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Medications Management – Search and Prescribe
User Interface Design Guidance

PREFACE

Documents replaced by this document

Document Title	Version
Medications Management – Search and Prescribe – User Interface Design Guidance	1.0.0.0[1]
Design Guide Entry – Medications Management – Search and Prescribe	2.0.0.0
Design Guide Entry – Medications Management – Search and Prescribe	1.0.0.0

Documents to be read in conjunction with this document

Document Title	Version
Medications Management – Medication Line – User Interface Design Guidance	2.0.0.0
Medications Management – Medications List – User Interface Design Guidance	1.0.0.0
Medications Management – Drug Administration – User Interface Design Guidance	4.0.0.0
Design Guide Entry – Time Display	4.0.0.0
Design Guide Entry – Date Display	5.0.0.0
Design Guide Entry – Date and Time Input	3.0.0.0
Design Guide Entry – Patient Banner	4.0.0.0
Design Guidance – Accessibility Checkpoints for NHS Applications	1.0.0.0

This document was prepared for NHS Connecting for Health which ceased to exist on 31 March 2013. It may contain references to organisations, projects and other initiatives which also no longer exist. If you have any questions relating to any such references, or to any other aspect of the content, please contact cuistakeholder.mailbox@hscic.gov.uk

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[1]Previous baseline was incorrectly numbered v1.0.0.0 not v3.0.0.0. Hence, the current document is v4.0.0.0.

TABLE OF CONTENTS

Patient Safety Process

The development lifecycle for this design guide includes an integrated patient / clinical safety risk assessment and management process.

Known patient safety incidents relevant to this design guidance area have been researched and reviewed as part of ongoing development. The resulting guidance points aim to support mitigation of these known patient safety risks. In addition, the developers of this design guide have undertaken a patient safety risk assessment to identify new risks that could potentially be introduced by the guidance points in this document. Any potential risks identified have been assessed and managed to support the ongoing clinical safety case for this design guide.

The Hazard Log records all the risks that have been identified during development and describes mitigatory actions that, in some cases, will need to be taken by users of this design guide. The Hazard Log is a live document that is updated as the design guide is developed and maintained. Until this design guide has received full Clinical Authority to Release (CATR) from the NHS Connecting for Health (CFH) Clinical Safety Group (CSG) – based on an approved Clinical Safety Case – there may be outstanding patient safety risks yet to be identified and mitigated.

Additionally, users implementing applications that follow this design guide's guidelines (for example, healthcare system suppliers) are expected to undertake further clinical safety risk assessments of their specific systems within their specific context of use.

Refer to NHS Common User Interface for further information on the patient safety process and for the safety status and any relevant accompanying safety documentation for this design guide.

1   INTRODUCTION

This document provides guidance for the design of searching for and prescribing of individual medications for single patients. It describes the area of focus, lists mandatory and recommended guidance points with usage examples and explains the rationale behind the guidance.

Electronic prescribing is envisaged as being part of a clinical system that includes a series of views, some of which present medications information for each patient. Guidance for the display of a patient's medications is defined in the document *Medications Management – Medications List* **{R1}**. Guidance for another medications view, the drug chart, is defined in the document *Medications Management – Drug Administration* **{R2}**.

More detailed guidance for the layout and formatting of individual medications is defined in the document *Medications Management – Medication Line* **{R3}**. This includes guidance that informs the selection of attributes and defines display formatting appropriate for the information used to express a single medication. (Later, this approach is referred to simply as 'medication line'.)

The structure of the prescribing processes considered in the creation of this guidance has been informed by the NHS National Programme for Information Technology (NPfIT) document *dm+d Implementation Guide (Secondary Care)*[2]. This work describes a Prescribing Model that is designed to minimise the risk when prescribing (or 'ordering') medications in secondary care. It advocates a dose-based prescribing system in which:

- A prescriber specifies a drug by its generic name plus dose, route and frequency

- A nurse (for example) then selects the correct quantity of an actual product to give to the patient

The Prescribing Model aims to provide the safeguards needed to ensure dose-based prescribing results in prescriptions without any unsafe ambiguities for those giving medicines to patients. NHS CFH requires software vendors to use the NHS *Dictionary of Medicines and Devices*[3] (referred to as 'dm+d'), so the Prescribing Model has been designed based on concepts such as those used in the dm+d. The guidance in this document does not assume the use of the dm+d and is intended to work with any drug database that uses the concepts of generic drug name, which equates to Virtual Therapeutic Moiety (VTM) in the dm+d, and branded drug name, which equates to Trade Family Name (TFN) in the dm+d.

