 4 medicines – are valid for prescribing, dispensing and administration only during the validity period defined by the legislation in the state or territory in which the EMM system operates; if these medicines are to continue beyond the duration defined in the legislation, the medication order should be renewed, and the date and time of the renewal recorded
- Records of current and recently ceased medication orders must be available during EMM system downtime to support medication safety
- All prescribing, dispensing and administration records should be retained for a period defined by the legislation in the state or territory in which the EMM system operates, and should be available promptly to an inspector appointed under the legislation
- As far as possible, the EMM system should conform with these *Electronic Medication Management Business Requirements*
- EMM systems must meet the mandatory prescribing data elements defined by the legislation in the state or territory in which the EMM system operates, to direct medication administration or dispensing – for example
  - the patient's name, date of birth and unique identifiers
  - the authorised prescriber's name
  - the medicine's active ingredient(s) or brand name (if brand name is approved for use by the facility), the route of administration, and (if applicable) the strength and form



- for a 'regular use' medicine, the dose to be administered, the frequency and times for administration, the number of doses, the intended duration of treatment, and the date and time for prescribing review; the duration of treatment until review is nominated by either the prescriber or the EMM system
- for a 'when required' medicine, the maximum individual dose, the maximum daily dose, the hourly frequency of administration, and the maximum number of doses for either a 24-hour period or the minimum dosage interval; the duration of treatment until review is nominated by either the prescriber or the EMM system
- the date and time of prescribing
- Printed paper-based medication charts generated by the EMM system must only be used when
  - printed by the prescriber and then signed in handwriting by the prescriber
  - printed by a person authorised to initiate business continuity planning procedures
  - printed by an authorised EMM user to assist medication reconciliation when patients transfer to and from clinical areas not using the EMM system; this would apply where paper medication charts operate, or a different EMM system operates and there is no interface between the EMM systems
- Printed paper-based prescriptions generated by the EMM system and used by a pharmacist for dispensing must be printed as defined by the legislation and any associated technical guidance in the state or territory in which the EMM system operates
- Printed paper-based prescriptions generated by the EMM system and used by a pharmacist for dispensing must be printed by the prescriber and then signed in handwriting by the prescriber, for use
  - when the EMM system cannot ensure the quantity of medicine prescribed in a manner that prevents accidental or intentional dispensing of more than the quantity prescribed; this applies when there is no electronic transaction of medication orders between the EMM system, dispensing systems and any third-party systems, such as prescription exchange services
  - to prescribe a Section 100 Highly Specialised Drug (S100) medicine, to meet Pharmaceutical Benefits Scheme (PBS) requirements
  - to prescribe medicines for community pharmacy dispensing.

## 2.2 Australian Government legislation

The EMM system must support PBS prescribing in line with the *National Health Act 1953*, which requires capture of:

- The information required for a valid prescription, as defined by legislation in the state or territory in which the EMM system operates
- Information required for PBS eligibility, including
  - strength
  - pack size (or quantity)
  - if required, PBS streamlined authority codes or other authority codes.

EMM systems should support integrated and optimised PBS workflow in all settings in which PBS medicines are prescribed, including:

- Private hospital prescribing for inpatient stays, on discharge, in ambulatory settings and for chemotherapy day services
- Public hospital prescribing on discharge, in ambulatory settings and for chemotherapy day services
- S100 medicine prescribing.

Optimised workflow should include:

- Capturing at the same time all information required to meet both state or territory, and PBS legislation, as part of the same process of prescribing a medicine
- Using the new online PBS Authority Approval system, when available
- Optimised mapping of generic inpatient medication orders and PBS-listed products on discharge.

# 2

## Requirements for the Australian context

EMM systems should also provide technology solutions that support ambulatory PBS workflow, in which prescribers move between outpatient consultation rooms. This can be achieved, for example, by using mobile devices, portable EMM sessions, or rapid user authentication and access to EMM systems.

### 2.3 National infrastructure and standards

The EMM system should apply the following national infrastructure, standards and guidelines:

- The My Health Record system, allowing clinicians to view information held in patient records, and to send information and documents to patient records
- The Healthcare Identifiers Service
- The National Clinical Terminology Service, including SNOMED CT-AU and the Australian Medicines Terminology
- Digital supply chain solutions
- Secure messaging, and the exchange of clinical information such as discharge summaries, prescriptions and dispense records
- *National Guidelines for On-Screen Display of Clinical Medicines Information*<sup>1</sup>
- *National Guidelines for On-Screen Presentation of Discharge Summaries*.<sup>2</sup>

The EMM system should support the exchange of medication information via secure messaging, including:

- The use of medication information received via inbound secure messaging either directly or via a third-party system, to support medication reconciliation on admission
- The use of assisted data import during medication reconciliation in the absence of sufficiently atomic medication information; the Australian Digital Health Agency<sup>3</sup> has published a guide to assisted data import, which has direct relevance to health service EMM systems seeking to import structured and coded medicines via secure messaging (although it was initially developed with primary care systems in mind)
- The provision of medication information via outbound secure messaging (either directly or via a third-party system), to support continuous medication management on discharge.

The EMM system should support the exchange of medication information with the My Health Record system (either directly or via a third-party system), including:

- Providing access to medication information held within the My Health Record system, including
  - shared health summaries
  - event summaries
  - discharge summaries
  - specialist letters
  - referrals
  - prescription records
  - dispense records
- Using assisted data import during medication reconciliation on admission, in the absence of sufficiently atomic medication information – see the guide to assisted data import published by the Australian Digital Health Agency<sup>3</sup>
- Providing medication information in discharge summaries and specialist letters, to support continuous medication management on discharge
- Providing prescription and dispense records
- Using the Medicines View within the My Health Record system (release 8), which will improve support for medication reconciliation on admission
- Including Individual Health Identifiers, Healthcare Provider Identifier – Individual and Healthcare Provider Identifier – Organisation within all outbound messages.





The EMM system should also:

- Embed SNOMED CT-AU so that medication and allergy information can be exchanged with other health service organisations and the My Health Record system
- Ensure that SNOMED CT-AU is in line with the SNOMED CT-AU guide<sup>4</sup>
- Be maintained in line with enhancements and extensions to SNOMED CT-AU.

If the scope of the EMM system includes supply chain capabilities, the EMM system should:

- Allow access to the National Product Catalogue
- Use GS1 standards for the unique identification of locations and location hierarchies
- Integrate with Recall Health.\*

The EMM system should embed the *National Guidelines for On-screen Display of Clinical Medicines Information*<sup>1</sup> and make use of the *National Guidelines for On-Screen Presentation of Discharge Summaries*<sup>2</sup> whenever the EMM system renders the content of electronic discharge summaries.

---

\*<https://www.gs1au.org/our-services/recall-health/>

# 2

## Requirements for the Australian context

### 2.4 National Safety and Quality Health Service Standards

EMM systems should support the following NSQHS Standards:

- Preventing and Controlling Healthcare-Associated Infections
- Medication Safety
- Patient Identification and Procedure Matching.

EMM systems should support the prevention and control of healthcare-associated infections by:

- Providing antimicrobial protocols or pathways within prescribing workflow
- Recording structured indications that guide the prescribing protocols or pathways
- Validating automated approval numbers
- Allowing workflow support for highly restricted antimicrobials requiring infectious diseases or microbiology specialist approvals
- Providing dashboard reporting in real time if a medication order contradicts antimicrobial policy
- Integrating with third-party antimicrobial stewardship systems to improve prescriber workflow and compliance with antimicrobial stewardship policy.

EMM systems should support medication reconciliation by:

- Allowing clinicians to gain access to, and review, medication information across previous inpatient admissions and ambulatory encounters
- Enabling previously supplied medicines to be transferred to a new encounter (via EMM system functionality, not by copying and pasting text)
- Enabling previously supplied medicines to be transferred to a new admission or ambulatory encounter for prescribing; this should be done using EMM system functionality, not by copying and pasting text
- Enabling the reconciled medicines list to be updated retrospectively when further medication information becomes available
- Supporting medication safety by linking any medicines that may have been prescribed before the medication reconciliation process starts – that is, so that the medicine appears once on the medication chart and once on the discharge documentation, including the discharge summary, discharge prescription and patient medicines list
- Enabling previously ordered and administered medicines to continue when a patient is transferred between wards or care settings
- Incorporating the safety features of the national inpatient medication chart onto a printed medication chart when
  - care is transferred to a service delivery setting that uses paper medication charts
  - different EMM systems operating within the organisation do not share an interface
  - the patient is discharged to an aged care home
- Removing artificial constraints associated with admission episodes and ambulatory encounters, so that medication information can flow across services.

EMM systems should support patient identification and procedure matching by:

- Alerting users to patients who have identical names, and prompting them to provide extra patient identification information when medicines are prescribed or administered
- Displaying patient identification information prominently and consistently on all screens within the EMM system from which medicines can be prescribed, reviewed, supplied or administered
- Limiting the ability to modify a patient's medication record to one user at a time
- Alerting users when more than one user is using the same patient medication record at the same time, so that all users are aware of the concurrent access



- Ensuring that, whenever there is concurrent access to a patient's medication record, any change to the record by one user is highlighted to all other users accessing the record at that time; this could be achieved through a message to the other users indicating that the record has changed
- Prominently displaying the name and role of the person currently logged in to the EMM system, ideally on all EMM screens, but at least on all screens that include medication prescribing and administration functions
- Supporting multiple health record numbers for a patient if there are multisite EMM systems
- Allowing authorised users to search for, and register, new patients within the EMM system – for example, when there is no out-of-hours administrative support or when the hospital's patient administration system is unavailable
- Including the My Health Record system Individual Health Identifier in inbound and outbound clinical information
- Ensuring patient privacy in line with the Australian Privacy Principles<sup>5</sup>
- Maintaining a continuous medication record for patients moving between admissions and ambulatory encounters.

EMM systems should support other national safety and quality standards by:

- Including new, suspended or changed medicines within clinical handover communication
- Using a workflow that prompts for a medication review when a patient is identified as being at risk of falls
- Autopopulating medication information in falls risk assessment tools
- Alerting prescribers when prescribing look-alike, sound-alike and high-risk medicines, such as sedatives, antidepressants, antipsychotics and centrally acting pain relief, to patients identified as a falls risk.

# 3

## General EMM requirements

General requirements are applicable to all electronic medication management (EMM) systems, irrespective of the scope of use. They relate to:

- EMM principles
- Audit, access and synchronisation
- Patient identification
- Allergies and adverse drug reactions
- Continuous medication management
- Medication-related clinical information
- Medication reconciliation.

### 3.1 EMM principles

To cover the basic principles that help ensure medication safety, the EMM system should:

- Ensure that medicines are prescribed and administered in line with state or territory legislation
- Ensure that Pharmaceutical Benefits Scheme (PBS) medicines are prescribed and supplied in line with Australian Government legislation
- Limit access to EMM functions in line with legislative requirements and professional practice standards
- Support the unique identification of patients<sup>6</sup>
- Support antimicrobial stewardship<sup>7</sup>
- Support medication safety<sup>8</sup>
- Support remote access to EMM systems to enable prescribers to review and change medicines when away from the health service organisation
- Support patient and medication selection using scanning technologies, if possible, particularly where medicines are administered
- Incorporate the *National Guidelines for On-screen Display of Clinical Medicines Information*<sup>1</sup>
- Support the national standard for medication labelling wherever EMM system components generate medicine labels (for example, dispensing systems or robotics)<sup>9</sup>
- Support improved medication safety through the automation of medication management processes
- Support Australian national infrastructure and standards.



