AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

National Guidelines for On-Screen Display of **Medicines Information**

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Contents

Acronyms

Acronym	Term
ACSQHC	Australian Commission on Safety and Quality in Health Care
AMT	Australian Medicines Terminology
CUI	Common User Interface (Programme)
EMM	electronic medication management
FDA	Food and Drug Administration (US)
ISMP	Institute for Safe Medication Practices
IT	information technology
NPSA	National Patient Safety Agency
SNOMED CT®*	Systematized Nomenclature of Medicine, Clinical Terms
SNOMED CT-AU	SNOMED core files with Australian-developed documentation and terminology, including reference sets
TGA	Therapeutic Goods Administration
WHO	World Health Organization

* SNOMED CT is a registered trademark of the International Health Terminology Standards Development Organisation (IHTSDO)

1. Summary

The *National Guidelines for On-Screen Display of Medicines Information* were developed by the Australian Commission on Safety and Quality in Health Care (the Commission) with funding support from the Australian Government Department of Health. The guidelines are part of an ongoing commitment to quality use of medicines described in the National Medicines Policy (and associated guiding principles), which form the platform for safe medicines use in Australia.[1,2] They are also consistent with the Commission's goal of improving the safety of Australian digital health records.

Unclear, incomplete or ambiguous displays increase the possibility of errors, which may result in harm to patients. The aim of these guidelines is to describe consistent, unambiguous terms and processes for on-screen display of medicines information in health information systems.

These guidelines are intended for those developing, assessing, procuring and implementing IT systems for medication management and electronic prescribing to:

- Understand how design contributes to patient safety
- Apply the recommendations during software development and iteration
- Evaluate systems during procurement.

These guidelines will require ongoing evaluation and iterative review as experience grows in the use of electronic medication management. The guidelines represent an agreed format and structure for the safer clinical and consumer-facing presentation of medicines information on-screen.

A wide range of stakeholders have contributed to the review process, including pharmacists, doctors, nurses, consumers, and experts in the field of IT usability and user interface design.

These guidelines comprise recommendations for clear, unambiguous, standardised on-screen presentation of medicines information. A rationale accompanies each recommendation and is based on examples where error has occurred in both handwritten and electronic prescriptions.

These guidelines also describe where consumer presentation differs from clinical presentation, with associated examples.

More detailed clinical scenarios follow two patients through an inpatient hospital stay to community prescribing and dispensing, and presentation in an electronic health record. These depict how the electronic medication management records may appear across the healthcare continuum using the Australian Medicines Terminology (AMT).[3]

These guidelines were first published in two parts: *National Guidelines for On-Screen Display of Clinical Medicines Information* (Clinical Guidelines, January 2016) and *National Guidelines for On-Screen Display of Consumer Medicines Information* (Consumer Guidelines, October 2016). This reflected their chronological development.

The Clinical Guidelines recommended design for presentation of medicines information across all clinical information systems. The Consumer Guidelines were developed with consumers, for consumers accessing electronic information about their medicines. The majority of recommendations in the Clinical Guidelines apply to consumers. However, there are a few important exceptions and additions.

These guidelines combine the previous publications with recommendations for standardised presentation of medicines information across the electronic health continuum.

2. Introduction

Medication errors remain the second most common type of healthcare incident reported in Australian hospitals and can result in serious adverse events.[4,5,6,7,8,9]

Similarly, medication errors in community settings can contribute to patient harm and hospital admissions.[10,11,12] Unclear, incomplete or confusing presentation of medicines information can increase the opportunity for clinicians and consumers to make errors and cause patient harm.[13,14,15] Some of these errors can be serious (that is, likely to lead to permanent reduction in body functioning, increased length of stay, a surgical intervention or death). Error-prone abbreviations occur in 8.4% of in-hospital medication orders[16] and at a considerably higher rate in outpatient prescribing.[17] A large proportion of error-prone abbreviations occur in handwritten prescriptions (61%); 27% involve medicine name abbreviations.

Providing clear, standardised medicines information in electronic medication management (EMM) has the potential to reduce errors, including procedural errors and error-prone abbreviations.[18] Patient safety and quality use of medicines may also be improved as a result. A recent review of 3,291 admissions across six wards in two Australian hospitals revealed a statistically significant reduction in error rates (4.28 errors per admission) following EMM implementation. This was largely driven by a fall in the 'procedural error' rate (that is, unclear or incomplete or illegal orders).[13]

The prescriber orders medicines for a patient to achieve a benefit that outweighs the risk of giving that medicine. The '5 rights'[19,20] (right patient, right medicine, right dose, right route and right time) are communicated clearly and unambiguously by clinicians to ensure the medicine is safely used according to the original intent.

The way that medicines information is displayed on-screen within clinical information systems is critical to the safe performance of the medication management process (that is, prescribe, dispense, administer).[21,22] Further, these systems have the potential to reduce medication errors by improving the way in which medicines information is communicated between clinicians.[23,24]

Electronic medicines information may be accessed, processed and interpreted by a wide audience (for example, consumers, prescribers, nurses, pharmacists, pharmacy technicians, other allied health professionals, and purchasing and supply staff). The clinician who works across different workplaces and across multiple devices encounters a variety of differently formatted medicines information in clinical systems. Consumers and clinicians may access and view differently formatted medicines information across a number of health records, including the prescription and dispense view, shared health summary and discharge summaries. Consistent communication is critical for an internationally diverse population, and where health professionals are increasingly mobile.

Consumers are increasingly able to access their medicines information on-screen through a number of resources (for example, the Medicare website, the My Health Record system). Providing clear, standardised medicines information in systems where consumers interact with this information has the potential to improve patient safety and quality use of medicines.

Prescribing, dispensing and administering using electronic information does not in itself ensure that errors will not occur. Unclear, incomplete or ambiguous displays can increase the possibility of people making errors, potentially resulting in harm to patients. A recent systematic review identified 42 design aspects of prescribing systems that influence usability, workflow, and the accuracy and completeness of medication orders.[25] Much research has shown that poor clinical information system design can lead to user errors (for example, wrong medication selection), with up to 42% of prescribing errors attributed to poor system usability.[26,27,28]

Searching for a medication by text input typically retrieves a list of similarly-spelled medications, which can lead to incorrect selections through false recognition.[29] Incorrect medicine selection makes up approximately 2% to 10% of all prescribing errors.[13,27,30,31,32] Receiving the wrong

2. Introduction

medicine is responsible for approximately 16% of deaths caused by medication error.[33] There is also the potential for a user to select the wrong medication strength or formulation at this stage. Such errors constitute between 2% and 9.5% of prescribing mistakes.[13,27,31,34]

Prescribing an inappropriate dose accounts for up to 26% of prescribing errors.[13,32,34,35] Approximately 40% of deaths caused by medication error are due to inappropriate dosage.[33] Errors of route and frequency also occur.[27,30] Many prescription software packages use abbreviations to denote these instructions (for example, 'q.i.d.' for 'four times per day' or 'p.o.' for 'orally').[36] This practice is likely to be problematic, as abbreviations are more likely to be misread, affected by a single typographic error, or misinterpreted compared with their unabbreviated equivalent.[16]

Calculation errors were noted as common in several studies.[37] For example, one study found 8.6% of total administration errors were due to miscalculation. In addition to mathematical error, other common causes of dosage error include missing a decimal point due to a trailing zero or omission of a leading zero (creating a 10-fold overdose), or confusing units of measurement.[38] Wrong route errors (for example, administering intravenously rather than orally) are less common, but still occur.[38] In a review, nearly half of the included studies reported dosage errors among the top three administration errors.[37]

An evaluation of two EMM systems in Australia found that system-related errors resulting from EMM use accounted for 35% of errors after electronic prescribing intervention.[27] Problematic or confusing presentation of data on-screen has been identified as a factor contributing to the generation of new kinds of errors following technology implementation.[39] These errors could be minimised through system redesign and targeted training[13,27], accepting that poorly designed displays are not the only source of error. The key tenet for improved safety is that human factors are considered in the early design of such systems.[40]

The design of clinical information systems is a rapidly evolving discipline, and these guidelines will require ongoing evaluation and iterative review as experience grows in the use of EMM.[41,42,43] Some recommendations will have only weak published 'healthcare-based' evidence to support their use. Their inclusion is based on 'human factors' evidence, consensus and consultation. Consistency of presentation to support a given recommendation is of utmost importance. This approach will allow evaluation where evidence to support use is lacking. These efforts to develop consistent display standards will be strengthened by the consistent use of medicines terminology in these systems.

These guidelines are intended for those developing, assessing, procuring and implementing systems for EMM, prescribing and consumer health records to understand how presentation contributes to patient safety. Health service organisations are encouraged to seek and procure software systems that work towards implementation of the standard formatting and terms set out in these guidelines. This is expected to be an evolving process, acknowledging existing system capability and current limited clinical evidence associated with on-screen presentation of medicines information.

The Commission is responsible for maintaining these guidelines and for reducing national barriers to implementation during their introduction and ongoing use.

Feedback on these guidelines will be collated for review by the Commission and considered by a Commission-convened expert advisory group. The outcomes of decisions on these issues will be made available on the Commission website.

3. Scope

These guidelines describe safety recommendations for on-screen display of medicines information in all health information systems where medicines information is used and recorded.

Within these guidelines, the term 'prescription' is used to define elements relating to a medicine that convey the intent of the prescriber of that medicine.

These guidelines apply to the display of medicines information in health information systems across the whole healthcare continuum, including:

- Acute health services specifying, procuring and implementing electronic health systems that include medicines information
- General practice prescribing and other software vendors
- Consumer-facing information, including My Health Record
- Aged care electronic medication charts and ordering systems
- Community health services
- Mental health services
- Pharmacy (inpatient, outpatient and community services)
- Dental and allied health services.

These guidelines apply to the on-screen display of medicines information for a prescription, medicine chart and medicine selection list used to create the prescription. Other relevant applications are implied, including:

- Hospital pharmacy dispensing
- Community pharmacy dispensing
- The point of administration of medicines to an individual
- Medication reconciliation
- Discharge summaries, referrals and other health records
- Consumer apps and electronic medicine lists.

These guidelines also provide principles for medicine presentation in selection lists. It is acknowledged that proprietary drug databases, state and territory catalogues, hospital formularies and other legacy systems may not conform at the time of publication.

The majority of medicines information displays are 'pack based' in primary, community and aged care. 'Dose-based' prescribing data is used in inpatient settings. Examples are provided for both pack-based and dose-based prescribing, where appropriate and significant (see Glossary).

A key piece of information associated with every prescription is that it has been made for the right indication, increasingly seen as a '6th right' of safe medicines use.[44] Centres of excellence in patient safety in the United States, such as the Brigham and Women's Hospital, are moving towards indication-based prescribing.

The user interfaces of electronic systems for medicines information are assembled from elements including text, graphics, user navigation elements, and screen layout formats. These guidelines focus on text display, acknowledging the requirements for other elements that shape the safe use of these systems. For example, visual cues and icons have been shown to enhance usability and safety.[25]

These guidelines are intended to aid the design and ease of use of systems that display medicines information. In Australia, systems currently take a proprietary route to the display of medicines information. A user is required to re-familiarise themselves with the presentation of this safety-critical information for each clinical information system used. This is in contrast to other industries (for example, finance, telecommunications and e-commerce) where years of high investment in IT and a strong commercial focus have resulted in a sophisticated awareness of the benefits of good usability. A clinical information system and its use at the point of care is more complex than most other environments. The case for unambiguous medicine display is well developed, and medicines information presented consistently and clearly may assist improvements in interoperability between clinical systems.

These guidelines will be further developed with time and evaluation. The recommendations will also inform the consumer medication action

3. Scope

plan and guidelines for labelling of dispensed medicines.[45]

These recommendations do not specify the process of data entry and do not preclude the use of keystroke combinations or abbreviations and shortened forms to enable rapid data entry. These guidelines are restricted to screen presentation, and designers are encouraged to ensure easy and unambiguous data entry to achieve correct on-screen presentation.

All web-delivered applications should follow best practice in accessibility and inclusive design. Developers are encouraged to conform to the latest published and international standards, including ISO 9241[46], covering ergonomics of human–computer interaction, and the Web Content Accessibility Guidelines (WCAG2.0)[47] endorsed by Australia for all government websites.[48]

The majority of recommendations for clinical information systems also apply to consumer-facing medicines information. However, there are some important exceptions and additions for consumer-facing medicines information to reflect the needs of consumers when accessing electronic information about their medicines (see Section 7).

The guidelines are intended to facilitate the steps involved in the prescribing process, but the processes themselves are out of scope, including the following:

- Identifying the right patient in the system database
- Review of the patient's medicines information, including current and elapsed prescriptions
- Medication reconciliation
- Clinical decision support to confirm the suitability of the selected medicine
- Electronic review of prescriptions, including a forcing function to prevent the printing of incomplete prescriptions
- Medication alerts and advisories, including drug interactions, drug–disease interactions, allergy warnings and other contraindications
- Processes involved in administering prescribed medicines.

It is acknowledged that the growing use of smartphones and tablet computers for clinical purposes[49], and their use by consumers, necessitates the further development of the requirements for medicines presentation on smaller devices. However, these guidelines place the following items displaying medicines information out of scope:

- Smart pumps, wearables, and other devices with small and/or low-resolution displays
- Labelling of dispensed items, unit dose dispensing, and bags containing dispensed products
- Mobile devices
- Reference items and monographs.

Further, these guidelines do not make recommendations for areas beyond medicines information (for example, pathology requests and reporting), although a number of recommendations could be applied to other areas of health informatics.

Application of these guidelines will assist health service organisations that are verifying their services against the National Safety and Quality Health Service Standards.[50] These guidelines should also be introduced in undergraduate clinical programs to support education and drive safety early in the clinician's career.

4. Aims and objectives

The aim of these guidelines is to describe consistent, unambiguous terms and processes for on-screen display of medicines information in clinical and consumer-facing medicines information systems.

The objectives of these guidelines are to:

- Standardise the format of on-screen display of medicines information
- Enhance the safety of the medicines component of clinical-facing information systems
- Reduce the burden on individuals and vendors by delivering consistent interface principles
- Promote safe and quality use of medicines across Australian health care
- Promote the migration of existing national medicines safety work into the electronic environment, including National Tall Man Lettering[51] and the *Recommendations for Terminology, Abbreviations and Symbols used in Medicines Documentation*.[52]

The development of nationally standardised guidelines for on-screen display of medicines information is consistent with the Commission's role to lead and coordinate national improvements in healthcare safety and quality.

5. Background

5.1 Australian Commission on Safety and Quality in Health Care

The Commission was established in 2006 to lead and coordinate improvements to the safety and quality of Australian health care. Among the functions of the Commission specified in the *National Health Reform Act 2011* are requirements to:

- Formulate standards, guidelines and indicators relating to healthcare safety and quality matters
- Promote, support and encourage the implementation of these standards and related guidelines and indicators.

The Medication Safety Program promotes improvements in the safety and quality of medicines use and operates in conjunction with the Safety in E-Health Program to assure the quality and safety dimension of EMM initiatives. Through this collaboration, the Commission makes available a range of resources to assist health service organisations and health professionals to safely implement and use EMM, primarily *Electronic Medication Management Systems: A guide to safe implementation*.[53] The first edition of the guide was recommended for use across the health system by Australian health ministers in 2011 to optimise the efficiency and safety of EMM systems implementation in hospitals. The second edition was published in 2012, and the third edition in 2017.[54]

The Commission's Medication Safety Program focuses on the electronic future for medicines management. The objectives are to:

- Develop and migrate medication standardisations into the electronic environment
- Assure the safety dimension of national EMM initiatives
- Evaluate and standardise medicines information in clinical information systems and electronic health record systems
- Assist with the development, evaluation and refinement of the format of presentation of medicines in e-systems and the e-transfer of prescriptions.

A significant part of the Commission's Medication Safety Program has focused on standardising parts of the medication management pathway to improve safety, including:

- Medication charts
- Terminology, abbreviations and symbols used in recording, prescribing and administering medicines in hospitals
- Medicines information presentation, such as National Tall Man Lettering and user-applied labelling of injectable medicines.

These standardisations provide a sound basis for future electronic health initiatives, including EMM. More information on the Commission's medication safety initiatives is at www.safetyandquality.gov.au/our-work/medication-safety.