The guidance in this document focuses on supporting secondary care settings. Although all care settings have been considered as part of the analysis for this work, the guidance does not attempt to meet requirements for primary care or other requirements that are specialist or specific to settings outside of secondary care.

> **Alternative Design Solutions**
>
> Whilst many different design alternatives have been considered, researched and tested in the construction of this guidance document, it is acknowledged that there are already a significant number of working electronic prescribing systems which may have employed design approaches that have not been directly assessed.
>
> Throughout this document, in sections where such alternatives are known to exist, the guidance document lists the key hazards that alternative design solutions must address. Within these sections, conformance ratings apply only where the guidance is followed by Independent Software Vendors (ISVs). Where the

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[2] NHS NPfIT – dm+d Implementation Guide (Secondary Care) **{R4}**: ePrescribing reference documents — NHS Connecting for Health

[3] NHS – dictionary of medicines + devices **{R5}**: Welcome to the dm+d website — The NHS Dictionary of Medicines and Devices

> guidance is not followed it is the responsibility of the providers of alternative solutions to ensure that known risks are addressed.

To indicate their relative importance, each guideline in this document is ranked by **Conformance** and by **Evidence Rating**. Table 1 defines those terms:

Term	Definition
Conformance	Indicates the extent to which you should follow the guideline when defining your UI implementation. There are two levels: **Mandatory** – An implementation should follow the guideline **Recommended** – An implementation is advised to follow the guideline
Evidence Rating	Summarises the strength of the research defining the guideline and the extent to which it mitigates patient safety hazards. There are three ratings (with example factors used to determine the appropriate rating): ■ **Low**: ■ Does not mitigate specific patient safety hazards ■ User research findings unclear and with few participants ■ Unreferenced usability principles indicate the design is not significantly better than alternatives ■ **Medium**: ■ Mitigates specific patient safety hazards ■ User research findings clear but with few participants ■ References old authoritative guidance (for example, from National Patient Safety Agency (NPSA), Institute for Safe Medication Practices (ISMP) or World Health Organization (WHO)) that is potentially soon to be superseded ■ Referenced usability principles indicate the design is significantly better than alternatives ■ **High**: ■ Mitigates specific patient safety hazards ■ User research findings clear and with a significant number of participants ■ References recent authoritative guidance (for example, from NPSA, ISMP or WHO) ■ Referenced usability principles indicate the design is significantly better than alternatives

Table 1: Conformance and Evidence Rating Definitions

> **Note**
>
> Refer to section 11.2 for definitions of the specific terminology used in this document.

Sections 4, 7 and 9 contain guidance that has been added since the previous version of this guidance (Baseline version 1.0.0.0 dated 13-Aug-2008). All previous guidance points have been re-numbered and some have been revised. Table 2 summarises the changes made by showing where the guidance points in each original section of the previous document have been moved to in this document:

Previous Section	New Section
3.3.1 Relating Drug Search to Context (two guidance points)	3.3.1 Relating Drug Search to Context
3.3.2 Positioning the Text Input Box (one guidance point) 3.3.3 Communicating the Scope of the Search (one guidance point)	5.3.1 Positioning the Search Text Input Box
3.3.4 Defining Text Input Box Behaviour (two guidance points) 3.3.5 Moving from text Input Box to Results List (two guidance points)	5.3.2 Defining Text Input Box Behaviour
3.3.6 Displaying Results with Progressive Matching (two guidance points)	5.3.3 Displaying Results with Progressive Matching
3.3.7 Providing Feedback for a Progressive Search (five guidance points) 3.3.10 Defining the Height of Search Results Lists (two guidance points)	5.3.4 Providing Feedback for a Progressive Search