## 3.2 Audit, access and synchronisation

To cover auditing, access and synchronisation requirements, the EMM system should:

- Maintain audit log records of all EMM transactions, including
  - all changes to medication orders and medication administration
  - the date and time of each transaction
  - the name and designation of the user undertaking each transaction
- Limit the ability to modify a patient's medication record to one user at any time
- Manage concurrency of medication record access when more than one user is accessing a patient's medication record simultaneously, so that all users are aware of the concurrent access
- Ensure that, whenever there is concurrent access to a patient's medication record, any change to the record by one user is highlighted to all other users using the record at that time, using a message stating that the record has changed
- Prominently display the name and role of the person currently logged in to the EMM system; ideally, this information would be displayed on all EMM screens, but, at a minimum, it must be displayed on all screens that incorporate functions that prescribe and administer medicines
- Synchronise patient demographic information with the hospital's patient administration system (PAS)
- Synchronise patient episode transactions with the hospital's PAS.

## 3.3 Patient identification

To align with patient identification requirements, the EMM system should:

- Ensure the unique identification of patients<sup>6</sup>
- Alert users to patients with identical names, and prompt them to provide extra patient identification information when medicines are prescribed or administered
- Display prominently and consistently patient identification information on all screens within the EMM system from which medicines can be prescribed, reviewed, supplied or administered
- Support multiple health record numbers for a patient, where multisite EMM systems operate
- Enable registration of new patients within the EMM system when, for example, there is no out-of-hours administrative support or the hospital's PAS is unavailable, and subsequently merge the temporary registration from the PAS
- Include patient search capabilities
- Include mechanisms that support the allocation of patients to individual clinicians to support clinician workflow; this could be achieved by sorting patients in a ward into clinician work groups or sorting a clinician's tasks to match a medication administration round
- Ensure patient privacy in line with the Australian Privacy Principles<sup>5</sup>
- Record parental or guardian consent for adolescents on certain high-risk medicines or clinical trial medicines
- Maintain continuous medication management for patients moving between admissions and ambulatory encounters within services, and between services or organisations using the same EMM system; the patient's medication record should continue to be available for medication reconciliation and ongoing use at each service and each encounter, without the need to re-prescribe medicines – this supports medication reconciliation and continuous medication administration with no missed doses
- Include a patient's Individual Health Identifier, enabling inbound and outbound clinical information sharing.

# 3

## General EMM requirements

### 3.4 Allergies and adverse drug reactions

To help manage patient allergies and adverse drug reactions (ADRs), the EMM system should:

- Be able to create and maintain an up-to-date list of patient allergies and ADRs in line with the data specifications published by the Australian Digital Health Agency<sup>10</sup>
- Include a prompt for clinicians to ask about and record patient allergies if no previous allergies are recorded, until patient allergies are recorded or the 'no known allergies' reference value has been selected (recording 'no known allergies' is not the same as not recording any allergies)
- Ensure that allergies and ADRs are visible on all screens from which medicines are prescribed, reviewed, supplied or administered
- Ensure that allergies and ADRs are displayed between encounters within facilities and between health service organisations that use the same EMM system
- Validate patient allergies and ADRs against a medicine's generic name, proprietary name, therapeutic class and list of ingredients whenever medicines are prescribed
- Prompt the user to record allergy and ADR information whenever a medicine is ceased because of an allergic reaction
- Allow the user to record ADRs for a patient resulting from administration, supply or prescribing errors
- Transmit ADR details electronically to the incident management system, if electronic reporting to local incident management systems is supported; if electronic reporting to local incident management systems is not supported, the system should alert the user to report the ADR in the incident management system.



## 3.5 Continuous medication management

Continuous medication management is essential so that medicines can be reconciled, ordered, reviewed and administered across service delivery settings. EMM systems should not constrain the medication management process artificially because of a requirement to accurately record episodic data within other systems (such as the PAS). They should support continuous medication management across all of a patient's inpatient and ambulatory encounters.

To support continuous medication management, the EMM system should:

- Support clinician access to, and review of, medication information from previous inpatient and ambulatory encounters, which may include medication information from
  - pre-admission clinics
  - inpatient stays
  - anaesthetics
  - discharge
  - emergency attendance
  - outpatient clinics
  - subacute services, including rehabilitation, aged care homes, community health services and mental health services
- Allow users to view encounters that were provided elsewhere in a multicampus facility that shares the same EMM system
- Enable selecting and copying previously supplied medicines to a new admission or ambulatory encounter through EMM system functionality, to support medication reconciliation; 'cut and paste' actions must not be used
- Enable selecting and copying previously supplied medicines to a new admission or ambulatory encounter through EMM system functionality, without having to re-prescribe the medicine as if it were a new medicine
- Enable previously ordered and administered medicines to continue to be administered when a patient is transferred between wards or care settings
- Support medication prescribing in advance of a planned admission or ambulatory encounter, setting the medication order start date and time to 'on attendance', so that the medication order becomes active at the time of the patient's arrival.

# 3

## General EMM requirements

### 3.6 Medication-related clinical information

Good prescribing and administration of medicines often depends on the availability of other patient clinical information. The scope and mix of a hospital's clinical information systems will determine the extent to which some or all of the required clinical information is readily available when prescribing or administering medicines.

The EMM system should:

- Make medication-related clinical information available, to support improved medication safety and clinician workflow, including information and clinical notes on
  - blood pressure
  - pulse
  - weight
  - height
  - body surface area
  - diagnostic test orders and results
  - fluid balance charts
  - venous thromboembolism risk assessment
  - falls risk assessment
- As a minimum, provide access to diagnostic test results
- As a minimum, allow the user to record measurements for medication doses that depend on test results – for example, INR for warfarin and blood glucose levels for insulin
- If the scope of the EMM system does not include broader clinical information, include prompts within medication-related activities that highlight that clinicians should seek or perform other clinical information or activities
- If a mix of electronic and paper clinical documentation exists, guide clinicians to the location of the required information or documentation.





## 3.7 Medication reconciliation

Medication reconciliation is a central requirement of medication safety. This section considers how EMM systems could provide optimum support to clinicians who are reconciling medicines, and specific aspects of medication reconciliation regarding admission, transfer and discharge.

The EMM system should support the three-stage medication reconciliation process:

1. Taking a medicines history
2. Determining the current medicines list
3. Activation of the current medicines list by an approved prescriber to allow administration and supply.

### 3.7.1 General requirements

The EMM system should support medication reconciliation, including:

- Taking a best possible medication history (BPMH) in line with taking a best possible medication history.<sup>11</sup>  
The BPMH should comprise
  - medicines on admission, transfer or discharge
  - new, changed and ceased medicines, and reasons for any changes
  - indication for each medicine
  - other information about a medicine (if required)
  - prescribed and non-prescribed medicines, including complementary medicines
  - nutritional or dietary supplements
  - medicated dressings
  - alcohol, tobacco and other substances
  - the information source(s) for a medicine – for example, the patient, a relative, a general practitioner referral letter, a general practitioner summary or community pharmacy
  - the credentials of the person reconciling each medicine
- Pre-populating a BPMH from previous patient episodes of care
- Supporting the addition of new medicines to the BPMH, including medicines not listed in the local formulary
- Enabling any clinician who is authorised by the hospital to reconcile medicines
- Creating an accurate, up-to-date list of current medicines at a point in the patient's journey, especially at transitions of care, including
  - at the pre-admission clinic
  - on emergency department attendance
  - on entry to a service – for example, on admission
  - on transfer to wards or other areas – for example, to and from intensive care units, high-dependency units and operating theatres
  - on exit from a service – for example, discharge
  - on transfer to other facilities within an organisation – for example, subacute or ambulatory services
  - wherever medicines are transcribed (to or from paper or electronic systems).

On completion of medication reconciliation, the EMM system should:

- Ensure that each reference to a medicine in the patient's medication plan indicates whether the medicine is ceased, withheld or to be continued, or has been changed
- Clearly display all clinicians who reconciled the medicines, and all changes to the medication reconciliation record

# 3

## General EMM requirements

- Support clinician workflow that identifies patients for whom medication reconciliation is overdue, and for locally defined priority cohorts, including within locally defined periods following entry into a service
- Allow the medicines information to be transferred to the medication record for validation and conversion to medication orders by an authorised prescriber; the medication record or administration view shows all the medicines prescribed and being administered for a patient at a given moment, and is the context in which medicines are prescribed and administered in many clinical settings (EMM systems may use different terms to describe the medication record or administration view)
- Enable the reconciled medicines list to be updated retrospectively if further medication information becomes available
- Support medication safety by linking any medicines that may have been prescribed before medication reconciliation took place; the medicine should appear once on the medication record and once on any discharge documentation, including the discharge summary, discharge prescription and patient take-home medicines list.

### 3.7.2 On entry to the organisation

On entry of a patient to a health service organisation, the EMM system should have functionality to use reconciled medicines information so that it can be validated and converted to medication orders by an authorised prescriber.

The EMM system should also enable the medicines (typically commercial product or pack-based medicines) to be mapped to hospital medicines which are typically generic, dose-based medicines. The reverse process should happen when a patient is discharged from the organisation. This will reduce unnecessary patient confusion. A worked example is shown in Table 1.

**Table 1: Worked example of how a medicine can be mapped from pre-admission information to an inpatient order, and back on discharge**

Before admission	Conversion to medication order in hospital	On discharge
Patient A takes Lasix 40 mg – half a tablet every morning	Frusemide 20 mg every morning – allowing administration of a generic frusemide available in the hospital	The discharge prescription and discharge summary should read: Lasix 40 mg – half a tablet every morning

### 3.7.3 On discharge from the organisation

When a patient is discharged from the health service or treated as an outpatient, the EMM system should:

- Pre-populate a discharge medicines list from the medication chart, including any medicines withheld or ceased on entry to the organisation; the clinician undertaking the discharge medication reconciliation should validate each medicine as being required for discharge
- Enable the prescriber to identify medicines that require a discharge prescription, including PBS eligible, non-PBS eligible and private prescriptions
- Transmit electronic orders for medicines requiring dispensing to the organisation’s dispensing system (preferably via an interface to the dispensing system) to prevent or minimise errors resulting from medication order transcription
- Support prescription printing for any medicines that are not being dispensed by the organisation’s pharmacy
- Provide a discharge medicines list to the discharge summary capability so that the medication information in the discharge summary accurately reflects the patient’s discharge medicines; any last-minute changes to discharge medicines before discharge should always be reflected accurately in the discharge summary
- For patients with a My Health Record, transmit prescription and dispensed notifications to My Health Record
- Support patients being discharged to an aged care home by printing a medication chart that incorporates the safety features of the national standard medication chart (NSMC).



### 3.7.4 Transfer

The EMM system should allow the medication chart to be printed, so that the safety features of the NSMC are incorporated. This should happen whenever care is transferred to a health service organisation or setting where paper charts operate, or when there is no interface between different EMM systems operating within the organisation.

### 3.7.5 Safety features of the printed national standard medication chart

EMM systems will sometimes need to print a paper medication chart that incorporates the safety features of the NSMC. This might occur in the following scenarios:

- Transfer of a patient from a service with electronic prescribing and administration systems to a service using paper charts
- Transfer of a patient between different EMM systems, when there is no exchange of structured and coded medication information between the EMM systems
- Management of medicines administration during system failure.