5.2 Basis for presentation of medicines information

These guidelines are based on a broad variety of information sources, including:

- The Common User Interface (CUI) Clinical Applications and Patient Safety Programme (see Section 5.2.1)[55]
- Publications such as *Design for Patient Safety: Guidelines for safe on-screen display of medication information* (see Section 5.2.2)
- National standards and recommendations, such as the *Recommendations for Terminology, Abbreviations and Symbols used in Medicines Documentation* (see Section 5.2.3)[56,57,58]
- Good practice for prescription writing as detailed in the *Australian Medicines Handbook*.[59]

These guidelines consolidate the principles of the above information sources and use them as a basis for application to Australian EMM. It is also acknowledged that the current standards for paper-based systems are not automatically applicable in the electronic environment.

Examples of medicines information presentation in these guidelines use the Australian Medicines Terminology (AMT)[60] as the standard nomenclature for all medicine names and dose

forms. Routes of administration, dose and other components of a prescription are derived from SNOMED CT-AU.[3,61] AMT uses concepts to define products, and further AMT implementation support is available from the Australian Digital Health Agency (see Appendix 9.4.3).[62]

5.2.1 The Common User Interface Programme

The CUI Programme[55] represents a large body of work undertaken by the National Health Service (NHS) in the UK in conjunction with Microsoft. The outcome was a portfolio of standards and guidance relating to the safe design of user interfaces for electronic healthcare systems.

The program's core objectives included:

- Increasing patient safety
- Increasing clinical take-up of electronic health systems
- Reducing health professional training costs.

The CUI Programme guidance documents provide criteria for designing web-based or standalone applications for clinicians. However, it is acknowledged that evaluation of CUI guidance implementation has not been reported.

The intellectual property in the CUI Programme documents is owned jointly by the NHS and Microsoft. The NHS chooses to make the documents freely available in perpetuity.

5.2.2 *Design for Patient Safety: Guidelines for safe on-screen display of medication information*

Design for Patient Safety: Guidelines for safe on-screen display of medication information[63] was developed by the NHS for in-hospital services from a variety of sources, including:

- Design guidance published by the CUI Clinical Applications and National Patient Safety Agency (NPSA) Patient Safety Programme[64]
- A review of existing research and guidance in the field of medication information design
- Good practice for prescription writing as detailed in the British National Formulary.[65]

In the UK, it is common practice to use the term 'generic' to describe the active ingredient within a branded product. Also, in contrast to the UK, Australia has a larger number of 'branded generic products' where the manufacturer or house branding is incorporated into the brand name and these are prescribed out of choice.

5.2.3 *Recommendations for Terminology, Abbreviations and Symbols used in Medicines Documentation*

The Australian recommendations[52] were developed from thorough research, interrogation of incident reporting databases and the work of overseas groups, including the NPSA and the Institute for Safe Medication Practices (ISMP).

The recommendations include:

- Principles for consistent prescribing terminology
- A set of recommended terms and acceptable abbreviations
- A list of error-prone abbreviations, symbols and dose designations that have a history of causing error and must be avoided.

The recommendations were initially developed by a working group of the New South Wales Therapeutic Advisory Group's SAFER Medicines Group and have been revised with extensive stakeholder consultation by the Commission.[66]

5.2.4 Human factors research

Human factors specialists apply evidence-based methods and knowledge about people to design, evaluate and improve the interaction between people, systems and organisations. Human factors engineering seeks to improve human performance by designing systems that are compatible with our physical, cognitive and perceptual abilities.[67,68,69,70]

Well-designed systems should minimise the risk of errors. In the current context, this would include medicine-related errors made by prescribers, pharmacists and nurses. Users should be able

to enter prescription information, effectively navigate the system, and interpret medicines information according to the prescriber's original intent. These goals might be typically attained by employing design strategies intended to, for example, reduce cognitive load and minimise the need to use working memory.

Although these guidelines outline current best practice for display of medicines information, it is expected that developers will also employ the latest published and international standards on human factors and usability, including the Web Content Accessibility Guidelines (WCAG2.0).[47]

There is clear evidence pointing to a number of factors that promote clear communication on-screen[71], especially:

- Typeface
- Font size and weight
- Line length and predictability regarding truncation and wrapping (see Appendix 9.3)
- Left and right justification
- Highlighting techniques (colour, bold, shading, underline, italics, upper case)
- Consistency in placement and location
- Screen position (central or peripheral)
- Information density.

Human factors design elements supported by heuristic analysis are recommended to enhance clarity and reduce ambiguity of displayed medicines information. Failure to deliver clear communication is associated with reduced performance, increased search times and increased number of errors. Care should be taken to use clear, concise wording and standardised formats.[72,73,74,75]

Human factors assessment was conducted to inform decisions on medicines information presentation where evidence for best practice from existing paper or electronic systems was inconclusive[76] (see Appendix 9.5).

Designers should also consider international standards for human–computer interaction, including ISO 9241, a standard from the International Organization for Standardization (ISO) covering ergonomics of human–computer interaction.[46]

5.2.5 National Tall Man Lettering List

The National Tall Man Lettering List[77] should be used for medicines with look-alike, sound-alike medicine names.[78,79] This list has been compiled to include look-alike, sound-alike names that are known to cause confusion and have been predicted to pose the greatest risks to patient safety. The overall risk rating is a combination of measures that estimate:

- The likelihood that the medicine names and associated products will be confused
- The overall patient harm that may occur if this confusion occurred.

Details of the methodology and development of the National Tall Man Lettering List are available on the Commission website in the *National Standard for the Application of Tall Man Lettering Project Report*.[51] Further guidance on AMT implementation and the use of National Tall Man Lettering is available on the Australian Digital Health Agency's AMT web page.[62]

5.2.6 Consumer-facing medicines information

A recent literature review identified studies on the information that consumers want or need about their medicines.[80] Studies show that consistency of information is critical – consumers want clear instructions from their doctor on exactly how to take their medicines, and for this information to be confirmed by their pharmacist.[81] Knowing when and how to use their medicines is an important need.[82]

Evidence on best practice for provision of medicines information to consumers was summarised by Vitry and Roughead.[80] Evidence included research and guidelines on print or electronic media, including Consumer Medicines Information (CMI), medicine labels, medicine lists and electronic health records.

5. Background

Vocabulary and information design

Research has focused on the vocabulary used and the graphical display of information for consumers, with the main aim to improve comprehension and therefore improve appropriate medicines use and adherence.

There is general consensus on best practice in information design for medicines information for consumers.[83] Main principles include use of:

- Short, familiar words (for example, blood pressure instead of hypertension)
- Short sentences
- Short headings that stand out from the text
- Conversational tone of voice, addressing the reader as 'you'
- Large type size while retaining sufficient white space
- Bullet points to organise lists
- Unjustified text (ragged right)
- Bold, lower-case text for emphasis.

The Consumers Health Forum of Australia held a consumer workshop in 2010 to discuss best practice for packaging and labelling of medicines.[84] Consumers made a range of recommendations, including the following:

- Positive statements should be used to avoid ambiguity of the message – negative directions may be misleading
- The active ingredient should be displayed in equal size and prominence as the brand name
- Information relating to the quantity of active ingredient per dose or unit must be clearly displayed.

Medicine labels

Guidance on labelling of dispensed medicines is outside the scope of these guidelines. However, some principles of best practice for medicine labelling apply to both pharmacy-dispensed medicine labelling and on-screen presentation of medicines information, especially relating to dosing instructions.

Recommendations and studies undertaken in the USA may be helpful to inform the development of a standard template for consumer dosage instructions in Australia. The 'Universal Medication Schedule' (UMS) developed by the Institute of Medicine recommends provision of dosage instructions into four time periods (morning, noon, evening, bedtime), use of simplified language and formatting to promote understanding (for example, 'take 1 tablet in the morning and 1 tablet at bedtime' instead of 'take one tablet twice daily') and use of numeric characters.[85]

A number of studies have shown that adherence to these best practices improved prescription understanding, regimen dosing and medicines reconciliation.[86,87,88]

In 2013, the Commission and the New South Wales Clinical Excellence Commission hosted a roundtable discussion on improving the safety and quality of pharmacy dispensing labels. Several recommendations from this roundtable are also relevant to on-screen medicines information for consumers, including the following:

- A standard template should be developed to present information to consumers in a consistent format
- Dosing instructions should be explicit and standardised
- Dose should be clearly separated from the interval, and the frequency of medicine dosage should be explicit
- Sentence case should be used; that is, lower-case lettering, capitalising the first word in the sentence only.

Medicine lists

Medicine lists may be given to patients as part of an educational intervention in community pharmacies, at hospital discharge, or downloaded from electronic health records or prescription records. The core elements of medicines information usually mirror information provided on the medicine prescription form itself – generic name, brand name, strength and form, dosage and sometimes treatment duration, with variations in the amount of additional information that may be included.

The Pharmaceutical Society of Australia's (PSA) *Guidelines and Standards for Pharmacists: Medication profiling service*, published in

2007[89], includes a table of the key elements that should be included by community pharmacists when they prepare a medicine list. These are brand and generic names, strength and form, a list of alternative brand names, coloured pictorial or written product description, dosage instructions including duration of treatment, and supplementary information (that is, indication for use, route of administration if unclear to the consumer, special directions or cautions).

Electronic mobile apps, such as NPS MedicineWise's MedicineList+ or MedAdvisor, allow consumers to make their medicine lists themselves by accessing prescription records stored in community pharmacies, scanning medicines' barcodes or selecting the medicine from a list. The apps may also set alarms for medicine doses and calendar alerts for refilling prescriptions. They do not typically include the indications for medicines unless manually entered by consumers. They provide links to more medicine or health information such as the CMI provided by the manufacturer. A small evaluation study showed that, among app users, adherence to the PSA guidelines improved by 8–17%. That is, there was an increase in the percentage of compliant prescriptions, with the increase equivalent to one to two more dispensings per year in app users compared with non-users for 10 common long-term prescription medications.[90]

See Section 7 for best-practice presentation of medicines information to consumers, consumer testing and variation to the guidelines for consumers.

6. Design recommendations

Medicine names – see 6.1 for details

Item	Description	Source
6.1.1 Recommendation	Display full medicine names	ISMP, NPSA, AMT
Rationale	Avoid confusion arising from non-standard medicine names	
6.1.2 Recommendation	Display medicines available as different salts	ISMP, NPSA, AMT
Rationale	Avoid confusion caused by abbreviating or omitting salts	
6.1.3 Recommendation	Display active ingredient name and brand name using consistent font styles for each	NPSA
Rationale	Avoid confusion between active ingredient and brand name	
6.1.4 Recommendation	Use National Tall Man Lettering for medicine names known to cause confusion	WHO, NPSA, FDA, ISMP, ACSQHC
Rationale	Avoid confusion between 'look-alike, sound-alike' medicine names	

Text, abbreviations and symbols – see 6.2 for details

Item	Description	Source
6.2.1 Recommendation	Do not use abbreviations	NPSA, AMT
Rationale	Avoid confusion caused by abbreviations	
6.2.2 Recommendation	Display prescription details in full	ISMP
Rationale	Prevent misreading symbols as numbers or words	
Exception	*For consumer presentation, use 'in', 'over' or other descriptors instead of '/'. (Retain '/' when this is consistent with other presentations of product information)*	
Exception	*For consumer presentation, spell out 'morning', 'evening' and other descriptors instead of using either the 24-hour clock, or 'am' and 'pm'*	
Addition	*For consumer presentation, use everyday words and avoid technical terms*	
Addition	*For consumer presentation, expand instructions to improve clarity*	

Numbers and units of measure – see 6.3 for details

Item	Description	Source
6.3.1 Recommendation	Use a consistent display format and order	CUI
Rationale	Prevent misinterpretation caused by different numerical elements having similar formats and units of measure	
Exception	*For consumer presentation, order of information on route differs*	
6.3.2 Recommendation	Use standard approved units of measure, consistently formatted	NPSA, ACSQHC
Rationale	Prevent misreading or misinterpreting units of measure	
6.3.3 Recommendation	Use spacing and labels to differentiate display elements	ISMP
Rationale	Prevent misreading numbers due to close proximity of preceding words	
6.3.4 Recommendation	Use a space between numbers and units of measure	ISMP, AMT
Rationale	Prevent misreading numbers due to close proximity of trailing units of measure	
6.3.5 Recommendation	Do not use trailing zeros	ACSQHC
Rationale	Prevent misreading numbers	
6.3.6 Recommendation	Display numbers without ambiguity	AMT
Rationale	Prevent misreading numbers	
6.3.7 Recommendation	Use a comma to separate groups of three digits for numbers 1,000 and above	ISMP
Rationale	Prevent misreading very large numbers	
6.3.8 Recommendation	Use ‘million’ instead of ‘mega’	ISMP
Rationale	Avoid confusion over the meaning of ‘m’ or ‘mega’	

General information display – see 6.4 for details

Item	Description	Source
6.4.1 Recommendation	Unambiguously position related elements and labels when using text wrapping	CUI
Rationale	Avoid confusion caused by visual dissociation between related prescription elements	
6.4.2 Recommendation	Never truncate any part of the prescription	CUI
Rationale	Prevent misinterpretation caused by part of the prescription not being visible	
6.4.3 Recommendation	Ensure the full details of multiple prescriptions in a selection list are accessible	CUI & Usability best practice
Rationale	Prevent misinterpretation caused by part of the prescription not being visible	
Variation	*For consumer presentation, see Section 7*	

Examples to support the guidelines are used throughout this document, illustrating each recommendation in terms of appropriate and inappropriate display. They are schematic and contain fragments representing individual AMT components rather than representing the design of a prescribing system with full AMT descriptors.

In addition, highlighting techniques (for example, colour, bold, shading, underline, italics, upper case) will enhance usability. The examples in these guidelines do not use all of these elements. Rather, designers are encouraged to employ these techniques to their best potential within their own systems.

6. Design recommendations

6.1 Medicine names

In general, medicine names may be confused with each other because of inevitable similarities in the large number of names in use. Confusion can also arise when brand names are similar to the 'parent' active ingredient name, and by non-standard naming of medicines within electronic prescribing systems.

Errors resulting from these confusions are well documented in patient safety literature.[27,34,62,91] The likelihood of these errors occurring can be reduced by following simple design recommendations when displaying medicine names in electronic systems.*

6.1.1 Display full medicine names

Recommendation – use full medicine names

The medicine name should be displayed in the prescription, medication order, medicines list or selection list in full with no abbreviation.

See Section 6.1.3 for guidance on using active ingredient and brand names and Appendix 9.4.3 for naming medicines in accordance with the AMT.

Rationale – avoid confusion arising from non-standard medicine names

Confusion can be caused by adopting locally approved medicine names, abbreviations, truncation, and acronyms for medicines with similar names.

Local names may not be universally recognised and may be misinterpreted by an increasingly mobile workforce. In the worst case, a shortening or abbreviation in one locale may directly conflict with a similar shortening from a different locale.

This recommendation does not preclude the use of shortened forms for rapid data entry, provided the data entry results in the full medicine name appearing on-screen.

Likewise, the recommendation does not preclude the user searching for medicines by brand name during the order entry or selection process.

In the example shown, 'Cpl' may be read as 'chloramphenicol' or 'cyclopentolate', both of which are available as eye drops with a 0.5% concentration of active ingredient. These medicines are not interchangeable, and this abbreviation would be unacceptable for short-cut data entry.†

* Active ingredient names in these guidelines align with names used internationally. In Australia, some active ingredients require dual labelling (with both the old and new name) until 2023. For more information, visit www.tga.gov.au/updating-medicine-ingredient-names

† Individual AMT components are used to illustrate the recommendation and rationale. The actual AMT descriptors are chloramphenicol 0.5% eye drops [Medicinal Product Unit of Use (MPUU)] and chloramphenicol 0.5% eye drops, 10 mL [Medicinal Product Pack (MPP)].