Previous Section	New Section
3.3.8 Limiting the Height of a Results List (three guidance points), 3.3.10 Defining the Height of Search Results Lists (one guidance point)	5.3.5 Limiting the Height of a Search Results List
3.3.9 Displaying a Longer Results List (three guidance points)	5.3.6 Extending the Search Results List
3.3.11 Providing Cascading Lists (three guidance points)	6.3.1 Providing Cascading Lists
3.3.12 Displaying Cascading Lists (three guidance points) 3.3.13 Displaying Selections in Cascading Lists (one guidance point)	6.3.2 Displaying Cascading Lists
3.3.13 Displaying Selections in Cascading Lists (one guidance point)	6.3.3 Contents of Cascading Lists
3.3.14 Matching Input Text to Results (three guidance points)	5.3.7 Matching Input Text to Results
3.3.15 Ordering the Results (one guidance point)	5.3.8 Ordering Search Results
3.3.16 Using Groups to Limit Search Results (two guidance points)	5.3.9 Using Groups to Limit Search Results
3.3.17 Supporting Spelling Matches (two guidance points)	5.3.10 Supporting Spelling Matches
3.3.18 Co-drugs and Their Ingredients (two guidance points)	5.3.11 Co-Drugs and Their Ingredients
3.3.19 Prioritising Results (five guidance points) and 3.3.20 Displaying Results without Prioritised Matches (one guidance point)	5.3.12 Prioritising Results
3.3.21 Defining Shortcut Keys for Prioritised Results (three guidance points)	5.3.13 Shortcut Keys in Search Results
3.3.22 Formatting Commonly Mis-Selected Matches (three guidance points)	5.3.14 Formatting Commonly Mis-Selected Matches
3.3.23 Formatting Spelling Matches (three guidance points)	5.3.15 Formatting Spelling Matches
3.3.24 Formatting List Results (three guidance points)	5.3.16 Formatting Search Results Lists
3.3.25 Generic Drug Names and Brand Names (four guidance points) 3.3.26 Supporting Selection of Brand Names (one guidance point)	5.3.17 Generic Drug Names and Brand Names

Table 2: Changes Since the Last Baseline Version

1.1   Customer Need

The first electronic prescribing systems generally evolved from individuals taking the initiative to develop software that could replace paper-based systems, improve reporting and auditing and help to reduce medication errors. Since these systems have evolved largely independently of one another, there is no commonly used standard for the design of electronic prescribing systems. The lack of a standard is itself a source of patient safety risk since clinical staff who work in more than one location and use more than one system have to cope with very different processes and different user interfaces for completing the same tasks.

Medications Incidents – In a study of safety incidents (that excluded non-preventable adverse drug reactions) in the NHS, the National Patient Safety Agency (NPSA) found that fifteen per cent of medication incidents reported between January 2005 and June 2006 were related to prescribing. To put this into perspective, the same study found that the majority of incidents related to the administration of medications (59.3 per cent), followed by incidents related to preparation and dispensing (17.8 per cent):

- 59.3 per cent – administration of medications

- 17.8 per cent – preparation and dispensing

- 15 per cent – prescribing

These findings are published in the document *Safety in doses: medication safety incidents in the NHS[4]*. In summary, the document lists the following as the most common types of reported medication incidents, which together make up over half of all reported medication incidents:

- Incorrect dose, strength or frequency

- Omitted medication

- Wrong medication (including medications prescribed as a result of a mis-selection error)

Existing Systems – Inpatient hospital care settings currently use multiple kinds of medications documents, in both paper-based and electronic formats. These documents differ depending on the medications that they are used for and, furthermore, they differ between care settings. The differences in the designs of these documents may well already impact patient safety, as care professionals move between hospitals and are faced with new prescribing processes while working in potentially time-pressured, high-stress environments. Differences in prescribing processes and the design of electronic prescription forms are an increasing safety concern as electronic systems are more widely adopted.

The Role of Electronic Prescribing – Research, in which extensive studies of medication-related errors were reviewed, suggests that the most powerful means of preventing medication-related errors are electronic prescribing and administration management, along with standards for processes and for the writing of prescriptions (see *Medication Errors* **{R7}**, *To Err Is Human* **{R8}** and *Understanding Patient Safety* **{R9}**).