This does not mean that the EMM system must print an exact copy of the NSMC, but that printed charts should incorporate the safety features of the NSMC, including:

- Patient demographics (family name, given name, date of birth, sex, organisation health record number, address, Medicare number), and weight and height
- Known allergies and ADRs
- A list of other known medication charts (for example, other paper or electronic medication charts that were used while the patient was being cared for)
- The health service organisation's name, provider number and previous service location (for example, ward)
- Medicines taken before hospital presentation (not for administration)
- Once-only and clinician-initiated medication orders
- Telephone medication orders
- Variable-dose medication orders
- Venous thromboembolism prophylaxis orders
- Warfarin orders and education provided
- Regular medication orders, including limited-duration medicines, slow-release medicines and ceased medicines.

In addition, each medication order on the printed chart should include:

- The prescriber's name, designation and contact details, and the date and time when the medicine was prescribed
- The date and time of administration that medicines were last administered, and the name and designation of the person who administered the medicines
- Any missed doses and the reason for not administering within the specified time window
- The pharmacist's name, designation and contact details, and any pharmacist instructions provided, along with the date and time of the instruction
- The medicine's generic name
- Medication information, in line with national guidelines.<sup>9,12</sup>

Each medication order on the printed chart should be sequenced as generic medicine name, route, dose and frequency.

The printed chart should not use abbreviations. It should also include PBS and Repatriation PBS entitlement numbers, although this is not a medication safety requirement.

# 4

## Prescribing medicines

### 4.1 Prescriber workflow

The electronic medication management (EMM) system should support prescriber workflow, including the operational context of the different clinical settings where medicines are prescribed. Conventional workflows have medicines prescribed, supplied and administered in that order. The order can change in some situations, and the processes can happen simultaneously, to meet the clinical need of a setting.

For example, in *anaesthetics and intensive care units*, the flow sheet is likely to provide the operating context for prescribing and administering medicines. In this setting, medicines are part of a wider set of clinical data being presented and used. Clinicians are likely to consider vital signs, fluid balance and laboratory data. EMM prescribing in an anaesthetics or intensive care unit context would need to consider:

- Maintaining visibility of the flow sheet, so that vital signs, diagnostic results and other medicines information can continue to be seen when clinicians are prescribing new medicines
- Prescribing and administration undertaken as a single transaction, sometimes after the event, with reference to a point on the flow sheet specified by the prescriber; this requires visibility of the flow sheet, and a combined prescribe and administer function
- Using a more limited set of medicines to provide an opportunity for better medicines workflow support – for example, by selecting medicines with predefined doses and routes.

*Emergency situations* such as resuscitation are likely to include verbal medication orders, retrospective recording of medicines administered, prescribing and administering as a single transaction, and recording of medicines prescribed or administered by someone else.

*Oncology and haematology wards* will require special attention. The workflow for the prescribing, supply and administration of chemotherapy medicines is specific to this clinical area because of the complexity of treatments and the high-risk nature of the medicines involved. The EMM system must be capable of managing this workflow directly or interfacing with other software products to allow clinicians to view a patient's chemotherapy treatment.

In most wards, medicines will be prescribed on admission to a ward. In an EMM system, the medicines information can be drawn from a previous admission or a medication reconciliation process. The information is validated by an authorised prescriber, and the medicine can then be supplied or administered.

The EMM system should also support an approvals workflow for the prescribing of certain medicines, including:

- Non-formulary medicines requiring internal approval
- High-risk antimicrobials requiring internal approval
- New and pre-existing clinical trials medicines requiring Therapeutic Goods Administration (TGA) and internal approvals
- Special Access Scheme (SAS) medicines requiring TGA approval.

Approvals workflow should include:

- Pre-populating required information, wherever possible, supplemented by manually entering any missing information, depending on the type of approval being sought
- For internal approvals, routing the approval requests to the correct approver – for example, an infectious diseases specialist for antimicrobials, or the director of medical services for non-formulary items; these clinicians require an alerting function, such as an SMS or pager
- For SAS medicines, emailing the SAS approval request to the TGA, and the pharmacist recording the approval outcome before supply
- For clinical trial medicines, linking to the TGA website to complete the online request, and the pharmacist recording the approval outcome before supply
- Once approved, providing confirmation to the prescriber via workflow, enabling these medicines to then be prescribed for the patient



- Regularly reviewing medicines based on time frames configured locally; groups of medicines could include standing orders, duration of medicine order, by class of medicine or by individual medicine (review tasks appear on the prescriber work list for action)
- Ensuring that the medication review functions support efficient prescriber workflow
- Bringing together medication-related activities for prescribers into prescriber work lists for follow-up action; work list activities might include
  - telephone orders requiring validation and authorisation
  - standing orders requiring validation and authorisation
  - medicines with an impending review date
  - medicines with an impending stop date
  - medication monitoring activities, if required
  - medication orders with pharmacist-requested clarification
  - medication orders rejected by the pharmacist
  - medication orders with pharmacist-suggested alternatives
  - medication orders awaiting internal approval, such as non-formulary and high-risk antimicrobials
  - medication orders awaiting a requested senior prescriber review before the medicine is available for administration
  - medication orders awaiting TGA approval, such as SAS and clinical trial medicines
  - waiting for prescriber validation for medicines that have been reconciled by a non-prescribing clinician, so they can be added to the medication chart and administered
  - overdue medication reconciliation for priority cohorts, as defined locally
  - medication-related communication between prescribers, pharmacists and nurses
- Notifying prescribers about any new or outstanding work list actions, using the prescriber's preferred communication channel, such as an EMM system alert, a page or an SMS
- Supporting mobile access to work list activities.

# 4

## Prescribing medicines

### 4.2 General prescribing

The EMM system should support general prescribing of medicines, including:

- Prescribing rights in line with legislation, including limiting the prescribing rights of non-medical prescribing roles
- Product or pack-based prescribing, and generic or dose-based prescribing; and the conversion of products or packs to generic or dose-based medicines, and vice versa, supporting inbound and outbound medication reconciliation
- Pharmaceutical Benefits Scheme (PBS) prescribing in inpatient units, in chemotherapy services, for outpatients and on discharge, where PBS prescribing is authorised
- Prescribing of private prescriptions
- Prescribing directly from the list of medicines on admission (refer to Section 4.1)
- Prescribing directly from the medication administration view.

The EMM system should support prescribing in all clinical settings, including:

- Emergency departments
- Ambulatory settings, including outpatient clinics and community-based services
- Pre-admission clinics
- Anaesthetic bays
- Inpatient units
- Procedure units, such as renal dialysis and colonoscopy
- Intensive care and high-dependency units
- Paediatric and neonatal units
- Diagnostic services.

The EMM system should:

- Support the default prescribing of medicines in the local formulary, with prescribing controls applied according to the indication or therapeutic class
- Support non-formulary prescribing; when non-formulary medicines are prescribed, an alert should be displayed, and the prescriber given the opportunity to select formulary medicines from a displayed list, or to override the alert and provide a reason for doing so
- Enable the prescribing of non-formulary medicines for which approvals are required, supported by approvals workflow
- Support workflow that allows prescribing of medicines that are unlicensed, to be administered via unlicensed routes, or part of a clinical trial.

Box 4.1 provides a list of medicines that should be supported by an EMM system.



#### **Box 4.1: Medicines that should be supported by an EMM system**

The electronic medication management (EMM) system should support the prescribing of all types of medicines used in health service organisations, including:

- Regular medicines
- 'As needed' (PRN) medicines
- Variable-dosing regimens (tapering doses, alternate day, conditional dosing, linked dosing)
- Weight-based and surface area-based prescribing
- Anticoagulants
- Antibiotics for prophylaxis
- Intravenous fluids
- Anaesthetics
- Chemotherapy
- Insulin
- Variable analgesia, such as patient-controlled and clinician-controlled analgesia
- Once-off medicines
- Intermittent medicines
- Slow-release medicines
- Infusions
- Dietetic products, foodstuffs and other products formulated for medical use
- Nutritional supplements
- Medicated dressings
- Wound care products
- Devices
- Blood products
- Dialysis solutions
- Contrast media
- Radiopharmaceuticals
- Bone cement with or without antimicrobials
- Implants and intra-uterine devices
- Locally manufactured medicines and products
- Herbal products.

# 4

## Prescribing medicines

The EMM system should support prescribing by:

- Medicine name (generic name, proprietary name or synonym)
- Diagnosis or indication
- Predefined regimen
- Order sentence and order set – these are medicines commonly prescribed together for a particular treatment
- Regularly used medicines or quick lists
- Standing orders
- Protocols, pathways and guidelines.

The EMM system should support locally configured prescribing restrictions, including:

- Site and route
- Cumulative dose
- Indication
- Therapeutic class of medicines
- Protocol
- Prescriber role or competencies
- Scope-of-practice prescribing, such as when a nurse practitioner has their own formulary defined by their scope of practice
- Location-based and unit-based prescribing.

The EMM system should include the following information for a medicine order:

- Prescriber name, designation, date and time of order
- Generic medicine name (or product or pack, if locally required)
- Route
- Dose
- Frequency
- Site
- Form
- Indication, which is selected from a structured, coded list, as well as the ability to add supplementary free text, if required
- Current order status
- Further instructions associated with particular medicines, including variable-dosing regimens, infusion times for intravenous (IV) medicines and diluents, and monitoring requirements
- Duration of the medication order, with a review date, if appropriate
- Start date and time
- Stop date and time if indicated
- Reason for stopping treatment
- Priority for supply
- Location of the medicine.

The EMM system should support prescribing of medicines by any appropriate route, including:

- Oral medicines
- IV medicines (peripheral or central administration), including diluents or flushes, and biological agents
- Medical gases – for example, oxygen
- Nebulised medicines, including driver gas or diluents, when necessary
- Enteral feeds, including the specification of the route or mode of administration





- Subcutaneous and intramuscular medicines, including vaccinations
- Intravesical fluids and medicines
- Epidural and intrathecal medicines.

The EMM system should:

- Display current medicines and current order status when clinicians are prescribing new medicines
- Ensure safe prescribing caused by incorrect medication selection during ordering by constraining medication order entries to valid and appropriate forms, routes, frequencies, strengths or doses
- Include validity periods for specified medicines, such as a period after which the medication administration route should be changed – for example, to minimise the risk of infection or to reduce irritation
- Allow automatic scheduling of administration times, based on recommended administration times – for example, morning, night, twice a day, three times a day, four times a day, regular (six hourly), regular (eight hourly)
- Allow an administration time to be changed when clinically required, showing a reason for the change
- Define the date and time that the prescribed medicine is to become active, at the time of prescribing the medicine
- Display the first administration date and, if possible, the time, at the time of prescribing the medicine
- Support non-standard administration times and ensure that prescribers can easily select them – for example, 1,000 mg twice a day on two days of the week only, with no doses on the remaining days of the week
- Support duration of therapy in months, weeks, days or number of doses; when a duration or number of doses is specified, the medication order must automatically be discontinued at the end of the duration or after the specified number of doses have been administered
- Prompt users to review and stop medication orders based on the duration of treatment or a locally configured maximum period for the medicine to be prescribed before requiring a review; review tasks should appear on the prescriber work list for action
- Ensure that medication orders that have reached any locally configured maximum prescribing duration do not disappear, but remain visible on the medication chart and are marked as requiring review
- Support prescribing of an urgent (STAT) order, followed by regular schedules of a medicine as a single prescribing transaction – for example, for antimicrobial therapy
- Alert prescribers that STAT doses may be required when using daily medication orders, to ensure no delay in receiving the first dose, and that subsequent regular doses may need amending
- Enable automatic stop orders for certain medicines based on locally configured rules – for example, duration-limited approval for antimicrobial therapy
- Assign review or stop dates to any medication order; review tasks should appear on the prescriber work list for follow-up
- Ensure that all required information is captured before the medication order is placed
- Ensure that, once a medicine has been ordered, the medicine name, form and strength are clearly displayed (in line with the *National Guidelines for On-screen Display of Clinical Medicines Information*<sup>1</sup>) on all screens from which medicines can be prescribed, changed, reviewed or administered
- Support the immediate availability of the medication order for administration as soon as the order has been completed subject to any scheduling time lag
- Enable non-impresst medication orders to be sent immediately to the pharmacy dispensing system for supply unless pre-approval is required by the pharmacist.