6. Design recommendations

Dose based

Do this: 6.1.1a

chloramphenicol 0.5% – eye drops – right eye – DOSE **1 drop** – four times a day

Don't do this: 6.1.1b

cpl 0.5% – eye drops – right eye DOSE **1 drop** – four times a day

Pack based

Do this: 6.1.1c

chloramphenicol 0.5% – eye drops – right eye – DOSE **1 drop** – four times a day SUPPLY 10 mL

Don't do this: 6.1.1d

cpl 0.5% – eye drops – right eye DOSE **1 drop** – four times a day – SUPPLY 10 mL

Dose based

Do this: 6.1.1e

isosorbide mononitrate – modified release tablet – oral – DOSE **60 mg** – once a day – swallow whole

Don't do this: 6.1.1f

ISMN – modified release tablet – oral DOSE **60 mg** – once a day – swallow whole

Pack based

Do this: 6.1.1g

isosorbide mononitrate 60 mg – modified release tablet – oral – DOSE **60 mg** – once a day – swallow whole – SUPPLY 30

Don't do this: 6.1.1h

ISMN 60 mg – modified release tablet – oral DOSE **60 mg** – once a day – swallow whole SUPPLY 30

Dose based

Do this: 6.1.1i

glyceryl trinitrate – sublingual DOSE **600 MICROg** – when required for chest pain

Don't do this: 6.1.1j

GTN – sublingual – DOSE **600 MICROg** – when required for chest pain

6.1.2 Display medicines available as different salts

Recommendation – display the base name without the salt except where the full salt name defines the strength of the medicine

For medicines containing salts of a base active ingredient, use the base name without the salt (for example, amoxicillin, not amoxicillin sodium).

However, include the salt as part of the active ingredient name for medicines available as different salts:

- Where the salt results in a discernible therapeutic difference to the base (for example, atropine sulfate monohydrate)
- Where the salt defines the strength of the product (for example, warfarin sodium 5 mg; phenytoin and phenytoin sodium).

For medicines where the salt confers a clinically significant potency:

- Use the full name of the active ingredient (base and salt) (for example, amphotericin B liposomal, lithium carbonate)
- Display the salt details following the base name
- Display the salt in full.

Refer to Appendix C of the AMT editorial rules[92] for further information on display of clinically significant salts. As a general rule, the expression of the name should be consistent with the display of the active ingredient within an AMT Medicinal Product Unit of Use.

Rationale – avoid confusion caused by abbreviating or omitting salts

If medicines containing salts are displayed using the abbreviated forms of their chemical elements, this may be confusing.

Other abbreviated forms, either used alone or in combination with full words, can also be misleading, such as HCl, Br or K.

Dose based

Do this: 6.1.2a

diclofenac sodium – oral – DOSE **50 mg** – twice a day – after food

Don't do this: 6.1.2b

diclofenac na – oral – DOSE **50 mg** – twice a day – after food

Dose based

Do this: 6.1.2c

metoprolol tartrate – oral – DOSE **100 mg** – twice a day

Don't do this: 6.1.2d

metoprolol – oral – DOSE **100 mg** – twice a day

Pack based

Do this: 6.1.2e

quinine sulfate dihydrate 300 mg tablet – oral – DOSE **300 mg** – once a day at night SUPPLY 50

Don't do this: 6.1.2f

quinine – oral – DOSE **300 mg** – once a day at night – SUPPLY 50

In Example 6.1.2e, 'quinine sulfate dihydrate 300 mg tablet' is the pre-coordinated AMT term and individual components are not listed separately. Hence, the AMT term is illustrated in bold typeface.

6.1.3 Display active ingredient name and brand name using consistent font styles for each

Recommendation – display the active ingredient name

The active ingredient must be displayed, except for combination products with four or more active ingredients or components.

To increase clarity, display ***both*** active ingredient and brand names for:

- Medicines that have significant bioavailability issues, such as **warfarin** (*Coumadin*)
- Medicines posing a higher risk than normal, including insulin, amphotericin and chemotherapeutic agents
- Medicines with two or three active ingredients, such as *Trizivir* tablets, which should be expressed as **abacavir** 300 mg + **lamivudine** 150 mg + **zidovudine** 300 mg – *Trizivir*.

The display order of the active ingredients in a combination product is derived from the innovator product.

The active ingredient name may be displayed alone for medicines that have significant bioavailability issues if there is only one available brand or the brand bioavailability is equivalent.

The brand name may be displayed alone for combination products, or multi-ingredient or multi-component products with four or more active ingredients or components. In this case, the active ingredient names must be displayed using a 'hover over' option with each active ingredient on a separate line (see Example 6.1.3.1e).

In a medicine selection list, display the active ingredient products first in the list followed by brand (innovator and branded generic) products. This separates the active ingredient from similarly named branded products, reducing the risk of selection error (see Example 6.1.3.2a).

Recommendation – systems should adequately differentiate between active ingredient and brand names

The following guidance on medicine name font styles is a suggested approach:

- Active ingredient names – use lower case and bold typeface (**atenolol**)
- Brand names – use italics (not bold) and title case. For example:
  - *Tenormin*
  - *Benadryl for the Family Chesty Cough and Nasal Congestion*.

Precede the brand name with an en dash (see Glossary) to provide further distinction between active ingredient and brand names (for example, **perindopril arginine** 5 mg – *Coversyl*; see Section 6.3.3).

The application of National Tall Man Lettering takes precedence over this guidance (see Section 6.1.4).

Rationale – avoid confusion between active ingredient and brand name

National regulatory authorities (for example, the Therapeutic Goods Administration) and international organisations (for example, the World Health Organization) attempt to ensure that the names of different medicines (both active ingredient and brand name) are sufficiently distinct from each other. This is challenging, given the ever-increasing number of medicines available.[67,76]

The brand name should only be displayed alone when display of active ingredient and brand names could cause confusion (for example, combination products).

6.1.3.1 Medicine order

Dose based

Do this: 6.1.3.1a

morphine sulfate pentahydrate – *MS Contin* – modified release tablet – oral
DOSE **30 mg** – twice a day

Don't do this: 6.1.3.1b

morphine sulfate pentahydrate – modified release tablet – oral
DOSE **30 mg** – twice a day

Dose based

Do this: 6.1.3.1c

Kenacomb – ear drops – right ear
DOSE **2 drops** – three times a day

Don't do this: 6.1.3.1d

triamcinolone acetonide 0.1% + **neomycin sulfate** 0.25% + **gramicidin** 0.025% + **nystatin** 90,000 units/mL – ear drops – right ear – DOSE **2 drops** – three times a day

Dose based

Do this: 6.1.3.1e

Kenacomb – ear drops – right ear
DOSE

triamcinolone acetonide 0.1%
neomycin sulfate 0.25%
gramicidin 0.025%
nystatin 90,000 units/mL

Don't do this: 6.1.3.1f

Kenacomb – ear drops – right ear
DOSE

triamcinolone acetonide 0.1% + **neomycin sulfate** 0.25% + **gramicidin** 0.025% + **nystatin** 90,000 units/mL

Pack based

Do this: 6.1.3.1g

warfarin sodium 5 mg – *Marevan* – tablet – oral – DOSE **5 mg** – once a day at night
SUPPLY 50

Don't do this: 6.1.3.1h

warfarin sodium 5 mg – tablet – oral
DOSE **5 mg** – once a day at night – SUPPLY 50

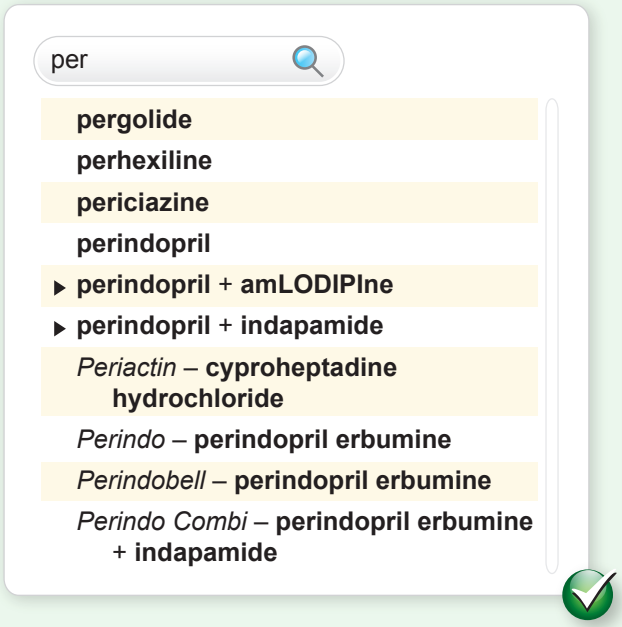
6.1.3.2 Medicine selection list

The 'Do this' examples in this section are indicative only and show an AMT Medicinal Product (MP) concept description or a Trade Product (TP) concept description and the associated active ingredient.

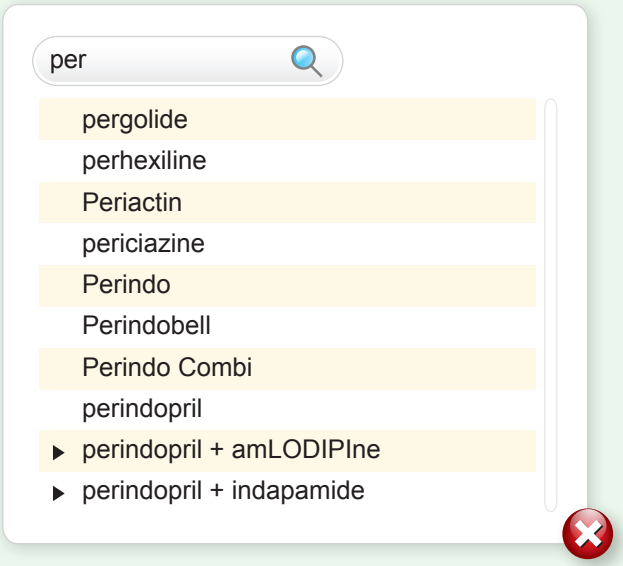
In Example 6.1.3.2b, all the active ingredient and brand names starting with 'per' are listed alphabetically. For a clinician searching for an unfamiliar or infrequently used medicine, this list is problematic as it contains a large number of similar-looking and similar-sounding names. A list like this increases the possibility of selection error, potentially leading to the wrong medicine being administered to the patient.

The 'good' example separates the products according to the rules above and displays the active ingredients first, followed by the brand names with distinct font styles.

Do this: 6.1.3.2a



Don't do this: 6.1.3.2b



This example is a selection list where products are represented without strength in the expectation that a further step in the selection process would display and allow choice of products with the relevant strength.

6.1.4 Use National Tall Man Lettering for medicine names known to cause confusion

Recommendation – use the National Tall Man Lettering List[51,77] for medicines with look-alike, sound-alike names

Implementation of National Tall Man Lettering should be used for active ingredient names and brand names in prescribing and dispensing displays and medicine selection lists. This rule takes precedence over the font recommendations in Section 6.1.3. Therefore, for medicine names where National Tall Man Lettering applies, the font should be a combination of lower case and upper case with:

- Bold font applied to the active ingredient
- Italics applied to the brand name.*

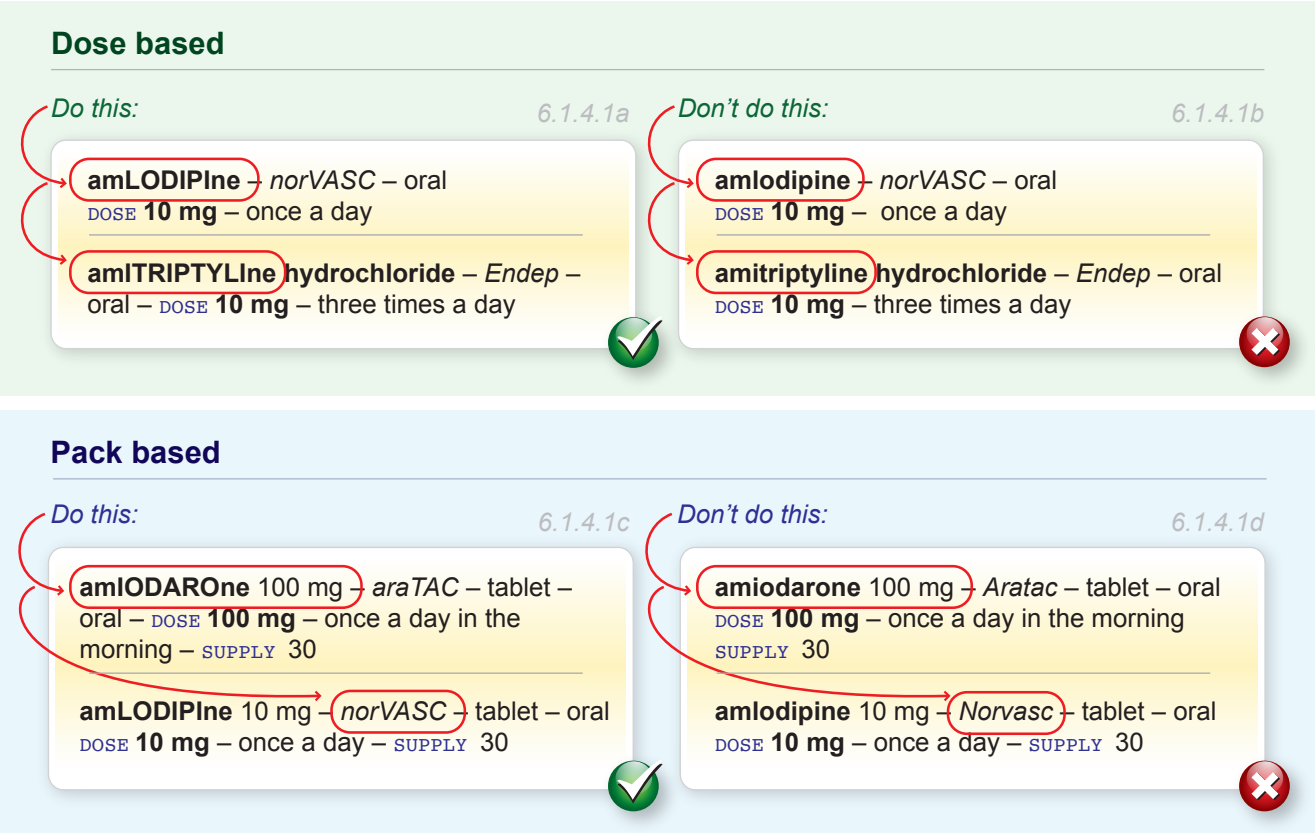
Care should be taken with sans serif fonts, as 'L' and 'I' may be visually identical, depending on their respective cases.

Rationale – avoid confusion between 'look-alike, sound-alike' medicine names

Confusion can occur between medicines which look or sound alike. The World Health Organization recognises this concern and has published a list of look-alike, sound-alike medicines.[93] In Australia, the National Tall Man Lettering List is managed by the Commission.[77]

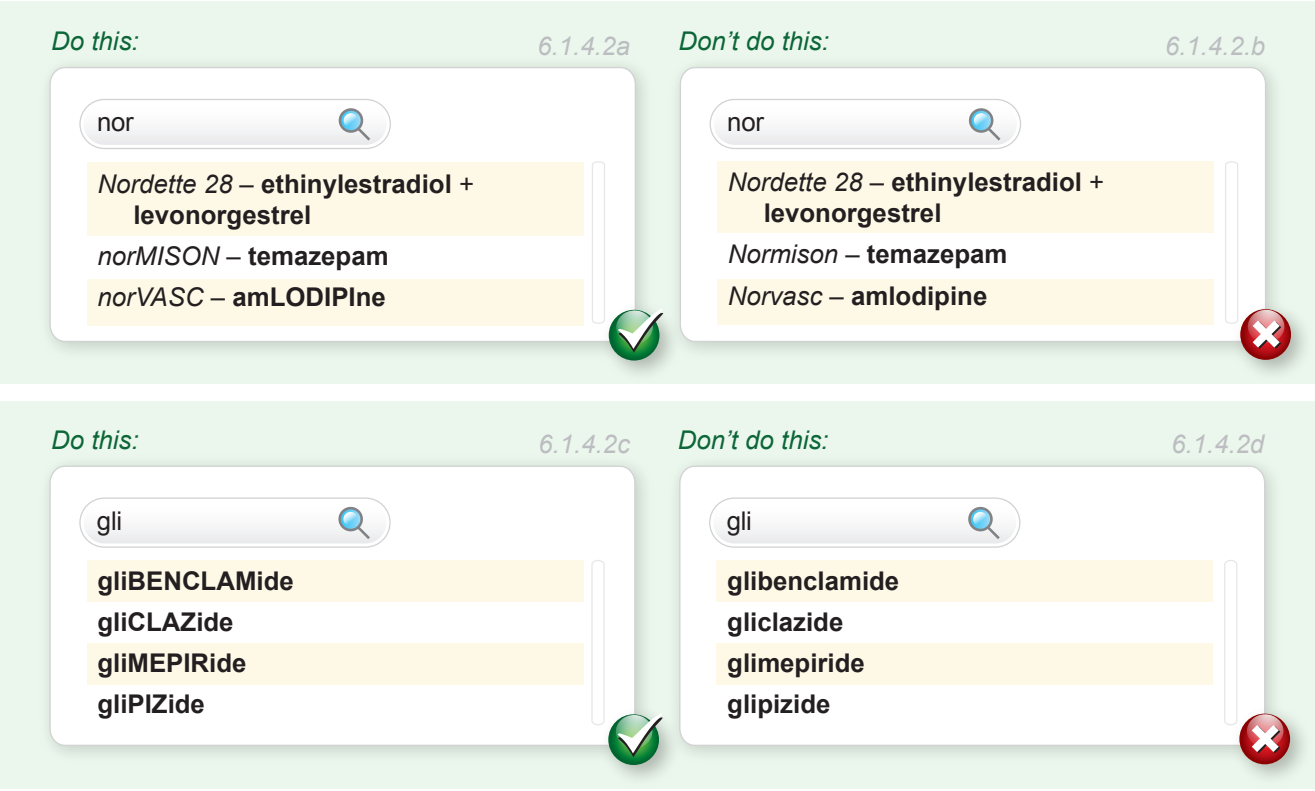
Errors may occur when a patient is prescribed two or more look-alike, sound-alike medicines. Errors may also arise at the point of selection where there is choice between look-alike, sound-alike medicines. It is important to design displays that reduce the likelihood of users selecting an incorrect medicine from an electronic medicine selection list.