When paper-based systems are replaced with electronic systems, visual cues, such as the colour and thickness of a patient chart and the large surface area on which information can be displayed, are lost. To be an effective replacement, the electronic system must find a different way of presenting and communicating this information.

Whilst electronic prescribing is effective at mitigating some of the risks associated with paper-based prescribing, and is generally found to reduce prescribing errors overall, it also has the potential to introduce new kinds of errors (see *The Extent and Importance of Unintended Consequences Related to Computerized Provider Order Entry* **{R10}**). Many of these errors are common to any human-computer interface and can be effectively mitigated by following current best practice usability principles.

The process of replacing a paper-based system with an electronic one inevitably also brings culture changes and changes to processes. Electronic systems that are perceived as being too restrictive are associated with loss of responsibility leading to complacency and over-reliance on the system. Inflexible prescribing systems may be effective at supporting the prescribing of common medications and the prevention of specific errors but the same inflexibility that supports these processes also introduces problems for prescribing non-standard medications (see *Role of Computerised Physician Order Entry Systems in Facilitating Medication Errors* **{R11}**).

The provision of a highly flexible electronic prescribing process, which still brings the benefits of reducing errors, relies on a comprehensive system that can perform complex error checking across information such as the patients' medications, diagnoses, demographics and test results.

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[4]NPSA – Safety in doses: medication safety incidents in the NHS **{R6}**:
http://www.npsa.nhs.uk/nrls/alerts-and-directives/directives-guidance/safety-in-doses/

1.2   Scope

This guidance informs the design of a user interface for prescribing a medication for a single patient in a hospital ward environment.

1.2.1   In Scope

Guidance Areas	Details
Users	Hospital-based doctors, nurses and pharmacists who prescribe medications
Care settings	Inpatient, hospital ward environment only
Tasks	Prescribing individual medications
Medications	■ Oral solids and liquids ■ Granules and powders ■ Inhalers and sprays ■ Suppositories and pessaries ■ Eye, ear and nose drops ■ Topical patches ■ Topical liquids ■ Nebuliser solutions ■ Creams, ointments and gels ■ Injections (insulin example only) ■ Enemas and rectal solutions ■ Unlicensed medications (chloramphenicol example only)
Finding a Drug	■ Text entry searching for generic or brand name ■ Pick lists (called 'Quick Lists')
Search Results	■ Differentiating between generic drugs and brand names in lists ■ Displaying, ordering and formatting search results lists ■ Navigating within and between search results lists ■ Interacting with search result list items ■ Indicating non-formulary drugs in search results lists
Template Prescriptions	Presentation of lists of predefined prescriptions
Defining a Prescription	■ Structure and layout of the prescription form ■ Presentation of required and optional attributes ■ Guidance for efficiently prescribing commonly prescribed medications ■ Guidance for prescribing less commonly prescribed and more detailed medications
Administration Schedules	Selection from a predefined set of administration times or the definition of an individual administrative event for a once only medication.
Previewing a Prescription	Guidance for supporting the review of a prescription before it is authorised

Table 3: In Scope

1.2.2   Out of Scope

> **Note**
>
> Listing an item as out of scope does not classify it as unimportant. Project time and resource constraints inevitably restrict what can be in scope for a particular release. It is possible that items out of scope for this release may be considered for a future release.

Table 4 defines areas that are not covered in this guidance. Although there may be specific risks associated with these areas that are not addressed in this guidance, it is likely that the principles in this guidance will extend to the display of medication information in many of the areas listed below.

The patient as a user of clinical software is out of scope; the guidance is designed to inform the design of user interfaces used by clinicians. As such, it will therefore present information in formats that are appropriate for health care professionals. The display of medication information in views that are designed for patients is not addressed in this guidance.

The guidance has been written in such as way that it should be adaptable for use with various display sizes and therefore does not make reference to specific dimensions for screen elements.

The care settings listed in Table 4 are out of scope because they have not been studied in depth in our research. Some of this guidance is likely to be relevant to these care settings, but there will be specific risks associated with each that have not been considered and therefore mitigated in this guidance.