# 4

## Prescribing medicines

### 4.3 Changes to medication orders

The EMM system should support changes to medication orders, including:

- Amending, suspending or discontinuing a medication order, with a reason selected from a predefined list, supplemented with free text if required; the system should automatically adjust the subsequent administration times
- Prescribing medicines that were previously ceased or withheld.

The system should:

- Ensure that previous changes to the medication order and the current order status are clearly displayed within the context of the current order
- Support the multiselect, suspending or restarting of medicines in a single action – for example, to release a block previously placed on a patient's medication record to facilitate time outside the hospital's EMM scope
- Display the last date on which any of a patient's medication orders were changed, including the time in hours since the change – for example, 'Medication orders last changed 30 SEPTEMBER 2016, 3 HOURS AGO'.

### 4.4 PRN medicines

The EMM system should support as-required (PRN) medicines, including:

- Prescribing of PRN medicines, including the
  - medicine name
  - maximum individual dose (or range)
  - minimum interval between administration (frequency)
  - maximum dose in 24 hours
  - option to limit the duration of a PRN order
- Prescribing a medicine as a scheduled and PRN medicine in a single transaction
- Recording PRN doses until the maximum safe dose or duration has been reached, to prevent further administration until the medication order has been reviewed by the prescriber
- Prescribing a dose range for some PRN medicines – for example, paracetamol 500–1000 mg or coloxyl with senna 1–2 tablets.



## 4.5 Medicines with complex instructions

The EMM system should support prescribing of medicines with complex instructions, such as variable-dose medicines, medicines that can be administered through multiple routes and medicines with doses that change depending on the time of the day. The following situations are common:

- A prescriber may indicate more than one route of administration for a medicine such as metoclopramide 10 mg, which can be prescribed for oral and IV administration simultaneously, depending on the patient's clinical condition
- Some medicines may have their total daily dose given in different amounts at different times of the day; for example, frusemide may be given in two doses (80 mg at 8.00 am and 20 mg at 12.00 pm) to ease a patient's symptoms – the EMM system should display these orders side by side, as a single order, or alert the clinician appropriately
- Some medicines need to be introduced slowly by titrating a dose upwards, or withdrawn slowly – the EMM system should allow a prescriber to taper a course of steroids down in a single transaction.

The display of these types of medicine orders should be such that inadvertent double dosing does not happen and that administering clinicians can easily see the prescriber's intentions.

When appropriate, the EMM system should provide prompts to clinicians to switch from parenteral administration to oral administration.

## 4.6 High-risk medicines

The EMM system should support high-risk medicines, including:

- Supporting safe prescribing of insulin and other high-risk medicines including APINCH (anti-infectives, potassium and other electrolytes, narcotics and other sedatives, chemotherapeutic agents, heparin and other anticoagulants) medicines
- Restricting the dosing schedules for some medicines
- Configuring some medicines to be prescribed for inpatient use only.

For each category of high-risk medicines, the EMM system should support appropriate corrective action, including:

- Recording or reviewing blood glucose levels (BGLs) when prescribing and administering insulin
- Undertaking cardiac monitoring when prescribing and administering potassium
- When prescribing and administering narcotics
  - reviewing duplication of scheduled administration and PRN doses
  - considering therapeutic duplications
  - configuring administration lock-outs
  - using sedation scores and pain scores
- Using sedation scores for sedatives other than narcotics
- Limiting chemotherapy medicines to appropriate clinical settings and considering cumulative lifetime doses
- Reviewing biochemistry results when prescribing or administering heparin and other anticoagulants.

# 4

## Prescribing medicines

### 4.7 Variable-dose medicines

The EMM system should support variable-dose medicines, including:

- Supporting their prescribing as a single process without having to enter multiple separate orders; the EMM system should automatically calculate the dates that dose changes will apply
- Supporting variable-dosing regimens, including
  - loading doses – for example, heparin infusions
  - tapering regimes – for example, steroids
  - dose rounding
  - conditional dosing – for example, warfarin based on an INR result, supplemental insulin based on abnormal BGLs and not adequately controlled by basal insulin, and medicine doses requiring renal or hepatic function test results
  - prescribing based on age, weight and body surface area (mandatory for some medicines) – for example, paediatric prescribing (mg/kg) and antineoplastic prescribing (mg/m<sup>2</sup>)
- Providing support tools (for example, dose calculators) and templates that assist with variable-dose decision-making, integrated within medication prescribing, review and administration functions
- When high-dose medicines and increasing dose strengths are ordered, ensuring the display of appropriate warnings, based on locally configured rules.

Boxes 4.2–4.5 provide worked examples of how variable-dose medicines should be supported in the EMM system.

#### Box 4.2: Worked example of alternate day dosing

##### Thyroxin with alternating dose instructions

A patient is admitted who takes thyroxin 50 microgram on three days per week and thyroxin 100 microgram the remaining four.

The implications for the EMM system are as follows:

- The EMM system should support the prescribing of two different doses of a medicine on different days in a single transaction
- The prescriber should be able to enter instructions that reflect the patient's usual dosing schedule
  - Thyroxin 50 MICROg on Monday, Wednesday and Friday
  - Thyroxin 100 MICROg on Tuesday, Thursday, Saturday and Sunday.

#### Box 4.3: Worked example of intermittent dosing

##### Fentanyl patch 75 microgram

Apply a patch to a hair-free area of skin. The patch should be removed after 72 hours and a new patch applied.

The implications for the EMM system are as follows:

- The instructions for the fentanyl patch must show the first day of application and the day for the patch to be removed
- The medicines view must show the fentanyl patch order at all times
- When the order is ceased or the patch is removed, the clinician removing the patch should be able to record the removal and the time of removal in the EMM system.



#### Box 4.4: Worked example of multicomponent oral medicines

##### Nexium HP7®

This treatment contains three oral medicines. Each component medicine has different directions. The EMM system should support the prescriber to complete the three medicine orders in a single transaction without having to select each component separately. By selecting Nexium HP7®, the following orders are populated for validation:

- Esomeprazole 20 mg – ONE tablet to be administered TWICE daily for 7 days
- Clarithromycin 500 mg – ONE tablet to be administered TWICE daily for 7 days
- Amoxicillin 500 mg – TWO capsules to be administered TWICE daily for 7 days.

#### Box 4.5: Worked example of multicomponent oral and subcutaneous medicines

##### Pegatron®

This treatment consists of a weekly subcutaneous injection, and oral tablets that need to be taken daily. The EMM system should support the prescriber to generate the two orders for this treatment in a single transaction when the strength of Pegatron® is selected. The following orders should be generated for validation:

- Peginterferon alfa-2a 180 MICROg – Inject subcutaneously ONCE weekly on (specify day)
- Ribavirin 200 mg tablets – TWO tablets to be administered TWICE daily.

## 4.8 Conditional dosing

Consideration should be given to the types of conditional dosing the health service uses. Candidate EMM systems should be tested against conditional dosing scripts.

The EMM system should have easy access to pathology results that support the accurate prescribing and administration of medicines such as warfarin and insulin. When results are missing or not available, the EMM system should provide a prompt to get them before prescribing or administering the next dose.

In the case of warfarin, the prescriber should acknowledge that the most recent INR result has been reviewed and the next test has been ordered before the EMM system allows the next dose of warfarin to be validated for administration.

In the same way, a nurse should acknowledge the most recent INR result before administering the next dose of warfarin.

For insulin, clinicians should have access to enough recent BGLs to allow any trends to be apparent. The EMM system should prompt for BGLs before administration of basal insulin doses. If supplemental doses have been administered, the EMM system should alert the prescriber to review the patient's basal insulin needs.

# 4

## Prescribing medicines

### 4.9 Infusions

The EMM system should support the prescribing of all types of infusions, including:

- To replace lost fluids
- To maintain fluids
- To provide nutrients
- To deliver medicines
- To deliver colloids
- To deliver line patency fluids (low-dose heparin in physiological solution under pressure).

The EMM system should record the following attributes for IV medicine orders:

- Medicine name and dose
- Infusion fluid (only compatible fluids should be presented to the prescriber)
- Volume of infusion and rate of infusion – for example, constant, sliding scale (insulin) or titrating (inotropes)
- Route of infusion (peripheral or central line as a minimum)
- Duration and frequency
- Further instructions – for example, maximum hourly rate and daily limits.

The EMM system should:

- Support the prescribing and administration of simple infusions, consisting of a single infusion solution, such as 1 L Hartmann's solution administered over 12 hours, or a single additive in an infusion solution being administered at a constant rate over a specified period (for example, 20 mmol magnesium sulfate in 100 mL of 0.9% sodium chloride administered over 1 hour)
- Support the prescribing and administration of medicines that have complex formulation and complex administration
- Enable the prescriber to select the carrier solution and the additives as a single prescribing transaction, and present the final order (or mixture) for verification before authorisation
- Support the prescribing of initial bolus or loading dose, followed by a maintenance infusion rate and any final infusion, as part of a single prescribing transaction
- Support the prescribing of variable or sliding-scale infusion rates as a single prescribing transaction
- Enable the duration of the infusion to be automatically calculated when a rate of infusion is prescribed
- Support the pausing (intermittent break in the infusion) or suspension (prolonged break) of IV fluids for a period of time
- Enable IV fluid administration volumes to automatically update the fluid balance chart
- Support monitoring activities when higher volumes or concentrations of certain medicines are prescribed; the monitoring activities should be brought to the attention of the clinician when administering the medicine – for example, potassium chloride may require cardiac monitoring
- Support monitoring activities when nonlinear infusion rates are prescribed; the monitoring activities should be brought to the attention of the clinician when administering the medicine – for example, inotropes require constant monitoring of heart rate, heart rhythm and blood pressure, and adjusting the rate according to the patient's clinical parameters
- Enable the clinician to record the required clinical parameters at the time of administration
- If physiological monitoring devices are connected to the EMM system, support clinician validation of the required clinical parameters obtained electronically from these devices
- Support administration of variable or sliding-scale infusions from the original medication order, without requiring any changes to the original medication order
- Support administration of multiple infusion bags against a single medication order, which represents the total input from the prescriber; clinicians should record infusion bag changes, including information associated with each



extra infusion bag, such as start and stop times, infusion rates, pauses in the infusion, bolus doses, discarded fluid and (possibly) batch details

- Remind the clinical workforce when the fluids are about to finish for patients within their work area, in line with any electronic workflow capabilities
- Enable the clinician to record how much fluid has been administered and relate it to the medication order, including recording any discarded fluid.