6.1.4.1 Medicines order



* The examples on this page show Tall Man lettering applied to an AMT amlodipine Medicinal Product concept description and to an AMT amitriptyline hydrochloride substance concept description. AMT does not include Tall Man lettering in descriptions at the time of publication.

6.1.4.2 Medicine selection list



For simplicity, this example does not show any potential brand name matches for a 'gli' search.

6.2 Text, abbreviations and symbols

Medicine has a strong tradition of using Latin words and abbreviations in place of full English words. This usage has continued due to a combination of handwritten communication on paper and increasing time pressures on practitioners. However, English is the main language used to describe medicines, and clinical staff training does not include Latin or abbreviated terms to describe a medication order. While using Latin abbreviations may be convenient, their use is open to ambiguity and misunderstanding, and ultimately may lead to patient harm.[94]

Further, with an internationally mobile workforce, there is increasing potential for misunderstanding when using these conventions. This is also true for abbreviated forms of English words and the use of symbols in place of words.

Errors resulting from these misunderstandings are well documented in the patient safety literature.[36,95,96,97] EMM systems can help prevent these errors by following simple design recommendations when displaying prescription details and medicine descriptions.

Human factors research[98] recommends the minimal use of abbreviations. Guidelines in Appendix 9.3 set out where wrapping may be appropriate. Abbreviations of dosing and units of measure should only be used with reference to Appendices 9.1 and 9.2.

Abbreviations and acronyms may be very helpful in accelerating the entry of clinical data, provided they are expanded into their full term before being finally stored and displayed.

6.2.1 Do not use abbreviations

Recommendation – display elements of a prescription in full, with no abbreviation, including:

- Route of administration (for example, oral)
- Administration site (for example, left ear)
- Frequency description (for example, at night)
- Medicine form (for example, ear/eye drops).

Exceptions to this recommendation

Modified release products, including slow release, controlled release and continuous release, may use abbreviations. The description used in the brand name may denote release characteristics (for example, Tramal ***SR***, Tegretol ***CR***). Abbreviations to denote modifications of release that are part of the brand name should not be changed. However, note that AMT uses 'modified release' in full as part of the medicine dose form. This includes slow release and controlled release (for example, 'tramadol hydrochloride 100 mg tablet: modified release, 10 tablets', or 'carbamazepine 200 mg tablet: modified release, 200 tablets').

Units of measure may be abbreviated according to the recommended short forms in Appendix 9.1. In most cases, units falling within approved international standards are applied in these guidelines. However, units with potential for confusion and error may be described in a form that differs from approved international standards (see Appendix 9.1).

Days of the week may be abbreviated to three letters, with the first letter capitalised (for example, Mon, Tue, Sat). However, the full word is preferred where space is available.

Rationale – avoid confusion caused by abbreviations

The misinterpretation of abbreviations or acronyms increases where there are a number of interpretations of the shortened form.

In Example 6.2.1b, an error could occur if 'LE' was mistaken for 'left eye' rather than 'left ear'. The full description of 'left ear' avoids ambiguity.

In Example 6.2.1d, the Latin acronym 'ON' has been used instead of 'at night'. This may be misinterpreted, assumed to be an error, or overlooked and lead to incorrect medicine administration.

Dose based

Do this: 6.2.1a

framycetin sulfate 0.5% – eye/ear drops – left ear – DOSE **2 drops** – three times a day

Don't do this: 6.2.1b

framycetin sulfate 0.5% – eye/ear drops – LE – DOSE **2 drops** – three times a day

Dose based

Do this: 6.2.1c

hydrocortisone 1% – cream – topical – to the affected area – DOSE **sparingly** – once a day at night

Don't do this: 6.2.1d

hydrocortisone 1% – cream – topical – to the affected area – DOSE **sparingly** – ON

6.2.2 Display prescription details in full

Recommendation – use full English words in place of symbols

Use full English words to describe all text elements of a prescription. For example, the symbols '<' and '>' may be interpreted inversely to their meaning and must be displayed as 'less than' or 'greater than' in words. 'Greater than' is the preferred option across all contexts. However, terms specific to context (for example, 'longer than' for duration and 'more than' for dose) may be used.

There are exceptions to this recommendation where replacing words would not confer a safety benefit:

- Use '%' instead of 'per cent'
- Use decimal points instead of verbal descriptions of fractions (see exceptions in Section 6.3.6 for tablet quantities)
- Use the '+' separator to combine two or more active ingredients (preferred terms) within a single medicinal product (for example, **paracetamol 500 mg + codeine phosphate 15 mg tablet** as an example of an AMT MP)
- Use the '&' separator to combine two or more components in a multi-component pack (for example, the components of *Nexium Hp7*, **esomeprazole** 20 mg enteric coated tablets & **clarithromycin** 500 mg tablets & **amoxicillin** 500 mg capsules)
- Use '/'
  - to separate measures within an expression of strength (for example, 2 mg/mL)
  - to separate measures within an expression of rate (for example, 10 mg/hour)
  - for brand name combinations (for example, *Coversyl Plus* 5 mg/1.25 mg).

Rationale – prevent misreading symbols as numbers or words

Symbols may be misread as numbers. For example, the symbol '@' used in place of 'at' may be misread as the number 2.

The symbols '&' and '+' should be reserved for the specific purposes described above. They should not be used elsewhere, as supported by heuristic evaluation (see Appendix 9.5), because:

- The symbol '&' may be misread as the number 2 or the number 8
- The symbol '+' may be misread as the number 4 or a dash.

The compressed layout in Example 6.2.2b increases the likelihood of misinterpretation. In the example, the prescription could be misread as 'days 1 4 8', or the '+' could be misread as a dash, making the prescription appear to state 'days 1 – 8'. Misinterpretation in either case could lead to an overdose.

The administration schedule on days 1 and 8 is clearly described in Example 6.2.2a by nominating the dates of intended administration. In addition, time of administration is described in a standardised format by using the 24-hour clock. For example, 11.00 am for 11:00 in the morning and 23:00 for 11:00 at night.

Dose based

Do this: 6.2.2a

vinORELBine – injection – intravenous –
11-Mar-2014 DOSE **50 mg** – at 10:00 am
18-Mar-2014 DOSE **50 mg** – at 10:00 am

Don't do this: 6.2.2b

vinORELBine – injection – intravenous
DOSE **50 mg** – days 1 + 8 @ 10

This example specifies a medicines order where relative dates are not acceptable.

Pack based

Do this: 6.2.2c

furosemide 40 mg – tablet – oral
DOSE **40 mg** – once a day at 10:00 am – SUPPLY 30

Don't do this: 6.2.2d

furosemide 40 mg – tablet – oral
DOSE **40 mg** – once a day @ 10 – SUPPLY 30

Refer to Appendix 9.2 for display of time according to the 24-hour clock.

6.3 Numbers and units of measure

Prescription details and medicine product descriptions contain predictably structured combinations of words and numbers. Sometimes the juxtaposition of words and numbers can cause legibility problems. Also, some units of measure are known to be prone to misunderstanding and should not be used.

Errors resulting from these misunderstandings and legibility problems are well documented in patient safety literature.[36,95,96,97] EMM systems can help avoid these errors by following some simple rules for formatting prescription details and medicine product descriptions, and by using only standard approved units of measure.

6.3.1 Use a consistent display format and order

Recommendation – Display elements of a prescription in a consistent format and order

Use labels

Dose (or dose equivalent, such as volume or rate) is a key element, and its prominence and readability are increased by:

- Preceding it by a label
- Using visually distinctive type (for example, bold)
- Using larger font to differentiate dose from strength (optional; for example, appropriate for administration screens).

Use separators

A separator increases the readability of separate data elements while reducing the amount of space needed between the elements. Recommended separators are:

- The en dash; however, do not use the en dash to precede a number to avoid erroneously implying a negative value
- The '+' separator to combine two or more active ingredients (preferred terms) within a single medicinal product (see Section 6.2.2)
- The '&' separator to combine two or more components in a multi-component pack (see Section 6.2.2).

A separator is not required between the active ingredient name and strength because these are inextricably linked. A separator is optional between frequency, frequency qualifier and indication. In most instances, the en dash will not improve readability; for example, '2 tablets – four times a day when required for pain relief' is preferable to '2 tablets – four times a day – when required – for pain relief'.

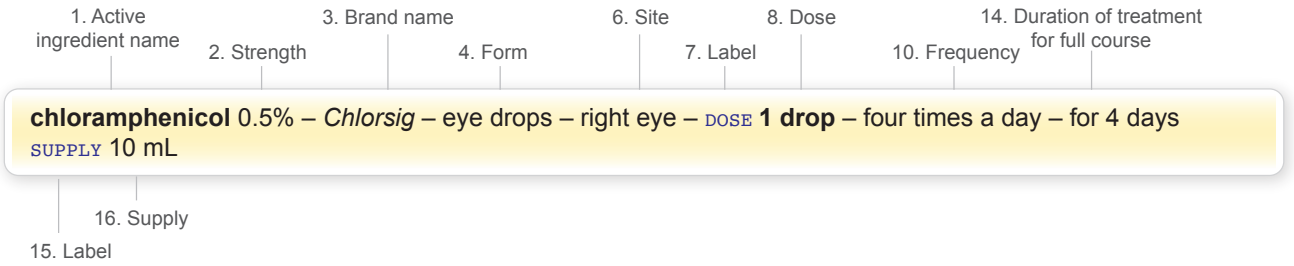
Use a consistent display order of prescription elements

The following examples are recommendations for the consistent display of single- and multiple-ingredient products in medicines orders. In relation to these examples, please note:

- For information on text wrapping in these orders, see Section 6.4.1
- The mandatory elements required to create an order are defined; however, it is beyond the scope of these guidelines to define where elements are mandatory or optional for other uses, including dispensing, supplying and administering medicines
- The examples show individual components that predefined AMT concepts will display in one description.

6. Design recommendations

Single active ingredient product: pack-based example

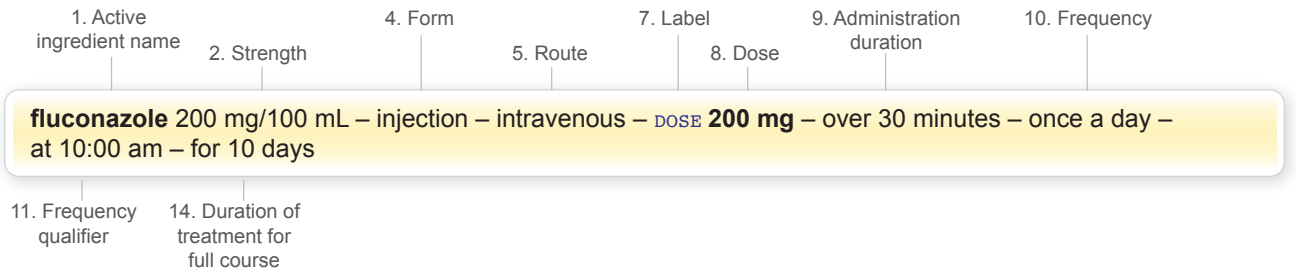


Description	Example	Status	Notes
1 Active ingredient	**chloramphenicol**	Mandatory	
2 Strength	0.5%	Mandatory for pack-based prescribing	*Described as quantity, non-breaking space and a unit of measure* *Optional for dose-based prescribing*
3 Brand name	*Chlorsig*	Optional	*Mandatory for dispense according to display requirements in Section 6.1.3; title case*
4 Form	eye drops	Optional	
5 Route	–	Mandatory	*Mandatory unless adequately described by site*
6 Site	right eye	Optional	
7 Label	DOSE	Optional	*DOSE, RATE or VOLUME*
8 Dose	**1 drop**	Mandatory	*Or equivalent (for example, rate or volume). This may be omitted where a dose cannot be expressed (for example, creams and ointments).*
9 Administration duration	–	Optional	*Time over which a single dose is administered*
10 Frequency	four times a day	Mandatory	
11 Frequency qualifier	–	Optional	
12 Indication	–	Optional	*Mandatory for medicines prescribed 'when required'*
13 Additional instructions	–	Optional	
14 Duration of treatment for full course	for 4 days	Optional	
15 Label	SUPPLY	Mandatory	*Mandatory for pack-based prescribing*
16 Supply	10 mL	Mandatory	*Mandatory for pack-based prescribing*

LEGEND: Yellow indicates items to be presented in bold

6. Design recommendations

Single active ingredient product: dose-based example

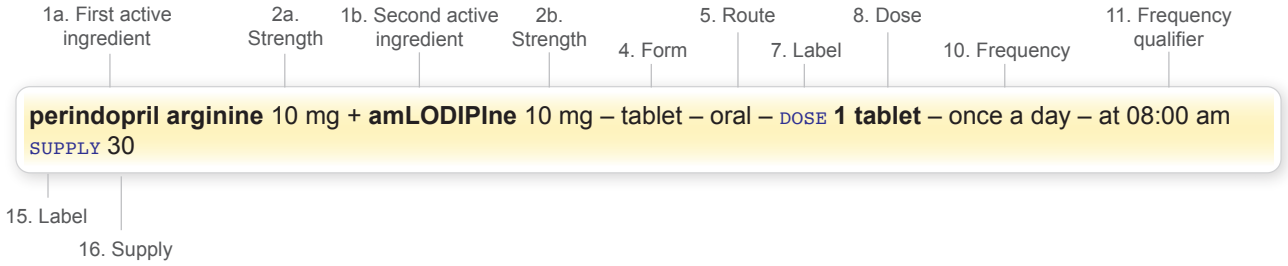


Description	Example	Status	Notes
1 Active ingredient	**fluconazole**	Mandatory	
2 Strength	200 mg/100 mL	Mandatory for pack-based prescribing	*Described as quantity, non-breaking space and a unit of measure* *Optional for dose-based prescribing*
3 Brand name	–	Optional	*Mandatory for dispense according to display requirements in Section 6.1.3*
4 Form	injection	Optional	
5 Route	intravenous	Mandatory	*Mandatory unless adequately described by site*
6 Site	–	Optional	
7 Label	DOSE	Optional	*DOSE, RATE or VOLUME*
8 Dose	**200 mg**	Mandatory	*Or equivalent (for example, rate or volume). This may be omitted where a dose cannot be expressed (for example, creams and ointments).*
9 Administration duration	over 30 minutes	Optional	*Time over which a single dose is administered*
10 Frequency	once a day	Mandatory	
11 Frequency qualifier	at 10:00 am	Optional	
12 Indication	–	Optional	*Mandatory for medicines prescribed 'when required'*
13 Additional instructions	–	Optional	
14 Duration of treatment for full course	for 10 days	Optional	
15 Label	–	N/A	*Mandatory for pack-based prescribing*
16 Supply	–	N/A	*Mandatory for pack-based prescribing*