There are many medication types listed in Table 4 because they have not been sufficiently researched to be able to make assumptions about the extent to which they are addressed by guidance.

> **Note**
>
> Since this guidance uses a dose-based prescribing approach, it is not directly appropriate for Primary Care or general practice.

Guidance Areas	Details
Users	Non-clinical staff, patients and other health care professionals not listed in the in scope section (that is, only hospital-based doctors, nurses and pharmacists are in scope).
Care settings	▪ Care settings other than inpatient, hospital ward environments, including: outpatients, clinics, pharmacies, emergency services and departments, intensive care, High Dependency Unit (HDU), primary care, including general practice, community and home visits, ward management, multi-patient tasks ▪ Paediatric prescribing
Tasks	Any task other than prescribing individual medications, including: ▪ Reviewing administration events to gain an understanding of the degree to which the medication has been successfully administered ▪ Relating medications to information elsewhere in the patient record, including the linking of information in a plan or notes to medications ▪ Medications reconciliation ▪ Any task that follows authorisation of a prescription, such as editing or deleting a medication after it has been prescribed ▪ Creating links or associations between prescriptions or between prescriptions and other data (such as test results)
Application Context	▪ The display of the prescribing area in relation to other medications and non-medications views ▪ Interactions between and access to other views whilst prescribing ▪ Entry and exit points for the prescribing process, including 'Cancel' or 'Close', except for the default entry point, 'initiate prescribing'

Guidance Areas	Details	
Medications These medications may have additional requirements or introduce specific risks that are not explicitly addressed by the guidance.	▪ Enteral feeds ▪ Dressings and devices ▪ Implants and sticks ▪ Intrauterine devices (IUDs) ▪ Cements ▪ Dialysis solutions ▪ Injections (except insulin example) ▪ Infusions and fluids (except by specific examples) ▪ Combination infusions ▪ Total Parenteral Nutrition (TPN) ▪ Gases ▪ Blood and platelet products ▪ Variable dose medications	▪ Foams ▪ Radioactive agents ▪ Regimens and order sets ▪ Advisory Committee on Borderline Substances (ACBS) products ▪ Over the counter (OTC) medications ▪ Recreational drugs ▪ Medications with titrating doses ▪ Discharge medications – to take out (TTO) ▪ Patient's own drugs (PODs) ▪ Epidurals and patient controlled analgesia ▪ Extemporaneous prescriptions ▪ Unlicensed medications (except chloramphenicol example) ▪ Controlled drugs
Prescription Types	▪ Medication administered or supplied as part of a Patient Group Direction (PGD) ▪ Medication prescribed by supplementary prescribers ▪ Corollary orders that require a view of additional patient-related information before and/or during prescribing (for example, warfarin and International Normalized Ratio (INR) results).	
Prescription Data	▪ Specific data fields for prescriptions, including which should be required and which optional ▪ Values for data fields for prescriptions	
Formularies	▪ Formulary management, including the definition of formularies and which medications belong to them ▪ The selection of a formulary for use during a drug search for prescribing	
Recommendations	The definition of a draft prescription that is sent from one prescriber to another as a recommendation for the treatment of a particular patient.	
Prescriptions with Conditions	Definition of conditions such as criteria that must be met before administration can begin, criteria that must be checked at each administration or criteria that determine when a medication should end.	
Administration Schedules	▪ The definition and modification of individual administrative events (except for once only medications) in an administration schedule ▪ Addition of once only medications to supplement a regular medication with a first dose too far in the future	
Previewing a prescription	The saving of completed medications in a list (similar to a 'shopping cart') such that they can be reviewed both individually and as a set before they are authorised.	
Changing Prescriptions	▪ The selection of a medication (such as in a Medications List or a Drug Administration view) and modification of the prescription ▪ The selection of a past medication for re-prescribing, such that the past medication is used as a template for a new prescription ▪ Discontinuing, suspending or restarting a medication	
Retrospective Prescribing	The recording of prescriptions for medications that have been or are being administered.	
Partial Prescriptions	Saving of partially completed prescriptions for review and authorisation at another time.	
Permissions	Limiting access to individual controls (such as command buttons or input controls) and options available within them (such as list items in a drop-down list) based on permissions (associated with login).	
Input Forms	▪ Structure and layout that would apply to standard forms ▪ Validation and error handling ▪ Truncation and abbreviation	