The EMM system should support integration to infusion devices. Recording should include:

- Specific fluids by line
- Concentration of medicines in the infusion
- Concentration of additives in the infusion
- Throughput of the infusion line
- Scheduling of a review for the infusion line – for example, the IV line should be visually checked every 'x' minutes
- Administration of an infusion based on the patient's total parenteral nutrition.

## 4.10 Antimicrobial medicines

The EMM system should support an antimicrobial prescribing and approvals workflow that follows antimicrobial prescribing guidelines, including:

- Displaying the selected antimicrobial's prescribing guidelines
- Supporting antimicrobial restrictions based on the class or antimicrobial selected – that is, those requiring no approvals, those requiring automated approvals based on the prescribing algorithm, and those requiring approval from a microbiologist or infectious diseases specialist
- Recording the indication and other clinical parameters that influence the use of the selected antimicrobial
- Calculating the antimicrobial dose and duration based on the clinical parameters
- For restricted antimicrobials, recording the approval number of the microbiologist or infectious diseases specialist
- Facilitating the prescribing of antimicrobials by indication according to the results of microbiology sensitivity reports
- Locally maintaining the content of antimicrobial prescribing guidelines.

## 4.11 Controlled medicines

The EMM system should support prescribing of controlled medicines. Controlled medicines should be prescribed, supplied and administered in line with state or territory legislation, including any requirements for:

- Printed prescriptions
- Handwritten annotations
- Witnesses
- Approvals.

# 5

## Clinical decision support

The electronic medication management (EMM) system should support clinical decision support, which should be:

- Appropriate and applicable to Australian medication practice
- Available and active during the prescribing process
- Available during medication administration
- Automatically re-run whenever new medicines or changed medicines are ordered for a patient
- Intelligently hyperlinked, so that reference material is available without the need for the prescriber to leave the prescribing function.

Reference information could include:

- A local formulary
- Locally configured pharmacy-supplied information – for example, treatment options
- *Therapeutic Guidelines*<sup>\*</sup>
- *Australian Medicines Handbook*<sup>†</sup>
- MIMS Australia<sup>§</sup>
- Hospital policies
- Information on pharmacokinetics or pharmacodynamics
- External websites or online resources.

Box 5.1 lists items and actions that benefit from using a clinical decision support system.

### Box 5.1: Items and actions for decision support

An electronic medication management system should include decision support tools for the following items:

- Medicine–allergy checks
- Medicine adverse reactions
- Intolerance
- Contraindications
- Dose range checking
- Therapeutic duplication
- Medicine–medicine interactions
- Medicine–allergy interactions
- Medicine – diagnostic test result checking
- Medicine–disease checking
- Cumulative dose checking

<sup>\*</sup> <https://www.tg.org.au>

<sup>†</sup> <https://amhonline.amh.net.au>

<sup>§</sup> <http://www.mims.com.au>





- Medicine–age interaction
- Medicine–gender interaction, such as excluding pregnancy and breastfeeding warnings on medicines prescribed to male patients
- Interactions of medicines with certain foods, alcohol, tobacco or recreational drugs
- Low weight or high weight, based on the patient’s age
- When weight and height are not recorded
- Once-in-a-lifetime medicines – for example, streptokinase
- Alerts for monitoring test results
- Need for supervised medicine administration
- Length of treatment – for example, antimicrobials
- Predisposing patient risk factors.

Medication dose warnings should be provided for certain conditions, including:

- Older age
- Pregnancy
- Breastfeeding
- Diabetes
- Paediatric patients
- Nil by mouth
- Impaired renal or hepatic function
- Cardiac failure.

Decision support should include:

- Alerts that occur immediately on prescribing a single medicine – that is, the alert should not be triggered only at the end of prescribing numerous medicines
- Duplicate therapy and cumulative dose checks on all the components of a linked order, although multiple-route linked orders should not generate duplication warnings
- The need for prescribers to acknowledge alerts and select a reason for overriding the alert, supplemented by free text comments, if required; this information should be available for audit in reviewing prescriber behaviour
- Configurable prescriber alerts based on role or sub-role, such as junior doctor, senior doctor and specialty
- Support for system-learned decision support, which increases or reduces alerts based on prescriber practice
- Ensuring that high-level alerts cannot be overridden without a reason for the override being recorded where a coded override reason is recorded, with explanatory free text, if required
- Prescriber overrides to be visible at the time of medication administration; high-risk medication overrides should be given specific prominence
- Configurable alert severity and prominence based on user credentials
- A unified view of alerts when displayed

# 5

## Clinical decision support

- Alerts linked to further information when displayed, if required – for example, to the evidence underpinning the alert
- Prompts for ordering of diagnostic tests or checks when prescribing specific medicines – for example, INRs, digoxin levels and serum potassium
- Other electronically available clinical information if it is required to calculate the dose of a medicine, or if further clinical information is required before administration of the medicine
- An alert if a test result falls outside the recommended limits for any given medicine; the alert should be sent to the prescriber work list, and the clinician should be alerted when reviewing the medication administration record
- Dose checking against configured dosing schedules (including those for age), with appropriate tolerances, to allow flexibility in the dosing of some medicines – if doses are inappropriate or outside the clinically indicated range, an alert must be generated; it must be possible to override these alerts, and a record must be kept for audit purposes
- Information about dose conversions from one medicine to another, suggesting equivalent doses of different preparations for medicines such as opiates and steroids, in line with *Australian Medicines Handbook*
- Support for medication substitution, including
  - indication of permissibility of substitution
  - recording of substitution
  - auditing of substitution
- All available strengths of a medicine, listed in order from the lowest strength to the highest strength
- Information on pregnancy or breastfeeding, as appropriate, including alerts to check and counsel about pregnancy when medicines that could be dangerous to an unborn child (for example, methotrexate) are prescribed to women of child-bearing age
- Dose reductions in elderly patients, and people with hepatic or renal impairment, if appropriate
- Nationally validated warfarin prescribing guidelines to support the prescribing and dose calculation of warfarin using a patient's INR and indication
- Prompts to measure coagulation for patients with trauma who are prescribed anticoagulants
- Prescriber alerts if there is therapeutic duplication within the same class of medicine being prescribed such as when two statins are prescribed at the same time
- Tracking of the cumulative dose of a medicine over time, and warnings when a maximum dose is reached at prescribing and at administration
- Alerts for medicine–disease and medicine–age contraindications such as beta blockers in asthma and aspirin in patients aged less than 16 years; it must be possible to override these warnings, provided that a reason is recorded
- Guidance on dosage adjustment for patients on different types of dialysis
- Routine recording and updating of venous thromboembolism risk assessments for all inpatients; clinical decision support should prompt prescribing of prophylaxis for those at risk, according to local policy, and this assessment must be completed before prescribing non-emergency medicines
- Prompts for intravenous (IV) to oral switches, determined by configuration that is aligned to infection control policy
- Alerts for IV fluids for medicine–fluid, fluid–fluid and medicine–medicine incompatibilities, and display of alternatives
- A variety of medicine dose calculators depending on the patient's clinical condition – for example, cardiovascular risk or renal impairment
- Dosage guidance and prompts for IV aminophylline, vancomycin and other medicines with a narrow therapeutic index that require individual dosing
- Guidance on the conversion of IV aminophylline to oral theophylline
- Reminders to prescribers of routes that may not be recommended for individuals because of specific concurrent conditions – for example, intramuscular injection in a patient with haemophilia
- The use of cytochrome P450 profiling to aid prescribing, with the results incorporated into the system



- Reminders about patients who require regular medicine specific tests because of the medicine they are taking such as tests for function, urea and electrolytes
- Dose calculations based on patient parameters, including
  - creatinine clearance (for example, Cockcroft–Gault equation)
  - ideal weight
  - actual weight
  - estimated glomerular filtration rate
  - body surface area
- Warnings when prescribing anticoagulants – for example, prompts for non-steroidal anti-inflammatory medicines, anti-platelets and other anticoagulants for patients already receiving these types of medicines
- Clinical data from interfaced devices in clinical decision support, including directly connected devices (such as smart pumps) and clinical systems that interface to their own devices (such as a renal system that interfaces to haemodialysis machines).

# 6

## Pharmacist review

The electronic medication management (EMM) system should support the pharmacist review of medication orders, including the following:

- Automatically place all medication orders on the medication chart for administration, and simultaneously make them available for pharmacy review – most medicines can be prescribed and administered without a pharmacist needing to review the medication order (subject to being configured in the EMM system in line with organisation policy), but pharmacists will endeavour to review as many medication orders as possible, starting with medication orders for priority cohorts
- Automatically transmit medication orders requiring dispensing to the dispensing system for supply, and clearly display medication orders awaiting supply on the medication chart; once the medicine is supplied, the medication chart should be updated to reflect the medication order status
- Clearly indicate on the medication chart any medication orders that are awaiting pharmacy review
- Once medication orders have been reviewed and verified by a pharmacist, indicate pharmacist verification on the medication chart so that it is visible to the clinician when administering medicines
- Display the full details of the medication orders on pharmacy work lists that require pharmacy review, with work list filtering, including
  - medicine order priority
  - time since the medication order was placed
  - priority cohorts such as paediatrics, patients on high volumes of medicines, older patients and pregnant women
  - prescriber
  - therapeutic class or group such as antimicrobials and anticoagulants
  - medication orders previously flagged for follow-up pharmacy review
  - service location
  - discharge orders
  - specific patient
- Review and verify medicine orders, including recording pharmacy instructions and notes against medication orders such as administration instructions, location of the medicine, or use of the patient's own medicines
- Automate some pharmacy instructions to improve medication safety at the time of prescribing such as injectable administration or 'do not crush' instructions
- Ensure that pharmacist instructions and notes are clearly visible at the time of medication administration
- Ensure that prescriber override alerts and reasons for overrides are visible to the pharmacist when reviewing medication orders
- Enable the pharmacist to initiate clinical decision support checks on the patient's existing and new medication orders
- Seek prescriber clarification about medication orders via the prescriber work list, including suggestions for alternative medicines for approval
- Return pharmacist-proposed changes to a medication order to the prescriber work list for approval
- Suspend medication orders while waiting on clarification from prescribers, clearly indicating the reason for suspension on the medication chart such as when approvals are required
- Clearly indicate on the medication chart any cancellations of medication orders and the reason for the cancellation
- Verify medication orders, and transmit medication orders requiring dispensing to the pharmacy dispensing system
- Provide easy access to patient diagnostic results and other clinical information when reviewing medication orders
- For some medicines that require monitoring, clearly indicate the monitoring requirements on the medication chart when the medicine is being administered
- For some medicines, remind the prescriber of the monitoring requirements via the prescriber work list
- Enable some medication orders to remain on the pharmacist work list and give the reason that they remain there such as for monitoring, awaiting Therapeutic Goods Administration or drug and therapeutics committee approval, or other reason for follow-up, including recording clinical notes



- Ensure that the performance of the EMM system is not compromised when large volumes of unverified medication orders accumulate as 'unactioned' in the pharmacy review queue
- Enable pharmacy to perform bulk selection and archiving of unverified medication orders so they are removed from the pharmacy review queue.