LEGEND: Yellow indicates items to be presented in bold

6. Design recommendations

Two active ingredients product

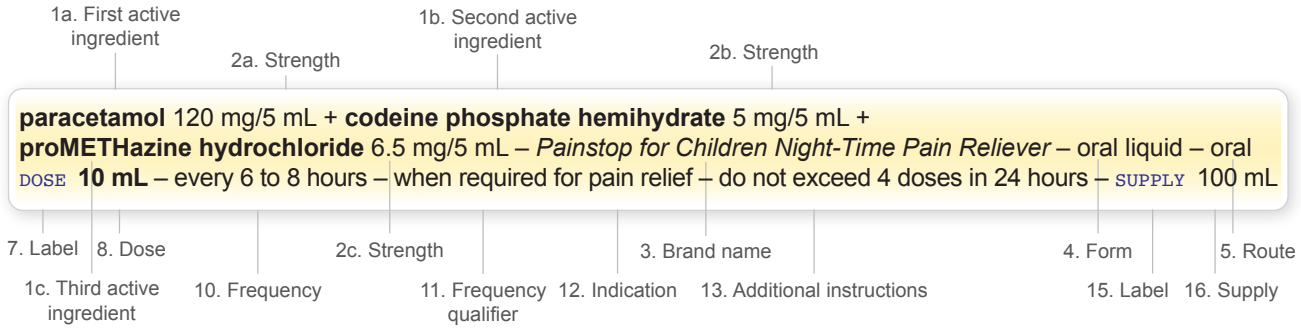


Description	Example	Status	Notes
1a 1st active ingredient	**perindopril arginine**	Mandatory	
2a Strength of 1st active ingredient	10 mg	Mandatory for pack-based prescribing	*Described as quantity, non-breaking space and a unit of measure* *Optional for dose-based prescribing*
1b 2nd active ingredient	**amLODIPIne**	Mandatory	
2b Strength of 2nd active ingredient	10 mg	Mandatory for pack-based prescribing	*As for first active ingredient*
3 Brand name	–	Optional	*Mandatory for dispense according to display requirements in Section 6.1.3*
4 Form	tablet	Optional	
5 Route	oral	Mandatory	*Mandatory unless adequately described by site*
6 Site	–	Optional	
7 Label	DOSE	Optional	*DOSE, RATE or VOLUME*
8 Dose	**1 tablet**	Mandatory	*Or equivalent (for example, rate or volume).* *This may be omitted where a dose cannot be expressed (for example, creams and ointments).*
9 Administration duration	–	Optional	*Time over which a single dose is administered*
10 Frequency	once a day	Mandatory	
11 Frequency qualifier	at 8:00 am	Optional	
12 Indication	–	Optional	*Mandatory for medicines prescribed 'when required'*
13 Additional instructions	–	Optional	
14 Duration of treatment for full course	–	Optional	
15 Label	SUPPLY	Mandatory	*Mandatory for pack-based prescribing*
16 Supply	30	Mandatory	*Mandatory for pack-based prescribing*

LEGEND: Yellow indicates items to be presented in bold

6. Design recommendations

Three active ingredients product



Description	Example	Status	Notes
1a 1st active ingredient	**paracetamol**	Mandatory	
2a Strength of 1st active ingredient	120 mg/5 mL	Mandatory for pack-based prescribing	*Described as quantity, non-breaking space and unit of measure* *Optional for dose-based prescribing*
1b 2nd active ingredient	**codeine phosphate hemihydrate**	Mandatory	
2b Strength of 2nd active ingredient	5 mg/5 mL	Mandatory for pack-based prescribing	*As for first active ingredient*
1c 3rd active ingredient	**proMETHazine hydrochloride**	Mandatory	
2c Strength of 3rd active ingredient	6.5 mg/5 mL	Mandatory for pack-based prescribing	*As for first active ingredient*
3 Brand name	*Painstop for Children Night-Time Pain Reliever*	Optional	*Title case*
4 Form	oral liquid	Optional	
5 Route	oral	Mandatory	
6 Site	–	Optional	
7 Label	DOSE	Optional	*DOSE, RATE or VOLUME*
8 Dose	**10 mL**	Mandatory	*Or equivalent (for example, rate or volume). This may be omitted where a dose cannot be expressed (for example, creams and ointments).*
9 Administration duration	–	Optional	*Time over which a single dose is administered*
10 Frequency	every 6 to 8 hours	Mandatory	
11 Frequency qualifier	when required	Optional	
12 Indication	for pain relief	Optional	*Mandatory for medicines prescribed 'when required'*
13 Additional instructions	do not exceed 4 doses in 24 hours	Optional	*The calculation of a maximum daily dose of paracetamol is outside of the scope of this document*
14 Duration of treatment for full course	–	Optional	
15 Label	SUPPLY	Mandatory	*Mandatory for pack-based prescribing*
16 Supply	100 mL	Mandatory	*Mandatory for pack-based prescribing*

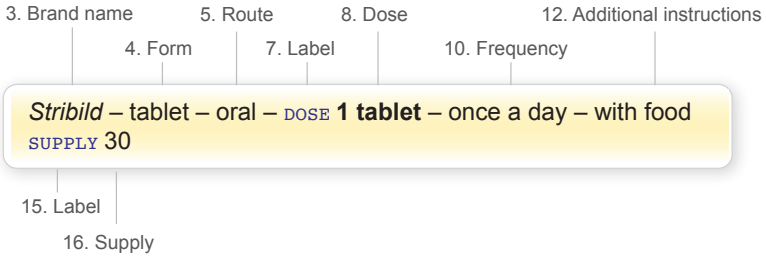
LEGEND: Yellow indicates items to be presented in bold

Product with four or more active ingredients

For example, the fixed-dose combination medicine *Stribild*, which contains:

- tenofovir disoproxil fumarate 300 mg
- emtricitabine 200 mg
- elvitegravir 150 mg
- cobicistat 150 mg.

Display the brand name alone for all fixed-dose formulations with four or more ingredients (see Section 6.1.3). However, the active ingredients should be easily accessible (for example, fully displayed on 'hover over', with each active ingredient displayed on a separate line).



Description	Example	Status	Notes
1 ~~Active ingredient~~	–	~~Mandatory~~	
2 ~~Strength~~	–	~~Optional~~	
3 Brand name	*Stribild*	Mandatory	*Title case*
4 Form	tablet	Optional	
5 Route	oral	Mandatory	
6 Site	–	Optional	
7 Label	DOSE	Optional	*DOSE, RATE or VOLUME*
8 Dose	**1 tablet**	Mandatory	*Or equivalent (for example, rate or volume). This may be omitted where a dose cannot be expressed (for example, creams and ointments).*
9 Administration duration	–	Optional	*Time over which a single dose is administered*
10 Frequency	once a day	Mandatory	
11 Frequency qualifier	–	Optional	
12 Additional instructions	with food	Optional	
13 Indication	–	Optional	*Mandatory for medicines prescribed 'when required'*
14 Duration of treatment for full course	–	Optional	
15 Label	SUPPLY	Mandatory	*Mandatory for pack-based prescribing*
16 Supply	30	Mandatory	*Mandatory for pack-based prescribing*

LEGEND: Yellow indicates items to be presented in bold

6. Design recommendations

For oral liquid preparations, dose should be expressed in weight as well as volume. For example, in the case of morphine oral liquid (5 mg/mL), prescribe the dose in milligrams and confirm the volume in brackets; for example, 10 mg (2 mL). This is particularly important for products available in multiple strengths, where selection of an incorrect product may result in an incorrect dose being delivered.

See Appendices 9.1 and 9.2 for standardised terminology used to describe these prescription elements on-screen.

Rationale – prevent misinterpretation caused by different numerical elements having similar formats and units of measure

Confusion can be caused by different elements of the same prescription, especially those that contain numbers, or that have similar formats and units of measure.

The most common problem is mistaking the strength (that is, concentration) of the medicine for the dose specified by the prescriber.

Clinical information systems can reduce the likelihood of this problem arising by:

- Displaying elements in familiar or consistent sequence
- Using appropriate units of measure and symbols
- Differentiating similar elements of the prescription
- Using labels as separators.

Other types of separators may take up less space than the en dash, such as commas. However, although commas produce a more compact output, human factors imply they may adversely impact readability.[55]

Dose based

Do this: 6.3.1a

fluconazole 200 mg – injection – intravenous
DOSE **200 mg** – over 30 minutes –
once a day – for 10 days

Don't do this: 6.3.1b

fluconazole 200mg – injection – intravenous –
10 days – once a day – 30 minutes

Pack based

Do this: 6.3.1c

atorvastatin 10 mg – tablet – oral
DOSE **10 mg** – once a day at night – SUPPLY 30

Don't do this: 6.3.1d

atorvastatin 10 mg – tablet – oral – **10 mg**
30 – once a day at night

6.3.2 Use standard approved units of measure, consistently formatted

Recommendation – use standard approved units of measure with the upper- and lower-case formatting exactly as described in Appendix 9.1

Some commonly used examples include:

- 'units' for 'units' (that is, do not abbreviate)
- 'mL' for 'millilitres' (capital 'L').

Consistently use either the full or abbreviated format, noting that these may not necessarily reflect approved international standards for units of measure (see Appendix 9.1). Do not be tempted to expand even if adequate display space is available (for example, by replacing 'mg' with 'milligrams' in some situations). A lack of consistency in one situation may increase the probability of confusion elsewhere.

Rationale – prevent misreading or misinterpreting units of measure

Units of measure are vital components of a prescription. IT systems can help reduce the possibility of misinterpretation by displaying only standard approved units of measure, in full or abbreviated, and using these consistently at all times.

Units of measure associated with error include:

- 'U' for 'unit' being misread as the number '0', causing a 10-fold dose error
- 'l' for 'litre' being misread as the number '1'.

Errors are more likely when proper spacing is not used between numbers and units of measure (see Section 6.3.4).

Dose based

Do this: 6.3.2a

insulin glargine 100 units/mL – *Lantus* – injection – subcutaneous – DOSE **32 units** – once a day

Don't do this: 6.3.2b

insulin glargine 100 units/mL – *Lantus* – injection – subcutaneous – DOSE **32 u** – once a day

Dose based

Do this: 6.3.2c

digoxin – oral – DOSE **250 MICROg** – once a day in the morning

Don't do this: 6.3.2d

digoxin – oral – DOSE **250 µg** – once a day in the morning

6.3.3 Use spacing and labels to differentiate display elements

Recommendation – use unambiguous spacing between the different display elements, so that there is no possibility of letters appearing to flow into the numbers which follow them

This can be achieved by using:

- A label or description, such as the word 'DOSE' (as in Example 6.3.3a)
- A single non-breaking space to separate the label from the following number.

If a non-breaking space is used, numbers and units will not be separated when wrapping occurs.

The en dash is a spacing tool that should be reserved for separating discrete elements (see Section 6.3.1).

Rationale – prevent misreading numbers due to close proximity of preceding words

Confusion is possible when the last letters of a word, typically the name of a medicine, appear to flow into the numbers that follow.

In Example 6.3.3b, a prescription for 'propranolol 60 mg' could be misread as 'propranolol 160 mg'.

This is a particular problem when the misread dosage is credible (as in this case, where propranolol 160 mg tablets are in regular use and available as *Deralin*).

An en dash will reduce potential confusion between different prescription elements, including active ingredient and brand names (see Section 6.1.3). However, the en dash should only precede words. Use of the en dash before a number may mislead by implying the negative.

Dose based

Do this: 6.3.3a

propRANOLol – oral – DOSE **60 mg** – twice a day

Don't do this: 6.3.3b

propRANOLol60 mg – oral – twice a day

6.3.4 Use a space between numbers and units of measure

Recommendation – leave a blank space between a number and unit of measure

Leave a single blank, non-breaking space between a number and its unit of measure (for example, 32 units).

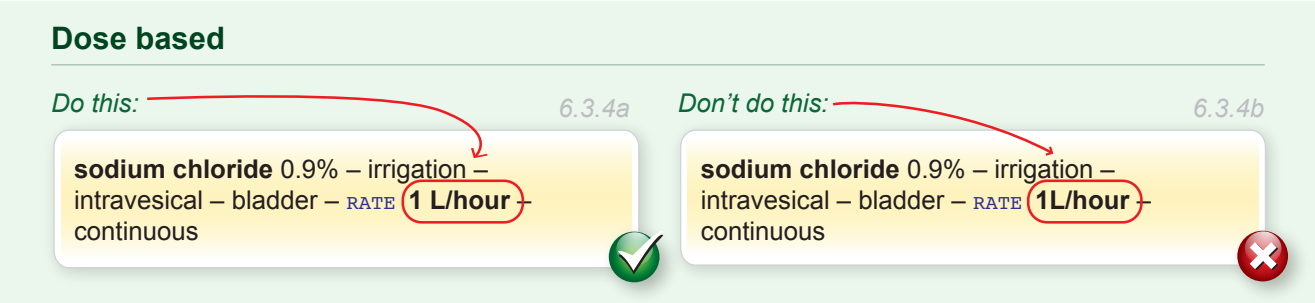
Rationale – prevent misreading numbers due to close proximity of trailing units of measure

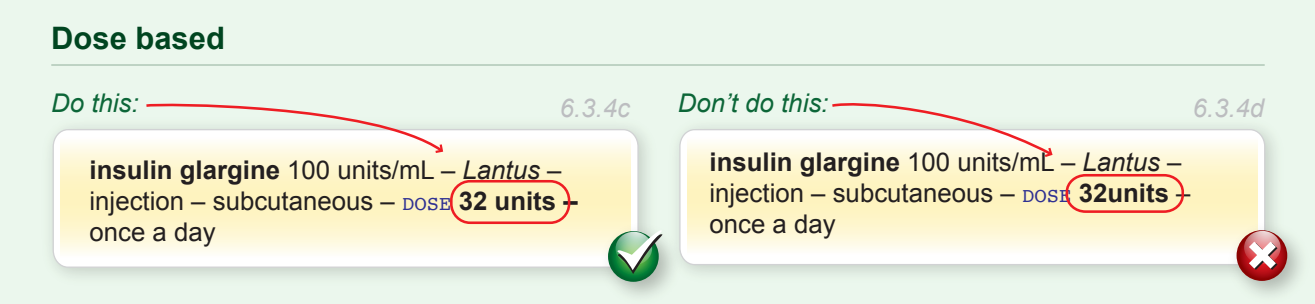
Confusion is possible when numbers appear to flow into the units of measure that follow them.

This situation can be exacerbated by insufficient spacing and incorrect display of units of measure.

In Examples 6.3.4b and 6.3.4d, no spacing has been used between the numbers and units of measure.

In the case of the sodium chloride infusion, the result may be misread as '11 litres per hour'. While the actual administration of 11 litres per hour would be very unlikely, the example shown would still be confusing. For the insulin injection, the dose may be misread as 320 units, with a 10-fold increase of the intended dose.





6.3.5 Do not use trailing zeros

Recommendation – do not use trailing zeros when displaying whole numbers

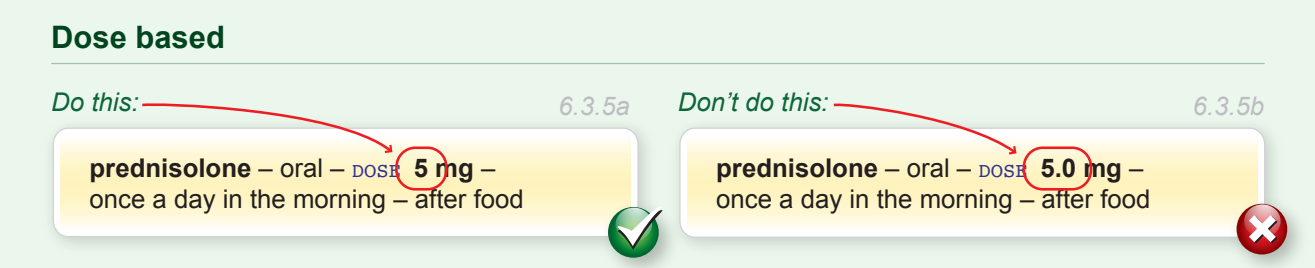
Clinical information systems must be flexible enough to change display formats according to the actual value of the numbers shown, so that whole numbers are shown as integers (that is, to zero decimal points).

Rationale – prevent misreading numbers

If numbers have a trailing zero (a decimal point followed by a zero), there is potential to miss the decimal point and administer a 10-fold overdose.

In Example 6.3.5b, the displayed dose of '5.0 mg' could be misread as '50 mg'.

This is a particular problem in situations where the misread dosage is within the typical range for the medicine. This makes it likely that, if the dose was misread, then the overdose would be administered to the patient.



6.3.6 Display numbers without ambiguity

Recommendation – avoid fractions and decimals and use leading zeros when required

Use units of measure that avoid fractions and decimals when displaying numerical information. For example:

- Use '500 mg' in place of '0.5 g'
- Use '500 MICROg' or 500 micrograms in place of '0.5 mg'.