Guidance Areas	Details
Dose Calculation	■ Automatic calculation of doses ■ Display and input of height, weight and mass
Authorisation	■ Any part of the user interface process that follows the activation of a control that authorises a prescription ■ Cancelling, closing or otherwise exiting a prescription before it is complete
Decision and knowledge support	■ Decision support alerting for allergies ■ Decision support for drug-to-drug interactions ■ Decision support alerting based on patient medical history, demographics or other information held in the patient record ■ Knowledge support for browsing drugs by classification ■ Knowledge support for looking up information about medications.
Allergies	The display and recording of allergy information and adverse drug reaction risks is covered in a separate guidance document.
Patient consent and preference	Patient preference, such as for a particular drug form. Patient consent, particularly in a mental health context.
Other	■ Sealed envelopes ■ Supply and dispensing ■ Guidance (other than notifications) that might be needed for when a patient is 'Nil by Mouth'

Table 4: Out of Scope

1.3 Assumptions

ID	Assumption
A1	The majority of medications prescribed by any given clinician will come from a short list of medications that are regularly prescribed by that clinician.
A2	The majority of prescriptions (about 80%) can be prescribed by selecting a predefined template prescription.
A3	When prescribers initiate the prescribing process, they know what they want to prescribe and are ready to prescribe it.
A4	When using the prescribing interface, the Common User Interface (CUI) Patient Banner remains visible throughout the prescribing process.
A5	In general (with known exceptions) prescribing by generic drug name should be encouraged in preference to prescribing by products or brand names.

Table 5: Assumptions

1.4 Dependencies

ID	Dependency
D1	This guidance is informed by the NHS NPfIT *dm+d Implementation Guide (Secondary Care)* **{R4}**
D2	This guidance is informed by the NHS NPfIT *ePrescribing Functional Specification*[5]

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[5] NHS NPfIT – ePrescribing Functional Specification **{R12}**:
http://www.connectingforhealth.nhs.uk/newsroom/news-stories/eprescfunctspec

ID	Dependency
D3	This guidance uses the concepts 'generic drug' and 'brand name' and depends on access to, or creation of, a database or dictionary, that can support these concepts. In the *Dictionary of Medicines and Devices* **{R5}** (known as 'dm+d'), the concept Virtual Therapeutic Moiety (VTM) equates to generic drug name and the recently created Trade Family Name (TFN) equates to brand name.
D4	The display of drug names and medications is defined by the document *Medications Management – Medication Line* **{R3}**.
D5	The display and entry of dates is defined by the documents *Time Display* **{R13}**, *Date Display* **{R14}** and *Date and Time Input* **{R15}**

Table 6: Dependencies

2   SEARCH AND PRESCRIBE GUIDANCE OVERVIEW

The guidance is divided into sections that are organised such that they follow the prescribing process from initiation through to authorisation. Within each section are a number of tables containing guidance points, usage examples and rationale for specific aspects of the user interface.

The guidance assumes a flexible prescribing process that can support both a quick prescribing process for the most commonly prescribed drugs and a more detailed prescribing process for less common prescribing practices, whilst mitigating known risks and meeting a high standard of patient safety.

Important

The visual representations used within this document to display the guidance are illustrative only. They are simplified in order to facilitate understanding of the guidance points. Stylistic choices, such as colours, fonts or icons are not part of the guidance and unless otherwise specified are not mandatory requirements for compliance with the guidance in this document.

The usage examples in this document include examples of sets of fields, some of which are shown as required and some as optional. These examples are illustrative only and are not intended to provide guidance on which fields should be available for specific types of medication nor which fields should be required or optional.