## 6.1 Supply and interface with dispensing systems

In Australia, all health service organisations that have implemented an EMM system have used a different dispensing system from the EMM system. Dispensing systems have their own specific functional scopes, which may include:

- Stock control functions
- Pharmaceutical Benefits Scheme medication supply and claiming
- Interface to medicine automation devices such as medication safes, automated dispensing cabinets, whole pack robots and unit dose robots.

The business requirements of dispensing systems are not included in these requirements, except when information exchange is required between EMM systems and dispensing systems.

An interface between the EMM system and the dispensing system should be able to:

- Send medication orders from the EMM system to the dispensing system (avoiding transcription errors)
- Map dose-based medication orders to product-based medicines based on the local formulary, provided that the mapping is supported by the Australian Medicines Terminology; pharmacist intervention should be available to manually deal with any shortfalls in converting dose-based medication orders to product-based medicines
- Receive dispensing status updates for medication orders so that anyone viewing the medication chart can clearly see the status of the medication orders
- Receive substitute medication information when substitutes are authorised by the prescriber and dispensed, with the substitute medicines replacing the original medicines on the medication chart
- Clearly display the location of the supply, recorded against each medication order; a medication supply may be from a patient's own supply, local imprest or pharmacy.

Other medication safety requirements for dispensing systems include:

- Labelling of medicines in line with legislation
- Supply of patient-friendly instructions for discharge and outpatient medicines
- Use of scanning technology in the dispensing process to avoid transcription errors
- Mechanisms for dispensing 'blind' clinical trial medicines – that is, a placebo or an active agent.

# 7

## Medical administration

The electronic medication management (EMM) system should support the administration of all types of medicines. It should:

- Record the medicines administered, including witnessing and dual checking, in line with legislative requirements and organisation policy
- Ensure that the patient's demographics, together with the name, form, strength and current status of the medicine, are prominently displayed throughout the medication administration process
- Ensure that a clinician can have access to only one patient record at any one time during the preparation and administration of medicines
- Ensure that it is not possible to gain access to medication administration records for medicines that are not currently scheduled
- Clearly display the name and designation of the person logged onto the EMM system, recording these details against each medicine being administered
- For each medicine due, confirm or record the date and time, dose, route and status of the medicine due, including given, missed, delayed, withheld, and any reason for not administering the medicine
- Allow medication administration workflow that supports ward-round medication administration, such as a ward view or clinician-allocated patient's view; this view should display patients whose doses are due, as well as patients whose medicines have been suspended (so these patients are not forgotten), but it should not be possible to open more than one patient record at a time
- Filter the medication administration view to leave out patients whose medicines are up to date, or have previously received their medicines – to maximise computer-screen 'real estate'.

### 7.1 Before administering medicines

Before administering medicines, the EMM system should ensure that:

- All required medication information, warnings and notes are available for review when the medicine is being administered; alerts that have been overridden by the prescriber should be highlighted and, if configured in this way, be available for acknowledgement by the person administering medicines
- When clinical notes are attached to medication orders, the information is displayed at the time of administration
- Any advice on the reconstitution of a medicine and the use of diluents is displayed at the time of administration
- Any medication storage or handling requirements are displayed at the time of administration
- The medication administration view displays previously administered medicines within a time frame appropriate to the clinical setting
- Medication orders requiring approval from a microbiologist or infectious diseases specialist (for restricted antimicrobials), or other approvals are displayed on the medication chart; this is essential even though some medicines may not be available for administration, depending on organisation policy (for example, off-formulary and Therapeutic Goods Administration–required approvals).



## 7.2 Medication administration workflow

The EMM system should support medication administration workflow, including supporting the operational context of the different clinical settings where medicines are administered. For example:

- In intensive care units, the flow sheet is likely to provide the operating context for administration of medicines – medicines are part of a wider set of clinical data being presented and used, including vital signs, neurological status, haemodynamic parameters, ventilator settings, respiratory parameters, fluid balance and laboratory data
- In chemotherapy units, the chemotherapy protocol is likely to provide the operating context for the administration of medicines
- In general, inpatient units and ambulatory settings, a more conventional medication administration view is likely to prevail.

EMM systems should:

- Display the patients requiring medicines on a medication administration round work list, configured to reflect how the workload of general inpatient units is allocated between clinicians on a shift such as a manager should be able to see all patients on an administration work list on the unit at a given time; each team member should first see their allocated patients, and should be able to gain access to other work lists, if required
- Display the patients for whom no medication administration is due, as a safety check to prevent patients being forgotten
- Highlight priority medicines that have time-critical administration such as medicines for patients with Parkinson's disease or myasthenia gravis
- For each patient, clearly display
  - patient identification information (in line with Section 3.3)
  - allergies and adverse drug reactions (in line with Section 3.4)
  - any overdue medicines
- Display all medication orders for all types of medicines that are due, without having to traverse multiple tabs or screens to prevent missed doses arising from EMM system design, including
  - 'as needed' (PRN) medicines
  - once-only and clinician-initiated medicines
  - telephone orders
  - warfarin orders (only applicable if the patient has been prescribed warfarin)
  - all regular medicines
- Display any specialist medicines that have been prescribed for the patient, including
  - intravenous (IV) fluids
  - insulin
  - acute pain relief
  - palliative care medicines
  - chemotherapy medicines
  - IV heparin
  - others (as defined by local configuration).

# 7

## Medical administration

- Display an alert for overdue medicines, such as overdue time-critical medicines and medicines for which the due time exceeds the locally configured time window; this includes alerts for escalation mechanisms to the clinician work list, the nurse unit manager work list and, for some medicines, the prescriber work list
- Display any medication orders that have been suspended as a safety check to prevent ceased medicines being forgotten; however, it should not be possible to administer these medicines while they are ceased
- Display a 'previous medication administration' window so that missed doses are clearly visible
- Prompt the clinician to check clinical measures or results before administering specific medicines, including
  - warfarin – prompt to check INR result
  - insulin – prompt to check blood glucose level (BGL)
  - digoxin – prompt to check pulse rate
- Display clinical documentation that needs to be completed at the time of administering a medicine – for example, a pain score or hourly observations
- Alert the clinician if the required clinical documentation is not completed before they leave the patient's administration record; outstanding clinical documentation should appear on the clinician work list for follow-up
- Alert the clinician if there are outstanding medicines requiring administration, if the clinician attempts to close the patient's medication administration record.

Box 7.1 provides a checklist of work list activities that may require follow-up.





#### **Box 7.1: Work list activities that may require follow-up**

The electronic medication management system should bring together medication-related activities for clinicians into a work list for follow-up action (based on allocated patients or all patients in a clinical unit). Work list activities and items might include:

- Impending administration of time-critical medicines
- Overdue administration of time-critical medicines
- Imminent intravenous fluid bag changes
- Overdue telephone orders
- Medicines with overdue review dates
- Medicines with an impending stop date (if configured locally)
- Medicine monitoring activities when medicines require clinical monitoring
- Overdue clinical documentation associated with a medicine
- Medication orders prescribed and included on the administration chart and subsequently rejected by the pharmacist
- Medication orders awaiting internal approval (for example, non-formulary and high-risk medicines, and antimicrobials)
- Medication orders awaiting a requested review by a senior prescriber before the medicine is available for administration
- Medicines that have been reconciled by a non-prescribing clinician and are awaiting prescriber validation so they can be added to the medication chart and administered
- Overdue medication reconciliation for priority cohorts, as defined locally
- Medicine-related communication between prescribers, pharmacists and nurses.

### 7.3 Medication administration

The EMM system should support medication administration, including:

- Ensuring that all medicines administered include a record of the date, time, clinician and clinician's designation
- Scanning patient wristbands and medicines to be administered at the point of medication administration, for improved medication safety
- Displaying the most recent change to any of a patient's medication orders, including the time in hours since the change – for example, 'Medication orders last changed 30 SEPTEMBER 2016, 3 HOURS AGO'
- Alerting the clinician if supervised administration is required
- Displaying all outstanding doses that are due, and highlighting overdue medicines
- Displaying medication administration information at the time of administration and, if configured in this way, requiring confirmation by the clinician at the time of administration
- Supporting the administration of alternative doses and forms of a medicine that may not have been defined by the prescriber – for example, when stock variations limit the availability of the medicine that was originally prescribed
- Suspending or deferring the administration of a medicine, with the ability to select a reason from a configured list and clarify using free text; these missed doses must be clearly visible on the medication administration record
- Recording medication administration with one or two electronic signatures; certain medicines (including Schedule 8 medicines, some Schedule 4 medicines, paediatric medicines, IV medicines and high-risk medicines) will require a witness, depending on the configuration of the medicine
- When administering a medicine with multiple linked orders for different routes, ensuring that, when one route is selected, any other route cannot be concurrently selected – for example, 'morphine, orally, 10 mg, QID PRN / morphine, IV, 1 mg QID PRN'
- When medicines have associated lock-out times, alerting the clinician to prevent subsequent medicine administration from being recorded until the lock-out time has elapsed
- Allowing retrospective charting of medication administration – for example, following resuscitation or during anaesthesia.

Box 7.2 lists some items that will need to be recorded during medication administration.



### Box 7.2: Medication administration items that need to be recorded by an EMM system

The electronic medication management (EMM) system should allow the following to be recorded:

- Clinician-initiated medicines, standing orders (for example, for chest pain, diarrhoea and vomiting, minor burns)
- Patient-controlled analgesia (PCA) and nurse-controlled analgesia (NCA), including the integration of PCA and NCA pumps to record information on dose, frequency, volume, intended duration, and when the syringe is changed or the contents discarded
- The strength of the medicine administered
- The dose of the medicine administered, for medicines within a prescribed range (ensuring that a dose outside the range cannot be administered)
- The actual dose administered (for example, a partial dose) and a reason why, if the dose is different from that prescribed
- Notes – for example, if the administration was different from that prescribed, such as tablets dissolved rather than swallowed
- Infusion volumes, with infusion volumes automatically updating the fluid balance chart
- The site of administration, if this is not explicit in the medication order
- The batch number and expiry date for certain medicines administered
- Any adverse drug events associated with a medicine administration.

The EMM system should:

- Display the latest relevant diagnostic test result, if available, for medicines that require monitoring (for example, INR for warfarin, BGL for insulin); the clinician should be able to record an acknowledgement after viewing the result
- Allow the clinician to enter results such as BGL for insulin if diagnostic test results are not available electronically or the test is undertaken locally
- Allow medicines to be administered earlier than the prescribed or scheduled time (but within a locally configured time window)
- Allow medical gases such as oxygen to be administered
- Allow multiple infusion bags to be administered to complete a medication order such as two 500 mL bags used sequentially to infuse 1 L over eight hours
- Allow the clinician to record the volume of a new infusion bag; the clinician should be alerted if the volume of the new infusion bag, combined with the volume of previous infusions for the medication order, is likely to exceed the total fluid volume that was prescribed
- Allow medication administration to be retrospectively recorded, if required
- Present a clear view of all medication administrations, including overdue and missed doses for the patient's current episode
- Filter the medication administration record – for example, next due, overdue, PRN or missed doses.

# 8

## Discharge medicines

The electronic medication management (EMM) system should support prescribing of discharge medicines and generate discharge medication documentation, including:

- A consolidated list of medicines, including patient-directed information
- Consumer medicines information for dispensed medicines
- Accurate discharge medicines in the discharge summary
- Discharge prescriptions.