However, this is not advisable when the smaller unit of measure is not commonly used. For example, '600 microlitres' is not an acceptable alternative to '0.6 mL'.

Use a leading zero where a decimal point is required for a value less than 1.

Use 'half', not '0.5', for description of tablet quantity.

Rationale – prevent misreading numbers

Fractions may be misinterpreted. For example, '1/7' could be interpreted as 'for one day', 'once daily', 'for one week' or 'once weekly', or '½' could be interpreted as 'half' or as 'one to two'.

Omitting leading zeros introduces a high possibility of misreading errors, because the decimal point preceding the number(s) may not be noticed.

Use AMT editorial rules[92] for units of measure. Convert units to avoid large numbers where possible. For example, use 1 g instead of 1,000 mg. There are exceptions:

- Where a product has a range of strengths that span micrograms and milligrams – it is safer for that product range to have the same unit of measure, so a microgram description that is more than 1,000 may be retained instead of converting to milligrams (for example, fentanyl lozenges 1,600 micrograms)
- Where units should be presented with consideration for the target consumer – it is safer to use a microgram description in paediatric prescribing for a medicine expressed in milligrams for adult prescribing (for example, for a child, prescribe adrenaline intravenous injection 50 MICROg or 50 micrograms rather than 0.05 mg).

Dose based

Do this: 6.3.6a

cyclosporin 100 mg/1 mL – *Sandimmun* – oral liquid – oral – DOSE **60 mg (0.6 mL)** – twice a day

Don't do this: 6.3.6b

cyclosporin 100 mg/1 mL – *Sandimmun* – oral liquid – oral – DOSE **.6 mL** – twice a day

Pack based

Do this: 6.3.6c

paracetamol 500 mg – tablet – oral DOSE **2 tablets** – every 6 hours when required for pain relief – do not exceed 8 tablets in 24 hours – SUPPLY 50

Don't do this: 6.3.6d

paracetamol 0.5 g – tablet – oral DOSE **2 tablets** – every 6 hours when required for pain relief – do not exceed 8 tablets in 24 hours – SUPPLY 50

Pack based

Do this: 6.3.6e

terbinafine 250 mg – tablet – oral DOSE **HALF a tablet** – once a day – SUPPLY 42

Don't do this: 6.3.6f

terbinafine 250 mg – tablet – oral DOSE **0.5 tablets** – once a day – SUPPLY 42

6.3.7 Use a comma to separate groups of three digits for numbers 1,000 and above

Recommendation – for numbers that have four or more whole-number digits, use a comma to separate groups of thousands

For example:

- 100
- 999
- 1,000
- 9,999
- 10,000
- 99,999
- 100,000

This recommendation aids visual interpretation of large numbers by breaking them up into groups of thousands and avoiding 10-fold (or even 100-fold) misreading errors. Consideration should also be given to the use of 'million' where appropriate (see Section 6.3.8).

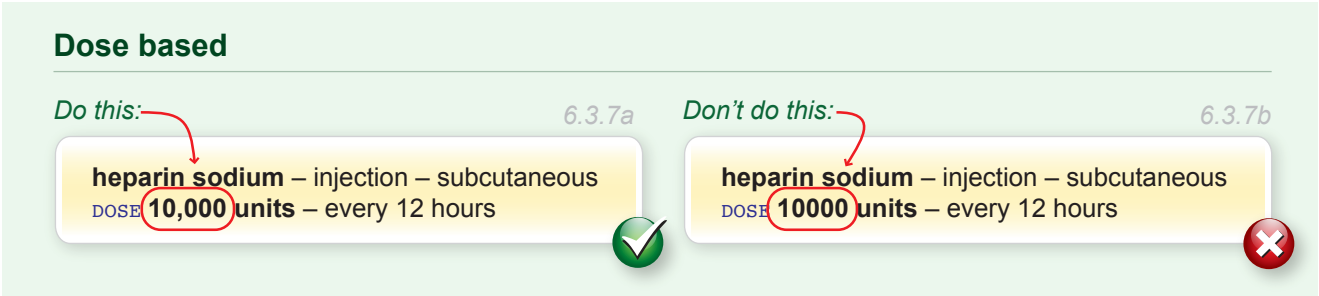
Note: The comma should be reserved for breaking up and interpreting large numbers – for the purposes of these guidelines, a large number is any number over 1,000.

Rationale – prevent misreading very large numbers

A long continuous string of zeros is hard to interpret correctly.

This is a particular issue with medicines that are described by an estimate of activity where the unit of measure is 'unit' rather than mass (for example, 'g' or 'mg'). Unfortunately, medicines measured by activity are both often used and associated with high rates of error.

In Example 6.3.7b, the dose could be misread as '1000', rather than '10,000'. When read in conjunction with an inappropriately displayed unit of measure it could also be misread as '100,000'.



6.3.8 Use ‘million’ instead of ‘mega’

Recommendation – always display the word ‘million’ in full

Do not use ‘mega’ or ‘m’ or ‘M’ to abbreviate ‘million’.

The word ‘million’ is preferred for whole increments of a million (for example, 6 million).

Fractions of a million should be written numerically (for example, 7,350,000, not 7.35 million).

Rationale – avoid confusion over the meaning of ‘m’ or ‘mega’

The word ‘mega’, meaning one million, may cause confusion, as it can be mistaken for ‘thousand’ (because of the association with the prefix ‘milli’), either when written in full or when abbreviated to ‘m’ or ‘M’. ‘Mega’ can also cause problems when used in conjunction with ‘units’ (that is, activity), as there is a high possibility of misreading the abbreviation ‘mu’ as ‘mg’.

In Example 6.3.8b, either of these misinterpretations is possible. Neither is likely to lead to an actual error because of the strengths available and units of measure used on the product packaging. However, such misinterpretations are avoidable.

Fractions of a million written in full are less likely to be mistaken for larger denominations. For example, 7,350,000 is unlikely to be mistaken for 7,350,0000 or 7,350,00000. However, 7.35 million may be read as 735 million.

Dose based

Do this: *6.3.8a*

interferon alfa – *Roferon A* – injection – subcutaneous – DOSE **9 million units** – three times a week on Mon Wed Sat

Don’t do this: *6.3.8b*

interferon alfa – *Roferon A* – injection – subcutaneous – DOSE **9 mega units** – three times a week on Mon Wed Sat

6.4 General information display

Misinterpretation and legibility problems may arise when the prescription elements are assembled together on-screen. There is potential for problems to arise from the way that the component parts are placed in relation to each other and the way that they are organised in relation to the whole screen.

Serious problems may emerge when prescription details or medicine names are truncated, and truncation is unacceptable for on-screen display (see Appendix 9.3). The visible information may be read in isolation and inferences made about the non-visible information.

Errors resulting from these problems are well documented in patient safety literature and have been supported by user research.[99] Dose errors can be avoided in EMMs by following simple formatting rules, using software that successfully manages text wrapping, and avoiding truncation or partial display of prescription details.

6.4.1 Unambiguously position related elements and labels when using text wrapping

Recommendation – keep text wrapping to a minimum

The following recommendations may reduce the probability of error due to unintended visual associations when used in conjunction with other recommendations in these guidelines. Further methodology and results are summarised in Appendix 9.3.

Position related elements to ensure that the following combinations are placed on the same line:

- Active ingredient and strength
- Route and site
- Dose label, dose and dose units (for example, 'DOSE', '240' and 'mg' in Example 6.4.1a)
- Supply label and supply.

In addition, position related elements to ensure that:

- Hyphenation is not required
- The dose label, dose, administration duration and frequency are on the same line if possible
- The contents of a single element are kept together unless it will not fit on one line (for example, DOSE 12 units in Example 6.4.1c). If a long medicine name exceeds the available screen space and has to be wrapped, ensure that the medicine name is wrapped between words and trailing delimiters are kept with the preceding element[100] (for example, *Actrapid* in Example 6.4.1c).

The en dash at the end of a line is optional if the next item is a label.

Rationale – avoid confusion caused by visual dissociation between related prescription elements

Confusion can be caused when information becomes too long to fit onto a single line. This 'text wrapping' can result in unclear juxtapositions of similar elements of the prescription, thereby increasing the possibility of confusion between them. However, it should also be noted that if all relevant information cannot be viewed at once (for example, a line of information is too wide for the display and hence requires scrolling to view some elements), this may lead to safety-critical information being missed. That is, the use of text wrapping may have to reflect a compromise between competing safety issues.

Dose based

Do this: 6.4.1a

paracetamol 120 mg/5 mL – oral liquid – oral – DOSE **240 mg (10 mL)** – every 6 hours when required for headache – do not exceed 4 doses in 24 hours

Don't do this: 6.4.1b

paracetamol 120 mg/5 mL – oral liquid – oral – DOSE **240 mg (10 mL)** – every 6 hours when required for headache – do not exceed 4 doses in 24 hours

Dose based

Do this: 6.4.1c

insulin neutral human 100 units/mL – *Actrapid* – injection – subcutaneous DOSE **12 units** – twice a day

Don't do this: 6.4.1d

insulin neutral human 100 units/mL – *Actrapid* – injection – subcutaneous DOSE **12 units** – twice a day

6.4.2 Never truncate any part of the prescription

Recommendation – do not truncate information which is too large to be accommodated within the standard size of the element of the screen in which it belongs[101]

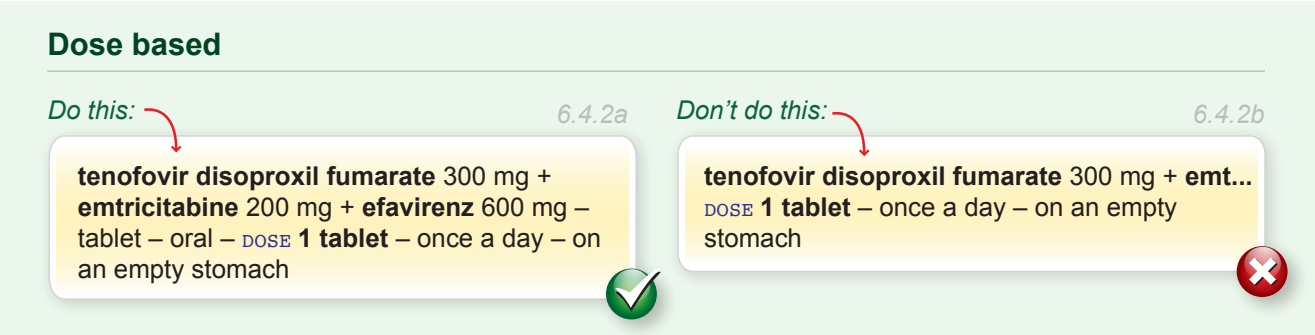
If necessary, wrap the prescription information (see Section 6.4.1), even if this means that fewer prescriptions overall are displayed. However, do not display a part of the prescription line alone if its meaning relies on other parts that are not displayed.

This can be achieved by using standard display technologies that allow screen elements to expand dynamically to display the full information provided. Other methodologies are discussed in Appendix 9.3.

Rationale – prevent misinterpretation caused by part of the prescription not being visible

Confusion can be caused by part of the prescription not being visible. For example, information within a particular section of the screen that is too large to be accommodated within a single line may be ambiguous if truncated.

Users may be tempted to assume that they know what information is hidden, when in fact the hidden information may not be as expected. In Example 6.4.2b, it might be reasonable to assume that the hidden information is 'tenofovir disoproxil fumarate, emtricitabine, elvitegravir and cobicistat' (active ingredients in *Stribild*) when in fact it is 'tenofovir disoproxil fumarate, emtricitabine and efavirenz'. This is a specific instance of a more general problem, where an incorrect assumption would lead to the administration of the wrong medicine or dose.



6.4.3 Ensure the full details of multiple prescriptions in a selection list are accessible

Recommendation – where possible, use vertical scrolling and do not allow any part of the prescription to scroll horizontally off-screen

Text wrapping will be necessary even though this increases the need for vertical scrolling.[100] Refer to Section 6.4.1.

Use a look-ahead scroll notification and ensure that the notification does not overlay or truncate other information.[102] A standard scroll bar is supplemented with notifications at the top and bottom to indicate that there are items in the list that are not currently visible. This notification alters the standard scroll-bar control and reminds the user that more information is viewable 'below the fold' (that is, scrolled off-screen).

These elements can be adjusted on clinician-specific user screens. In particular, the dose field on the administration view may be made much larger to distinguish it from the strength.

These recommendations will improve safety by ensuring that all required information is immediately visible, and reminding users to scroll down long lists. This may mean that fewer prescriptions are displayed overall.

Where vertical scrolling is implemented, care should be taken to ensure that all details for a given medication order or prescription are displayed on one screen.

Rationale – prevent misinterpretation caused by part of the prescription not being visible

Confusion can be caused by any part of the prescription not being fully visible. In general terms, this may tempt users to assume that they know what is hidden, when in fact the hidden information may not be as expected. This is a particular problem when the method of making the information visible is to scroll horizontally. Although horizontal scrolling may be useful outside medicine use (for example, timelines), horizontal scrolling is not good practice in general web usability, and should not be used within safety-critical healthcare IT software.

Usability testing shows that users do not notice visual cues for off-screen information that is accessible using horizontal scrolling, and may overlook information as a result. It can never be guaranteed that the hidden information will not be critically important.

Dose based

Do this: 6.4.3a

goserelin – implant – subcutaneous
DOSE **10.8 mg** – once only

latanoprost 50 MICROg/mL – eye drops – each eye – DOSE **1 drop** – once a day

furosemide – oral – DOSE **40 mg** – twice a day

sodium chloride 0.9% – irrigation – intravesical – bladder – RATE **1 L/hour** – continuous

ERYthromycin – enteric capsule – oral
DOSE **500 mg** – four times a day

enalapril – oral – DOSE **10 mg** – once a day in the morning

digoxin – oral – DOSE **250 MICROg** – once a day in the morning

More

Don't do this: 6.4.3b

goserelin – implant – subcutaneous – DOSE

latanoprost 50 MICROg/mL – eye drops –

furosemide – oral – DOSE **40 mg** – twice a d

sodium chloride 0.9% – irrigation – intrave

ERYthromycin – enteric capsule – oral – DO

enalapril – oral – DOSE **10 mg** – once a day i

digoxin – oral – DOSE **250 MICROg** – once a

Dose based

Do this: 6.4.3c

goserelin • latanoprost

furosemide – oral – DOSE **40 mg** – twice a day

sodium chloride 0.9% – irrigation – intravesical – bladder – RATE **1 L/hour** – continuous

ERYthromycin – enteric capsule – oral
DOSE **500 mg** – four times a day

3 more • **enalapril • digoxin**

Don't do this: 6.4.3d

furosemide – oral – DOSE **40 mg** – twice a day

sodium chloride 0.9% – irrigation – intravesical – bladder – RATE **1 L/hour** – continuous

ERYthromycin – enteric capsule – oral
DOSE **500 mg** – four times a day

7. Consumer-facing medicines information

7.1 Consumer testing

A range of examples of on-screen presentation of consumer medicines information was tested in a consumer focus group to determine information needs and preferences. These guidelines reflect these preferences. Further details of the focus group are provided in Appendix 9.6.

7.2 Guideline implementation and future work

Healthcare providers are encouraged to seek and procure software systems that work towards implementation of the standard formatting and terms set out in these guidelines. This is expected to be an evolving process, during which the Commission is responsible for maintaining these guidelines and reducing national barriers to implementation.

Feedback on these guidelines will be collated for review by a Commission-convened expert advisory group. The outcomes of decisions on these issues will be made available on the Commission website.

The display of consumer-facing medicines information differs minimally from recommendations for clinical display of medicines information. However, differences for consumer-facing medicines information described in Section 7, including the order of information and use of plain language, will require data to be transformed to take information from the clinical view to the consumer view. Machine readability of the information between the clinical and consumer views of medicines information must be maintained using strict mapping guidance to avoid introducing errors.

7.3 Variations for consumer-facing medicines information

This section details the items in Section 6 of these guidelines that should be modified for presentation to consumers.

7.3.1 Display prescription details in full

Recommendation – use full English words in place of symbols (Section 6.2.2)

Section 6.2.2 recommends using full English words to describe all text elements of a

Clinical: *7.3.1a*

sodium valproate 200 mg/5 mL – *Epilim*
DOSE **200 mg** – twice a day
SUPPLY 400 mL

Consumer: *7.3.1b*

sodium valproate 200 mg in 5 mL – *Epilim*
DOSE **Give 5 mL** by medicine measure by mouth in the morning and **5 mL** at night
SUPPLY 400 mL

Clinical: *7.3.1c*

furosemide – tablet – oral – DOSE **40 mg** – once a day at 10:00 am – SUPPLY 30

Consumer: *7.3.1d*

furosemide 40 mg – tablet – DOSE **Take 1 tablet** by mouth once a day at 10:00 in the morning
SUPPLY 30

prescription, with the exceptions of '%', decimal points, '+', '&' and '/'.