The EMM system should:

- Enable discharge medicines, as well as any medicines required on discharge that were ceased on admission, to be selected from the medication chart
- Alert the prescriber if 'as needed' (PRN), parenteral, rectal and inpatient-only medicines are selected for discharge
- Electronically transmit the discharge medication orders for in-house dispensing to the hospital dispensing system; the medication order should include any time constraints associated with discharge
- Allow pharmacy verification of the discharge medication order, through either the EMM system or the pharmacy dispensing system
- Record all annotations to the discharge medication order, through either the EMM system or the pharmacy dispensing system, for audit purposes
- Ensure that what is prescribed is dispensed; if there are any changes to the discharge medication order after it is electronically sent for dispensing, the prescriber will need to change the discharge medication order, and resend it for dispensing
- Ensure that any printed prescription reflects exactly what is prescribed; if there are any changes to the discharge medication order after a prescription has been printed, the prescriber will need to change the discharge medication order and reprint the prescription
- Electronically send discharge medication information to the discharge summary, including instructions to the general practitioner about continuing treatments, or requirements for review and monitoring
- Ensure that the medicines information in the discharge summary accurately reflects what was dispensed; if there are any changes to the discharge medication order after it was electronically sent to the discharge summary capability, the prescriber will need to change the discharge medication order and resend the discharge medication information to the discharge summary capability
- Ensure that any printed discharge prescription conforms with state or territory legislation
- For Pharmaceutical Benefits Scheme medicines, ensure that the prescription conforms with the *National Health Act 1953*
- Print the prescription for signing, if legislation requires a handwritten signature
- Print the prescription as defined by legislation for signing and annotation, if legislation requires handwritten annotations (for example, prescriptions for controlled medicines)
- Include the quantity prescribed in words and figures on the prescription, as defined by legislation, if legislation supports electronically generated prescriptions
- Electronically send the discharge prescription to a prescription exchange service, if available, to support consumer choice or if part of the prescription is dispensed elsewhere
- If the patient has a My Health Record, enable the discharge medication order and any dispensed records to be submitted to the My Health Record system
- Provide a patient discharge medicines list that is
  - free from jargon and abbreviations
  - written in a font large enough to be read by the patient
  - in plain English or other language, as required
- Support prescribing of leave medicines in a similar way to discharge medicines
  - When leave medicines are prescribed, the duration of the leave must be defined either as specified time frames or a set number of days



- The leave status should be displayed in the medication administration record so that administration entries are not required
- If a patient returns early, the leave status should be removed from the administration record so that medication administration can resume
- Ensure that discharge medication information meets the contemporary data definitions published by the Australian Digital Health Agency.

Box 8.1 shows a checklist for the patient discharge medicines list.

**Box 8.1: Patient discharge medicines list: checklist**

For each prescribed medicine, the patient discharge medicines list should include:

- The medicine, and its form, strength, dose, frequency and duration
- The generic medicine name and the brand name (if dispensed by the health service organisation)
- The indication
- Directions and supplementary information to support safe use
- The date and time of the last dose of the medicine given
- For weekly or monthly doses – for example, Zoladex – when the next dose is due
- Any appropriate cautions for high-risk medicines administered in the past 12–24 hours
- Whether the medicine is new or unchanged.

The patient discharge medicines list should also include:

- A separate list of ceased medicines, including the reason for cessation
- Known allergies and adverse drug reactions
- Contact details if patient follow-up is required.

## 9.1 Medication safety if there are multiple EMM systems

Some health service organisations operate more than one system containing medication information. Examples are health service organisations with specialist systems for intensive care units or chemotherapy. Where this occurs, electronic medication management (EMM) systems should:

- On entry to a service that is using an EMM system, support the import of structured and coded medication information held within other EMM systems within the organisation, and support inbound medication reconciliation
- On transfer from a service that is using an EMM system to a service using a different EMM system, support the export of structured and coded medication information held within the EMM system to the other EMM system, and support outbound medication reconciliation
- Incorporate an interface between the different EMM systems, with the electronic exchange of structured and coded medication data between these systems, and support medication reconciliation
- If no interface is available, consider other mechanisms to display medication information between the different EMM systems and support medication reconciliation – for example, a display window or hyperlink within the EMM system of the receiving service that displays the active medication orders by the sending service, including the next administration time.

If no technology options are available, local policies and procedures will determine what happens to patients who have medicines recorded in both systems. EMM system support could include:

- Alerting clinicians about other existing electronic medication charts – for example
  - the general EMM system would highlight that a chemotherapy chart exists in another EMM system
  - the chemotherapy system would highlight that other electronic charts exist in the general EMM system
- Printing a medication chart that incorporates the safety features of the national inpatient medication chart, to support medication reconciliation (refer to Section 3.7.5)
- On transfer out of a service, suspending the electronic medication chart, with the chart clearly marked as suspended and the reason for the chart's suspension
- On transfer back into a service, re-initiating the electronic medication chart, with the suspension period clearly marked as suspended, and no requirement to record any medication administration during this time.



## 9.2 Support for medication reconciliation

Primary care and the hospital sector are increasingly using secure messaging to electronically communicate with each other. Along with access to the My Health Record system, this provides greater opportunities for medication information exchange that supports medication reconciliation.

Medication reconciliation should include, if available, medication information held in other systems used within the health care organisation, including:

- Previous discharge summaries
- Previous specialist letters
- Electronic referrals received from general practice via secure messaging.

Medication reconciliation should include, if available, medication information held within the My Health Record system, including:

- Shared health summaries
- Event summaries
- Discharge summaries
- Specialist letters
- Referral notes.

Technical shortcomings may currently prevent the complete exchange of structured and coded medication information between external systems and EMM systems. However, the EMM system should make the most of what is available from external systems, to streamline and enhance the medication reconciliation process.

Examples of how the EMM system should support medication reconciliation include:

- If limited or no structured and coded medication information is available, the EMM system should display clinical documents within the medication reconciliation function for review by the clinician
- If structured and coded medication information is available, it should be electronically exchanged and imported to the EMM system so that it is available for use and review by the clinician
- If the dose instruction component of electronic medication information remains as free text, it should be electronically exchanged and displayed for the clinician to interpret.

This section considers specialty-specific electronic medication management (EMM) requirements, including for:

- Chemotherapy
- Paediatrics
- Anaesthetics and intensive care units (ICUs)
- Emergency department, including resuscitation
- Renal dialysis.

The requirements for speciality-specific medicines should be considered as extensions of, or variations to, the requirements for general medicines, including:

- Clinical decision support
- Variable doses
- Conditional doses
- Infusions
- Monitoring requirements
- Workflow.

The general requirements associated with speciality-specific medicines are not repeated in this section.

## 10.1 Chemotherapy

The EMM system should support the prescribing and administration of chemotherapy medicines, including:

- Chemotherapy treatment based on a readily available chemotherapy protocol (displayed in read-only format); these can be an *eviQ*\* protocol or a local one
- A chemotherapy treatment plan, which should include
  - the diagnosis
  - the name of the chemotherapy protocol
  - the date treatment started
  - the intended duration
  - the number of treatment cycles
  - the therapeutic goal of treatment – for example, curative or palliative
  - the tests to be performed after the specified number of cycles
  - other therapeutic plans (for example, surgery, radiation therapy)
  - any treatment variations (for example, dose reductions)
- Scheduling of treatment cycle appointments based on the capacity of the chemotherapy service, existing booking commitments, the availability of treatment chairs and the requirements of the patient's treatment plan
- Changes to scheduled appointments, which should not require changes to the protocol-based prescription
- Body surface area (BSA) or weight-based dose calculations; these include Mosteller or DuBois calculators that consider factors such as renal function and liver function
- Dose adjustments according to the presence or absence of toxicity and other prescribed medications, and renal and liver function
- For children, recording of the adjusted height and weight, and calculating a new BSA dose

\* *eviQ Cancer Treatments Online* <https://www.eviq.org.au/>





- A medication order that includes all parenteral and oral medicines that make up the targeted therapy, oral chemotherapy and supportive therapy; these include hydration and anti-emetics
- An 'automatically generated' medication order or order set that is based on the protocol, with the prescriber prompted to confirm or modify the medicine orders; when the prescriber modifies a medication order, the changed medication order should be subject to all configured decision support checks
- The cycle number – for example, 2 of 6.

For each prescribed medicine making up the cycle, the EMM system should record:

- The generic name of the medicine
- Dose per patient unit (for example, mg/m<sup>2</sup>) and the total calculated dose to be administered
- Days, dates and times for each administration
- Diluents, volume and rate of administration
- Form and route of administration
- Dose modifications depending on diagnostic test results or side effects
- Current order status.

The EMM system should ensure that cumulative lifetime dose checks are performed on all required medicines when prescribed. If patients have received previous chemotherapy medicines at other organisations, the starting lifetime dose for the new organisation should be updated to reflect these previous doses before any new chemotherapy medicines are prescribed or administered. Similarly, if subsequent chemotherapy medicines are administered elsewhere, the current lifetime dose should be updated to reflect these administrations before any new chemotherapy medicines are prescribed or administered.

On administration of chemotherapy, the EMM system should:

- Provide easy access to relevant clinical documentation – including weight, height, BSA, adverse drug reactions or allergies, and diagnostic results – before administering the medicine
- Support dual witnessing by two registered nurses, or one nurse and one appropriately trained pharmacist or doctor; this should confirm the patient's identification details, the name of the medicine, the dose, the route, the date and time of administration, the expiry date of the medicine, and any allergies
- Ensure that pre-medicines are administered at the required interval before the chemotherapy medicine, in line with the protocol
- Ensure that the medicines are administered in the correct sequence and times, in line with the protocol
- Automatically change the administration times of subsequent sequenced medicines if administration of previous sequenced medication was delayed
- Support administration of post-chemotherapy treatments – for example, fluids or anti-emetics – in line with the protocol
- Enable clinicians to fill out any required documentation
- Provide multidisciplinary patient information, tailored to the protocol, including support for complex self-administration schedules.

## 10.2 Paediatrics

The EMM system should support the prescribing and administration of paediatric medicines, including:

- Creating separate paediatric or neonatal prescribing roles (determined by user login) that
  - are linked to paediatric or neonatal formulary, order sets, order sentences and medicine dose ranges
  - enable health service organisations providing both paediatric and adult services to differentiate between paediatric and adult prescribing via different prescribing roles
- If prescribers require access to both adult and paediatric medicines (for example, when children are managed by clinicians who prescribe for adults)
  - creating separate adult, paediatric and neonatal prescribing roles
  - actively confirming the prescriber's logged-on prescribing role – for example, paediatrician – when logging on to the EMM system
  - on selecting a patient, alerting the prescriber if their prescriber role is inconsistent with the age of the patient selected – for example, a prescriber for adults selects a paediatric patient
  - defaulting to paediatric or neonatal formulary, order sets, order sentences and medicine dose ranges when prescribing medicines to children, based on the age of the child
  - defaulting to paediatric or neonatal decision support rules, and paediatric or neonatal reference materials when prescribing medicines to children, based on the age of the child
  - seeking prescriber confirmation whenever adult medicines or adult doses are selected for children, based on the age of the child
  - determining whether a patient is a child or an adult based on various factors, including age, height and weight
  - based on whether the patient is an adult or a child, setting the adult or child formulary, order sets, order sentences, medicine dose range, clinical decision support rules and reference material accordingly
  - if prescribers wish to prescribe paediatric medicines and doses for an adult patient, alerting the prescriber that the specific patient for whom paediatric medicines have been prescribed is classed as an adult
- Providing patient and family age-appropriate education materials.

The EMM system should:

- Ensure that all medicines prescribed for paediatric and neonatal patients have a weight-based dose calculation reference (such as mg/kg)
- Guide paediatric doses based on the most appropriate method for the medicine being prescribed, such as
  - weight
  - weight plus height (in calculating BSA)
  - age (may be based on gestational age or other age calculations)
- Alert the clinician when prescribing and administering medicines if no height, weight or age information is available
- Include decision support checks that are relevant to the dose calculation or dosing unit, including
  - weight-based checking for weight-based doses
  - total-dose checking (sometimes called strength dose) for total-dose medication orders
  - volume checking for volume-based medication orders, such as when one tablet is ordered
  - volume checking for volume fraction medication orders, such as when half a tablet is ordered
  - volume checking that ensures that the largest dose for all age and weight ranges cannot be exceeded (also known as the dose limit or dose cap).

Box 10.1 shows how the configuration of a paediatric EMM can have unintended consequences.



### Box 10.1: Potential unintended consequences

#### Dose range checking, dose expression and calculation checking

Take care if you are allowing paediatric orders to be placed by unit (such as '1 tablet') rather than strength (such as mg, MICROg, units):

- Depending on the software, dose range checking (DRC) may only check doses ordered with the same dosing unit as that programmed into the checking algorithm – that is, the DRC parameters may require a weight-based expression of dose to complete the DRC, resulting in unsafe volume doses that do not trigger any warnings
- DRC may need to be a whole integer (for example, DRC cannot fire for half a tablet), but one tablet may be a life-threatening overdose in paediatric patients
- Volume DRC must reflect the largest dose that cannot be exceeded across all age and weight ranges. For example, the adolescent (adult) dose of paracetamol 500 mg is set to fire at three tablets or more. Where a dose of 15 mg/kg for 40 kg 12-year-old patient is 600 mg, the system would cap the dose at 500 mg (one tablet). Two tablets of paracetamol 500 mg would be an overdose in this case
- If unit sentences have been defined for a product with multiple strengths, the DRC will only fire for doses greater than the maximum number of tablets, regardless of the strength of the tablet. For example, an order for digoxin 62.5 MICROg tablets or digoxin 250 MICROg tablets fires an alert when more than two tablets are prescribed, regardless of the strength of the tablet that is ordered. This can limit the relevance of the alert and contribute to alert fatigue.

The EMM system should ensure that:

- Both height and weight records are up to date; the date the measurements were recorded should be prominently displayed, and clinicians should be prompted with an alert when the records are not up to date
- Weight is compared with population percentile charts to identify outliers, including prescriber alerts when the patient's weight is more than two standard deviations from the applicable percentile
- If the dose has been calculated, the method of calculation is displayed – for example, mg/kg, microgram/kg or unit/kg; the dose should be displayed as both dose per weight and total dose
- Any calculated dose does not exceed the maximum recommended dose (to ensure that obese children do not receive unsafe doses); the clinician should be alerted when prescribing and administering these medicines
- Doses are automatically rounded, to support measurable administration of weight-based doses
- No manual calculation is required once a dose has been calculated and the medicine has been prescribed
- Prescribers are reminded to review and change doses after major weight changes, via workflow
- Doses cannot be finalised when expressed as a weight-based dose if the patient has no recorded weight or their weight record is not up to date
- The final dose cannot be expressed as a weight- or BSA-based dose – for example, mg/kg or mg/m<sup>2</sup>
- All administered paediatric medicines are witnessed by a qualified second-checker.

### 10.3 Anaesthetics and intensive care units

The EMM system should support the prescribing and administration of anaesthetic and ICU medicines, including:

- Linking to physiological monitoring devices, including individual devices, anaesthetic machines and smart pumps, and presenting patient parameters on an electronic flow sheet
- Displaying medication orders and administrations, including infusions, on the electronic flow sheet, to assist complex monitoring when determining the medicines to be prescribed and the doses to be administered
- When medicines are administered by the prescriber, ensuring that the prescribing and administration of medicines are a single activity; clinicians in ICU and anaesthetics should not have to use two separate prescribing and administration workflows
- Recording all medicines used in theatre procedures – whether prospectively or retrospectively – and displaying the medicines on the flow sheet
- Requiring that the actual time that the medicine was administered is recorded, by removing the default ‘time now’ option, which means that the clinician needs to record a time on each occasion
- For sedation medicines, including the infusion rate in the medication order as indicated by the sedation score, with the infusion rate modified according to the sedation level required; the required sedation level and the actual sedation level should be recorded over time
- For peripheral and central nerve block medicines, including both the bolus dose and the continuous infusion dose in the medication order
- Using complex administration routes, including multi-lumen lines
- Linking to physiological monitoring devices that suggest changes to the infusion rate of certain medicines such as inotropes and vasopressors
- Making anaesthetic medicines available to clinical decision support when prescribing both anaesthetic and non-anaesthetic medicines
- Placing infusions on hold while some procedures are carried out
- Supporting witnessing and medicine counts when administering controlled medicines
- Recording pain scores, nausea scores and sedation scores when analgesia, anti-emetics or sedatives are administered, and displaying the scores graphically for the administered medicine.

### 10.4 Emergency department, including resuscitation

The EMM system should support the prescribing and administration of accident and emergency medicines, including:

- Supporting temporary registration and subsequent merging of unknown patients, including unconscious or delirious patients
- Recording any medicines given before attendance, such as by paramedics, and considering these medicines during clinical decision support checks
- Prescribing and administering medicines as a single activity, such as in emergency or resuscitation scenarios; clinicians should not have to use two separate prescribing and administration workflows
- Recording prescribing and administration of medicines retrospectively after an emergency
- Prescribing and administering medicines on behalf of another person – for example, when the resuscitation ‘scribe’ adds the details to the EMM system, which is attested to by the prescriber after the event, or when paramedics have administered medicines before attendance
- Prescribing and administering larger volumes of infusions, such as for patients in burn units
- Supplying medicines via a number of different routes according to local policy and time of day
- On admission to hospital from the emergency department, continuing medication orders that were started in emergency
- Preparing discharge prescriptions for patients who are discharged directly from hospital.



## 10.5 Renal dialysis

The EMM system should support the prescribing of renal dialysis medicines, including:

- Recording all details required for dialysis, including
  - type of dialysis (haemodialysis or peritoneal dialysis)
  - for haemodialysis, the specific part of the machine dialyser to which the medicine is to be administered (pre- or post-dialyser)
  - or peritoneal dialysis, the type of peritoneal dialysis (continuous peritoneal dialysis or automated peritoneal dialysis)
  - fluid type
  - flow rate
  - concentration
  - diluent
  - time on dialysis
  - pressure in the dialyser
  - choice of kidney
  - wash back
- Prescribing all medicines that need to be given during dialysis, including
  - intravenous iron
  - plasma exchange
  - other agents such as heparin, calcium and antimicrobials, and including the dose and dwell time, if relevant, such as for antimicrobials
  - the specific time a medicine is required in relation to the infusion duration; this may be before dialysis, at the start of dialysis, during dialysis, during the last hour(s) of dialysis or at the end of dialysis
- For line locks, recording details of the medicine, the volume of fluid to be used, the specific line, and the duration that it is to remain in place (if required)
- Recording the availability of renal function and other diagnostic test results when prescribing and administering medicines to patients on renal dialysis
- Prescribing medicines for administration on dialysis days, as well as non-dialysis days
- For non-dialysis medicines, describing any dose changes that may be needed because of the effect that dialysis has on medicines already prescribed – for example, vancomycin 1 g in 100 mL rather than 250 mL sodium chloride for renal patients, with appropriate alerting on prescribing and administration
- Prescribing medicines that may otherwise be contraindicated
- Alerting prescribers about the possibility that levels of immunosuppression are affected. This is particularly important in transplant patients, and may be due to medicine interactions, changes in pathology tests or comorbidity, which should be subject to decision support
- Recording administration rates for dialysis, including changing administration rates based on other clinical parameters, such as blood pressure
- Linking fluid restriction and monitoring instructions to prescribing and administration of medicines, if required
- Monitoring medicine orders including variable-dose calculations based on diagnostic test results such as doses of intravenous iron subject to ferritin levels
- Recording changes to the dialysis schedule without needing to change the prescription
- Reminding clinicians via workflow of impending dialysis treatment for inpatients.

Electronic medication management (EMM) systems should support business-as-usual activities, including business continuity planning, ongoing evaluation and continuous quality improvement. This includes:

- Supporting business continuity in the event of an EMM system failure, including mechanisms that
  - allow medicines to be prescribed and administered during EMM system downtime – for example, printed charts that incorporate the safety features of the national inpatient medication chart
  - enable medication information to be updated retrospectively when the EMM system returns to service such as all medicines prescribed and administered
  - enable limited medication information to be updated retrospectively when there has been an extended period of EMM system downtime such as all newly prescribed medicines and the last administered dose of each medicine, with the intervening doses automatically recorded as given
  - make it clear that there was a system downtime when reviewing the electronic medicines administration view
  - allow the paper charts that were used during the downtime to be scanned into the EMM system
- Making use of EMM system data in routine reports, such as
  - EMM user data – for example, usage frequency, usage duration, and transaction and audit logs
  - volumetric data – for example, medicines ordered, doses administered, missed doses, alerts fired, alert overrides, pharmacy reviews and medicines reconciled
  - timing data – for example, timeliness of administration of medicines, timeliness of reconciliation of medicines, time to venous thromboembolism prophylaxis and timeliness of ordering of discharge medicines
  - usage data – for example, prescriber preferences for freehand prescribing or use of order sentences, off-formulary prescribing, alert override reasons, how medicine orders are changed (that is, was the medicine changed, or was it suspended and a new medicine ordered) and how discharge medicines are selected
  - EMM system performance – for example, response times, user volumes and activity peaks
- Producing clinical reports from EMM data, including
  - standard reports (see Box 11.1)
  - integrated dashboards and analytics modules
  - data extract facilities to third-party tools such as business intelligence capabilities.

Box 11.1 shows how EMM data should be used to support quality improvement activities through the production routine reports presented in a standard format.

#### Box 11.1: Examples of standard reports using EMM data

**EMM systems should be configured to produce reports in a standard format to support quality improvement activities**

The following reports are examples of what an EMM system should be able to produce regularly:

- Contraindicated drug-drug interactions
- Missed dose reports
- Compliance with published guidelines for specific conditions such as acute coronary syndromes and stroke
- Antimicrobial prescribing and utilisation.

# Appendix Information sources

The following sources were used to develop these Requirements:

- *Electronic Medication Management Systems: A guide to safe implementation*, 2nd edition<sup>13</sup>
- *Electronic Medication Management Systems: Specialist functions*<sup>14</sup>
- Electronic medication management (EMM) tender requirements, eHealth NSW
- Intensive care unit tender requirements, eHealth NSW
- EMM tender requirements, ACT Health
- Electronic medical record tender requirements, Royal Children's Hospital
- *Guidelines for the Safe Prescribing, Dispensing and Administration of Cancer Chemotherapy*<sup>15</sup>
- *ePrescribing Functional Specifications for NHS Trusts*<sup>16</sup>
- *Output Based Specification for the Procurement of a Trust-wide Electronic Prescribing and Medicines Administration System.*<sup>17</sup>

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