Consumers preferred that the '/' symbol be replaced with 'in' or other descriptors, as appropriate. For example:

- '2 mg/mL' becomes '2 mg in 1 mL'
- '10 mg/hour' becomes '10 mg over 1 hour'.

However, consistent information is also important, so where '/' is part of an expression of strength and is used in other presentations of product information, such as the packaging and Consumer Medicines Information, the '/' should be retained. The '/' symbol is also retained when it is part of a brand name combination (for example, *Coversyl Plus* 5 mg/1.25 mg).

Recommendation – display time using the 12-hour clock with descriptive words (Section 6.2.2)

Section 6.2.2 recommends using the 24-hour clock to display time, with 'am' used to show times before midday (for example, 10:00 am, 19:00).

For consumer-facing information, display time using the 12-hour clock, with 'in the morning' to show times before midday (for example, 10:00 in the morning) and 'in the afternoon', 'in the evening' or 'at night' to show times after midday (for example, 9:00 at night). Midnight should be displayed as '12:00 midnight' and midday should be displayed as '12:00 midday' (not '12:00 noon').

Rationale – improve clarity of information for consumers

Consumers may not be familiar with the way the '/' symbol is used by clinicians. Using everyday words such as 'in' or 'over' improves clarity and prevents misreading or misunderstanding. Consumer testing for these guidelines (see Appendix 9.6) suggested that 'am' or 'pm' to indicate time could be misread or missed altogether, and consumers preferred 'in the morning', 'in the evening', 'at night' and similar descriptors.

7.3.2 Use plain language

Recommendation – use common, everyday words instead of technical terms or jargon

Plain language includes:

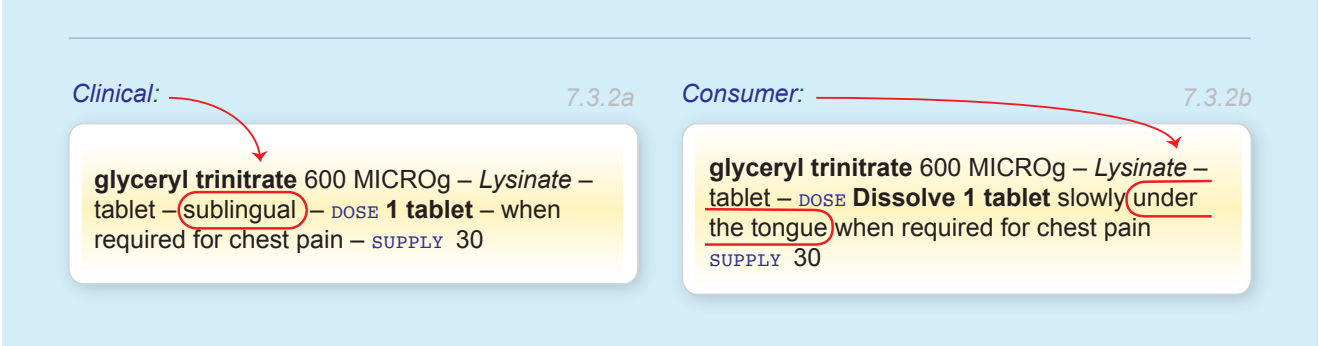
- Using the active voice ('Take 1 tablet', not '1 tablet should be taken')
- Using the imperative voice for instructions ('do this' or 'do not do this')
- Using short sentences and short, simple words instead of technical terms.

See Appendix 9.2 for acceptable terminology.

Rationale – improve readability and comprehension

Technical terms and jargon are not well understood by consumers. Using common, everyday words improves readability and comprehension by consumers. For example, use:

- 'Inside the cheek' instead of 'buccal'
- 'Under the tongue' instead of 'sublingual'
- 'Apply to the affected area' as appropriate instead of 'topical'.



7.3.3 Ensure dosing instructions are explicit and standardised

Recommendation – display full details of dosing instructions in a standardised format and order

Frequency, timing and interval

Dosing instructions (including frequency and timing) in consumer-facing medicines information should be explicit and standardised. For example, 'Take two tablets twice daily' should be displayed as 'Take 2 tablets in the morning and 2 tablets in the evening'. Specify the dosing interval if doses need to be evenly spaced (for example, for some medicines, 'Take 1 tablet every 12 hours' is preferable to 'Take 1 tablet in the morning and 1 tablet at night').

If doses should be taken with food, specify 'with food'. If doses should be taken with meals, specify 'with meals'.

Clinical: 7.3.3a

amITRIPTYLIne hydrochloride 10 mg – *Endep* – tablet – oral – DOSE **10 mg** – three times a day – SUPPLY 90

Consumer: 7.3.3b

amITRIPTYLIne hydrochloride 10 mg – *Endep* – tablet – DOSE **Take 1 tablet** by mouth in the morning, **1 tablet** at 12 midday and **1 tablet** at night – SUPPLY 90

Clinical: 7.3.3c

roxithromycin 150 mg – *Rulide* – tablet – oral – DOSE **1 tablet** – every 12 hours SUPPLY 14

Consumer: 7.3.3d

roxithromycin 150 mg – *Rulide* – tablet DOSE **Take 1 tablet** by mouth every 12 hours SUPPLY 14

7. Consumer-facing medicines information

Use of verbs

Verbs should be used in instructions (for example, '2 tablets' becomes 'Take 2 tablets', 'Sparingly' becomes 'Apply sparingly').

Clinical: 7.3.3e

paracetamol 500 mg – tablet – oral
DOSE **2 tablets** – every 6 hours when required for pain – do not exceed 8 tablets in 24 hours
SUPPLY 50

Consumer: 7.3.3f

paracetamol 500 mg – tablet
DOSE **Take 2 tablets** by mouth every 6 hours when required for pain – do not take more than 8 tablets in 24 hours – SUPPLY 50

Clinical: 7.3.3g

hydrocortisone 1% – cream – topical
DOSE **Sparingly** – once a day at night
SUPPLY 30 g

Consumer: 7.3.3h

hydrocortisone 1% – cream
DOSE **Apply sparingly** to the affected area once a day at night – SUPPLY 30 g

Alerts and warnings

Alerts or warnings should be included (for example, 'Do not take more than 8 tablets in 24 hours'). Consumer testing indicated that maximum daily doses can be a source of confusion, especially for liquids.

The minimum recommendation is to state the number of tablets or volume of liquid (for example, 'Do not take more than 8 tablets in 24 hours', 'Do not take more than 40 mL in 24 hours'). However, for liquids, doses may also be specified in brackets to aid consumers, if

Clinical: 7.3.3i

paracetamol 500 mg – tablet – oral
DOSE **2 tablets** – every 6 hours when required for pain – do not exceed 8 tablets in 24 hours
SUPPLY 50

Consumer: 7.3.3j

paracetamol 500 mg – tablet
DOSE **Take 2 tablets** by mouth every 6 hours when required for pain – do not take more than 8 tablets in 24 hours – SUPPLY 50

Clinical: 7.3.3k

paracetamol 120 mg/5 mL – *Panadol* – oral liquid – oral – DOSE **240 mg** – every 6 hours – when required for headache – do not exceed 4 doses in 24 hours
SUPPLY 200 mL

Consumer: 7.3.3l

paracetamol 120 mg in 5 mL – *Panadol* – oral liquid – DOSE **Give 10 mL** by medicine measure every 6 hours when required for headache – do not give more than 40 mL (4 doses) in 24 hours – SUPPLY 200 mL

necessary (for example, 'Do not take more than 40 mL (4 doses) in 24 hours').

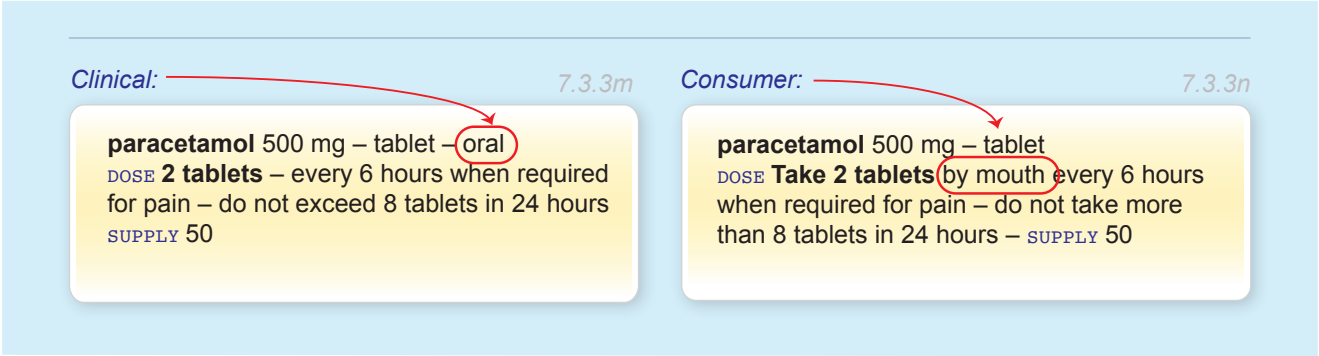
Order of information

These guidelines recommend presenting information in a consistent order. This is true for both clinical and consumer-facing medicines information. However, the order of information is different in consumer-facing medicines information – the route of administration should be moved to become part of the dosing instructions to improve readability. For example:

- Clinical information systems: 'paracetamol 500 mg – tablet – oral – DOSE 2 tablets every 6 hours'
- Consumer-facing medicines information: 'paracetamol 500 mg – tablets – DOSE Take 2 tablets by mouth every 6 hours'.

Rationale – avoid misinterpretation of instructions

Consumers want clear and consistent instructions about how to take their medicines. For most consumers, the most important information is instructions on when and how to take their medicine.



8. Glossary

Active ingredient

The therapeutically active component in the medicine's final formulation that is responsible for its physiological or pharmacological action.[103]

Brand name

The name given to a medicinal product by the manufacturer. The use of the name is reserved exclusively for its owner. The brand name may also be referred to as a trade name and be used as part of the manufacturer's trademark for that product.

Clinical information systems

The electronic sharing of clinical information across the healthcare continuum, including electronic medication management as part of a broader suite that also includes diagnostic and pathology orders, adverse event records and discharge summaries.

Delimiter

A character that identifies the beginning or the end of a character string (a contiguous sequence of characters).

Dose-based prescribing

Prescribing or ordering medicines by expressing the active ingredient (or brand name), the required dose, the route of administration, directions for use and a start date.

This typically applies to prescribing within acute care where there is no cease date and where one or more products are administered to provide a given dose.

Dose form

The pharmaceutical form in which a product is presented for therapeutic administration (for example, tablet, cream).[104]

Electronic medication management (EMM)

The electronic processes that safely support the sharing of medicines information across the healthcare continuum.

En dash

A punctuation mark (–) that is slightly longer than a hyphen (-).

Generic medicine

A pharmaceutical product, usually intended to be interchangeable with an innovator product, that is manufactured and marketed after the expiry date of the patent or other exclusive rights.

A generic product is a medicine that, in comparison with the innovator medicine:

- Has the same quantitative composition of therapeutically active substances, being substances of similar quality to those used in the innovator medicine
- Has the same pharmaceutical form
- Is bioequivalent
- Has the same safety and efficacy properties.[103]

The generic medicine name may also refer to the active ingredient(s) of a registered medicine in some countries, including Australia.

Innovator brand medicine

The first patented brand of the medicine, also known as the originator brand. The innovator brand may differ by country.

Label

In these guidelines, the term 'label' is used as an on-screen identifier, unless specifically indicated otherwise. It is used to describe the subsequent data item(s) and add clarity to their description, while also acting as a spacing device.

8. Glossary

Medicinal Product Unit of Use (MPUU)

The Australian Medicines Terminology MPUU is an abstract concept that defines a medicine based on the active ingredient, strength and dose form.

Medicine

Therapeutic goods that are represented to achieve, or are likely to achieve, their principal intended action by pharmacological, chemical, immunological or metabolic means in or on the body of a human or animal.[105]

The Australian Pharmaceutical Advisory Council's guiding principles define a medicine as 'a substance given with the intention of preventing, diagnosing, curing, controlling or alleviating disease or otherwise enhancing the physical or mental welfare of people. This includes prescription and non-prescription medicines, including complementary healthcare products, irrespective of the administered route'.[106]

Medicine selection list

A list of medicines matching specified search criteria that is displayed to allow selection of a required product for prescribing, dispensing, administration or inclusion in a medicines history.

Non-breaking space

A variant of the space character that prevents an automatic line break when a new line might otherwise have occurred at the point of insertion.

Pack-based prescribing

Prescribing or ordering medicines by expressing the active ingredient (or brand name), the required dose, the dosage form, strength, route of administration, directions for use and the supply quantity. This typically applies to community prescribing or discharge prescribing from hospital, and specifies each product that is to be dispensed.

Prescription

Prescription defines all elements relating to a medicine that convey the intent of the original prescriber for the use of that medicine. Note: This definition is for the purposes of this document and is not a legislative definition.

Salt

For the purposes of these guidelines, the term 'salt' represents any modification to a base (for example, salt, ester, water of hydration).

Sentence case

Sentence case uses a capital letter for the first word of the sentence, as well as proper nouns. Other words are in lower case.

Separator

A symbol, line or space used to provide differentiation between components of a medicines prescription or medicines order.

SNOMED CT®

A computer-processable clinical terminology, distributed and maintained by the International Health Terminology Standards Development Organisation.

SNOMED CT-AU

SNOMED core files with Australian-developed documentation and terminology, including reference sets.

Strength

The amount of an active ingredient contained in a defined dosage form, volume of a solution or weight of a solid.

8. Glossary

Text wrapping

Occurs when text does not fit into the remaining space on a line and is automatically moved to the next line.

Title case

Title case uses capital letters to start the principal words – that is, words other than articles, conjunctions and prepositions.

Trade name

See brand name.

Unit of measure

The qualifier associated with a numeric value that provides a standardised quantity.

9. Appendices

9.1 On-screen display of units of measure

The recommendations for display of units of measure were developed from a usability perspective based on the *Recommendations for Terminology, Abbreviations and Symbols used in Medicines Documentation*[52], units of measure adopted by the Therapeutic Goods Administration and SNOMED CT, and the unified code for units of measure (UCUM).[107]

For on-screen display, always use the form consistently as defined in this appendix, noting the following:

- Do not use plural abbreviations, except for units and description of time
- The use of upper case and lower case in the following examples is deliberate
- Some units of measure must not be abbreviated (for example, nanogram).

Unit of measure	On-screen display	Notes
Centimetre	**cm**	
Gram	**g**	
Hour	**hour**	Use plural form where appropriate (i.e. 'hours')
International unit	**unit**	'Units' should always be considered to be 'International Units'. Exceptions such as ELISA units and D antigen units should be explicitly stated. Do not abbreviate. Use plural form where appropriate (i.e. 'units').
Kilogram	**kg**	
Litre	**Litre**	Do not abbreviate 'litre' when used in isolation. Only abbreviate in a word or phrase (for example, mg/mL, L/hour).
Mega units	**Do not use**	
Metre	**metre**	Do not abbreviate 'metre' when used in isolation. Only abbreviate in a word or phrase (for example, sq m).
Microgram	**MICROg, microgram**	Do not abbreviate to mcg or μg
Microlitre	**microlitre**	Do not abbreviate
Micromol	**micromol**	Do not abbreviate
Milligram	**mg**	
Milligram per litre	**mg/L**	Abbreviate 'litre' when used in a phrase
Millilitre	**mL**	Abbreviate 'litre' when used in a word
Millimetre	**mm**	
Millimolar	**millimolar**	Do not abbreviate

9. Appendices

Unit of measure	On-screen display	Notes
Millimole	**mmol**	
Millimole per litre	**mmol/L**	Abbreviate ‘litre’ when used in a phrase
Minute	**minute**	Use plural form where appropriate (i.e. ‘minutes’)
Nanogram	**nanogram**	Do not abbreviate
Percentage	**%**	
Square centimetre	**sq cm**	cm^2 may also be acceptable if superscript is clearly shown
Square metre	**sq m**	m^2 may also be acceptable if superscript is clearly shown
Unit	**unit**	Do not abbreviate. Use plural form where appropriate (i.e. ‘units’).

9.2 Acceptable terminology for on-screen presentation

The following table lists the acceptable terms for on-screen presentation of medicines information. The list is a set of commonly used dose frequencies, routes of administration and dose forms. It is not intended to be exhaustive or complete.

Abbreviations may be used for 'short-cut' and 'accelerator' data entry keystrokes, provided their use is not ambiguous. However, the preferred term must be displayed on-screen.

On-screen terms	Historical term
Dose frequency or timing	
once a day in the morning	morning, mane
once a day at midday	midday
once a day at night	night, nocte
once a day (preferably specifying the time of day, such as at night, at 8:00 pm)	daily (preferably specifying the time of day, such as at night, at 8:00 pm)
twice a day	bd
three times a day	tds
four times a day	qid
every hour*	hourly, every hour
every 2 hours*	every two hours
every 4 hours*	every 4 hrs, 4 hourly, 4 hrly
every 6 hours*	every 6 hrs, 6 hourly, 6 hrly
every 8 hours*	every 8 hrs, 8 hourly, 8 hrly
every 12 hours*	every 12 hours
every 2 days	every second day, on alternate days
once a week and specify the day in full (e.g. once a week on Tuesday)†	once a week
three times a week and specify the exact days in full (e.g. three times a week on Mon, Wed and Sat)†	three times a week
every 2 weeks	every two weeks per fortnight
when required	prn
immediately	stat
once	single dose
for 1 day	for one day only
for 3 days	for three days
before food	ante cibum, ac

On-screen terms	Historical term
Dose frequency or timing (continued)	
after food	post cibum, pc
with food	cum cubus, cc
days of the week (Mon, Tue, Wed, Thu, Fri, Sat, Sun)†, minimum of 3 letters	Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday
less than	<
greater than, more than (alternative form 'longer than' may be used in the context of time)	>
All times should be expressed in 24-hour clock format, using a colon to separate hours and minutes. Times before midday should be appended with 'am', to remove ambiguity (for example, 11:30 am and 23:30). Midnight and noon should be expressed as 24:00 and 12:00.	

* A maximum dosage in 24 hours must accompany a 'when required' medicines order.

† The weekday may be abbreviated to three letters, with the first letter capitalised.

On-screen terms	Historical term
Route of administration	
buccal	buccal
in the [left/right/each] ear	ear (specify left, right or each)
in the [left/right/each] eye	eye (specify left, right or each)
epidural	epid
inhalation	inh
intraarticular	intraart
intradermal	id
intramuscular	IM
intraosseous	io
intrathecal	it
intranasal	in
intraperitoneal	inp
intravenous	IV
irrigation	irrig
nebulised	NEB
nasogastric	NG
oral	PO
PEG, percutaneous enteral gastrostomy*	PEG

On-screen terms	Historical term
Route of administration (continued)	
vaginal	PV
rectal	PR
PICC, peripherally inserted central catheter*	PICC
subcutaneous	subcut
sublingual	subling
topical	top

On-screen terms	Historical term
Dose forms	
capsule	cap
cream	cream
drops	drops
ear drops	gut
ear ointment	ung
eye drops	gut
eye ointment	oculentum
injection	inj
inhaler	MDI, metered dose inhaler
mixture	mixture
ointment	oint
PCA, patient controlled analgesia*	PCA
pessary	pess
powder	powder
suppository	sup
tablet	tab

* Consider mouse-over expansion or similar

9.3 Recommendations for wrapping medicines information

Recommendations for wrapping of coded clinical data displayed by clinical information systems are provided for presentation of medicines information deemed to be 'long' compared with the available display.

This guidance is intended to be applicable to SNOMED CT-AU and the AMT, but may also apply to other terminologies in use.

In keeping with the scope of this document, these recommendations apply to all human-readable display outputs of clinical information systems, but do not apply to the storage and retrieval of clinical codes and descriptions:

- During data entry, the full (that is, non-truncated) description of the chosen clinical code MUST have been displayed so that it can be medico-legally 'accepted' at some point in the data entry process
- The description 'accepted' during data entry (whether preferred term or synonym) MUST be available for display by all systems holding this data, in perpetuity (that is, exactly as 'accepted')
  - in some cases, it may be possible that the description 'accepted' at the point of data entry will not be a preferred term or native synonym (that is, an 'interface terminology' will have been used for data entry purposes)
  - it is assumed, for the purposes of this appendix, that any agreed use of interface terminologies have been previously reviewed for clinical correctness and safety across the end-to-end process, so that their use does not introduce ambiguity to patient records
  - precise, detailed rules for the safe use of interface terminologies are out of scope of this appendix
- The first two rules MUST apply both to the display of 'native' descriptions of clinical codes within systems, and to those descriptions and codes when messaged to other systems, and subsequently used within them
- Truncation MUST NOT occur in the display of medicines descriptions (for example, of SNOMED CT-AU[108] or AMT concepts)
- Clinical content MUST NOT be separated from its label (see Section 6.4.1 of these guidelines)
- Hyphenation or any other punctuation marks (over and above any already present) MUST NOT be added to a description of a clinical code for display purposes
- Words within the code's description MUST NOT be fragmented for display purposes – if words used within a description are joined by hyphens, then these MUST NOT be taken as points for wrapping.

9.4 Clinical scenarios

9.4.1 Case study 1

74-year-old woman with coronary heart disease and angina. Patient has hypertension and rheumatoid arthritis.

eHealth Record

Community Dispense Record

Patient Identifier

Dispensed Medicines

17-Sep-15 **niFEDIPine** 20 mg – *Adalat Oros* – modified release tablet – oral
DOSE **Take 1 tablet** – once a day – swallowed whole – SUPPLY 30 – Original dispense

17-Sep-15 **methotrexate** 10 mg – *Methoblastin* – tablet – oral – DOSE **Take 1 tablet** once a week on Monday – SUPPLY 10 – Original dispense

17-Sep-15 **piroxicam** 0.5% – *Feldene* – gel – topical
DOSE **Apply to the affected area** – once a day in the morning – SUPPLY 50 g – Original dispense

17-Sep-15 **paracetamol** 500 mg – *Panadol* – tablet – oral – DOSE **Take 2 tablets** – every 6 hours – when required for pain relief – do not take more than 8 in 24 hours – SUPPLY 100 – Original dispense

eHealth Record

Consumer Electronic Health Record

Patient Identifier

Dispensed Medicines

17-Sep-15 **niFEDIPine** 20 mg – *Adalat Oros* – modified release tablet – DOSE **Take 1 tablet** by mouth swallowed whole once a day – SUPPLY 30

17-Sep-15 **methotrexate** 10 mg – *Methoblastin* – tablet – DOSE **Take 1 tablet** by mouth once a week on Monday – SUPPLY 10

17-Sep-15 **piroxicam** 0.5% – *Feldene* – gel
DOSE **Apply to the affected area** – once a day in the morning – SUPPLY 50 g

17-Sep-15 **paracetamol** 500 mg – *Panadol* – tablet
DOSE **Take 2 tablets** by mouth every 6 hours – when required for pain relief – do not take more than 8 tablets in 24 hours – SUPPLY 100

9.4.2 Case study 2

60-year-old man with type 2 diabetes and dyslipidaemia.

eHealth Record

Community Dispense Record

Patient Identifier

Dispensed Medicines

16-Sep-15 **metformin hydrochloride** 1 g – *Diabex-1000* – tablet – oral
DOSE **Take 1 tablet** – twice a day
SUPPLY 90 – Original dispense

16-Sep-15 **insulin glargine** 100 units/mL – *Lantus Solostar* – injection – subcutaneous
DOSE **Inject 18 units** once a day at bedtime
SUPPLY 5 x 3 mL cartridges – Original dispense

16-Sep-15 **insulin lispro** 100 units/mL – *Humalog Kwikpen* – injection – subcutaneous
DOSE **Inject 5 units** before meals
SUPPLY 5 x 3 mL cartridges – Original dispense

16-Sep-15 **atorvastatin** 10 mg – *Lipitor* – tablet – oral
DOSE **Take 1 tablet** – once a day at night
SUPPLY 30 – Original dispense

eHealth Record

Consumer Electronic Health Record

Patient Identifier

Dispensed Medicines

16-Sep-15 **metformin hydrochloride** 1 g – *Diabex-1000* – tablet – DOSE **Take 1 tablet** by mouth in the morning and **1 tablet** in the evening – SUPPLY 90

16-Sep-15 **insulin glargine** 100 units in 1 mL – *Lantus Solostar* – injection – DOSE **Inject 18 units** (0.18 mL) under the skin once a day at bedtime – SUPPLY 5 x 3 mL

16-Sep-15 **insulin lispro** 100 units in 1 mL – *Humalog Kwikpen* – injection – DOSE **Inject 5 units** (0.05 mL) under the skin before meals
SUPPLY 5 x 3 mL

16-Sep-15 **atorvastatin** 10 mg – *Lipitor* – tablet
DOSE **Take 1 tablet** – once a day at night
SUPPLY 30

9.4.3 The relationship between the on-screen display of medicines information and the Australian Medicines Terminology

The Australian Medicines Terminology (AMT)[60] allows unique and unambiguous identification of all commonly used medicines in Australia and is a national extension of the strategic terminology SNOMED CT-AU (the Australian release of SNOMED CT).[108] It can be implemented in clinical information systems to support activities such as:

- Prescribing
- Recording
- Review
- Supply, including dispensing
- Administration
- Transfer of information between systems.

An overview is available at the Australian Digital Health Agency website[62], along with resources and guidance.[109]

AMT concepts normally describe medicines by their active ingredient name(s) or by brand name. In certain cases, extra information is included in descriptions when required for safety reasons. For example, descriptions of *Coveram* brand products also include the active ingredients ordered according to the strength cited in the brand name. These predefined concepts may be used for multiple purposes, including the population of selection lists, to guide prescribing, dispensing and medicine administration recording. Always use the preferred term (as opposed to the fully specified term) in on-screen display.

The concept descriptions present all the information required to define the components of a specific medicine. Examples of Medicinal Product Unit of Use (MPUU) concept descriptions are:

- Amoxicillin 500 mg capsule
- Diclofenac sodium 50 mg tablet.

In these examples, the active ingredient, the amount of active ingredient and the dose form are described in one term.

Trade Product Unit of Use (TPUU) concept descriptions proposed in AMT for the MPUUs above are:

- Amoxil 500 mg capsule
- Voltaren 50 mg tablet.

9.5 Human factors assessment

Human factors assessment was undertaken on recommendations in the guidelines that may have been ambiguous. Twelve questions were identified and, for each, a number of display solutions were developed and subjected to heuristic evaluation. These display solutions were chosen as plausible alternative recommendations relevant to each of the key questions. A panel of human factors experts was recruited to evaluate which solution or solutions should be recommended as best practice (or to recommend that a different approach should be taken with respect to a particular guideline).

Example prescriptions were provided by the Commission to allow the development of simulated on-screen interface screenshots of each of the display solutions to inform the evaluators' deliberations. The alternative solutions were evaluated with reference to three sets of published heuristics for user interface design.[69,76,110] All panel members had previous experience in medical human factors research, and discrepancies between evaluators' judgements were resolved through discussion.

A summary of the heuristic evaluation, including advantages and disadvantages of each of the alternative solutions for the 12 research questions, is presented in the final human factors assessment report.[76] This report provides background relevant to each question, lists each of the alternative solutions to each question considered by the panel, and provides a summary of the panel's conclusions. Where applicable, explanations are provided as to why particular options were not preferred. For each research question, the solution recommended by the expert panel has been incorporated into these guidelines.

The Commission acknowledges that there are limitations to the heuristic evaluation in that it has no empirical foundation and is based on inspection of a limited set of examples in a limited range of contexts. Further research to examine each recommendation in more detail could include:

1. An expanded task analysis using prescription software. The range of contexts investigated could be expanded to include pharmacist-centred tasks (hospital and community based) and medication administration contexts beyond the inpatient hospital-based situation
2. Rapid prototyping of alternative software interfaces and conducting informal usability trials to assess the apparent usability of alternative design options. The simulations could vary in fidelity from mock-up screenshots (as used in the present project) to interactive software simulations or real prescription systems (tested using simulated patient data)
3. Controlled behavioural experiments to test all recommendations empirically. Heuristic evaluation is a qualitative method, so conclusions should not be regarded as definitive. To address this issue, empirically based evidence for best practice should be sought in future work.[76]

9.6 Development of recommendations for consumer-facing medicines information

To inform the development of these guidelines, the Commission engaged the Consumers Health Forum of Australia (CHF) to conduct a consumer focus group to elicit consumers' preferences about on-screen display of medicines information. Participants were sought from consumer organisations, as well as individuals with an interest in medicines information.

A focus group of 10 consumers was held in April 2016. All the participants were experienced health consumer representatives and had high degrees of health literacy and understanding of quality use of medicines, but they were encouraged to reflect a cross-section of consumers' views. Participants were given a workbook with options for displaying the information, which covered the following areas of the guidelines:

- Presentation of the medicine name (using National Tall Man Lettering or not)
- Use of symbols (for example, '/' or 'in')
- A range of ways to display time
- Use of plain English
- Use of words or numerals to display numbers
- A range of ways to describe when to take a medicine (for example, 'twice a day' or '1 in the morning and 1 in the evening')
- A range of ways to describe maximum daily dose
- Order of information
- Use of 'food' or 'meals'.

Consumers broadly agreed on most issues, and these preferences are reflected in these guidelines. Issues of interest are described below.

9.6.1 Tall Man lettering

Consumers did not reach a complete consensus on whether National Tall Man Lettering was preferred. Participants felt that Tall Man lettering helped to draw attention to the active ingredient and would be especially helpful for people whose first language is not English. Overall, participants felt that the purpose of Tall Man lettering is to reduce risks (which apply to both pharmacists and consumers), and that use of Tall Man lettering is unlikely to cause harm.

Some consumers felt Tall Man lettering may be confusing as it does not apply to all medicines, and that the on-screen presentation should be consistent with the presentation of the medicine name on the product pack.

In line with the World Health Organization initiative of Tall Man lettering, National Tall Man Lettering is recommended for clinical on-screen display of medicines for medicines with look-alike, sound-alike names that are known to cause confusion. Consumer views did not reject National Tall Man Lettering, and it is therefore retained in

the consumer addendum for consistency across clinical and consumer views.

9.6.2 Time

Participants agreed that 'am' and 'pm' to indicate before and after midday can be easily missed or misunderstood, and preferred phrases such as 'in the morning' and 'in the evening'.

9.6.3 Maximum daily doses

Participants suggested that maximum daily doses should be highlighted in bold or similar (for example, 'do not take more than 8 tablets in 24 hours'). Participants also felt that maximum daily doses for tablets and liquids could be presented differently for clarity (see Section 7.3.3 in these guidelines).

9.6.4 'Food' or 'meals'

Consumers preferred the term 'food' rather than 'meals', as this is more easily understood by people from culturally and linguistically diverse backgrounds.

9.6.5 MICROg

MICROg as a presentation of micrograms was not specifically tested with consumers.

The strong support for clinical presentation to reduce the display of microgram in full led to the term MICROg.[76]

The presentation of microgram in full is consistent with consumer views relating to clarity and plain language. Microgram may be represented as MICROg or microgram.

9.7 Acknowledgements

Extensive stakeholder review of these guidelines was funded by the Australian Government Department of Health and addressed a wide and representative range of issues across the health provider and consumer spectrum. The Commission particularly acknowledges the consumers who participated in the focus group, the Consumers Health Forum and members of the working group from the Australian Digital Health Agency. The Commission also acknowledges the assistance of the following stakeholders who participated in the draft guideline review:

- Australian College of Health Informatics
- Australian Digital Health Agency
- Australian Medical Association
- Australian Medicines Handbook
- Australian Nursing and Midwifery Federation
- Australian Patient Safety Foundation
- Clinical Skills Development Service
- Consumers Health Forum of Australia
- Australian Institute of Health Innovation
- Medical Software Industry Association
- National Health and Medical Research Council Centre of Research Excellence in Informatics
- NPS MedicineWise
- Pharmaceutical Society of Australia
- Pharmacy Guild of Australia
- Public and private, acute, primary and ambulatory health services
- Royal Australian College of General Practitioners
- Royal College of Pathologists of Australasia
- Society of Hospital Pharmacists of Australia
- State and territory governments
- Therapeutic Goods Administration
- University of Queensland (School of Psychology and School of Medicine).

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