Figure 1 and Figure 2 show an example of a prescribing process. The process itself does not form part of this guidance. The illustration shows how each section of the guidance can potentially relate to the previous and the next steps in the prescribing process. It thus shows a subset of the many valid alternative paths through the process of prescribing.
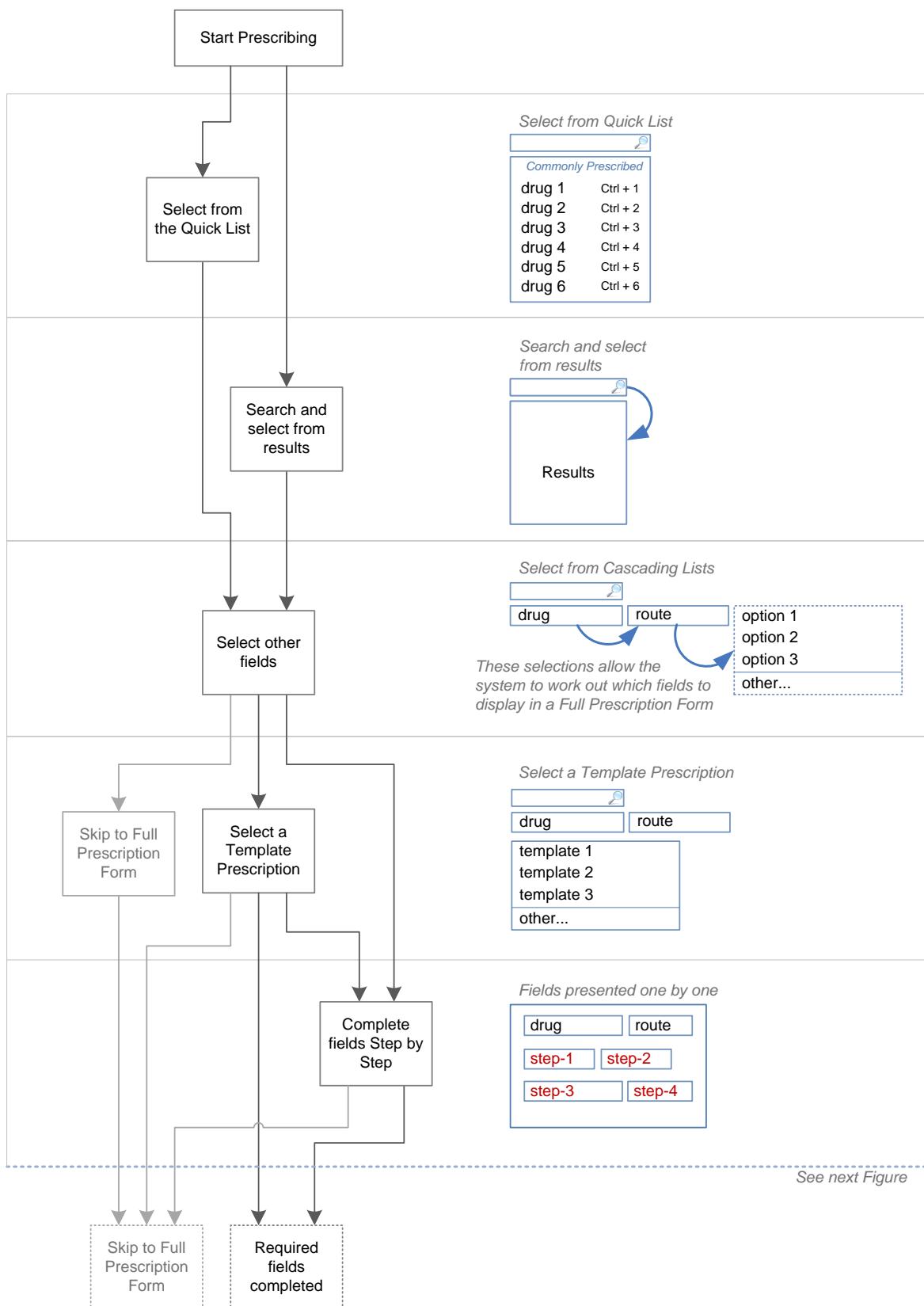
Figure 1: Overview of the Prescribing Process and Corresponding User Interface Prescribing Steps (Part 1 of 2)
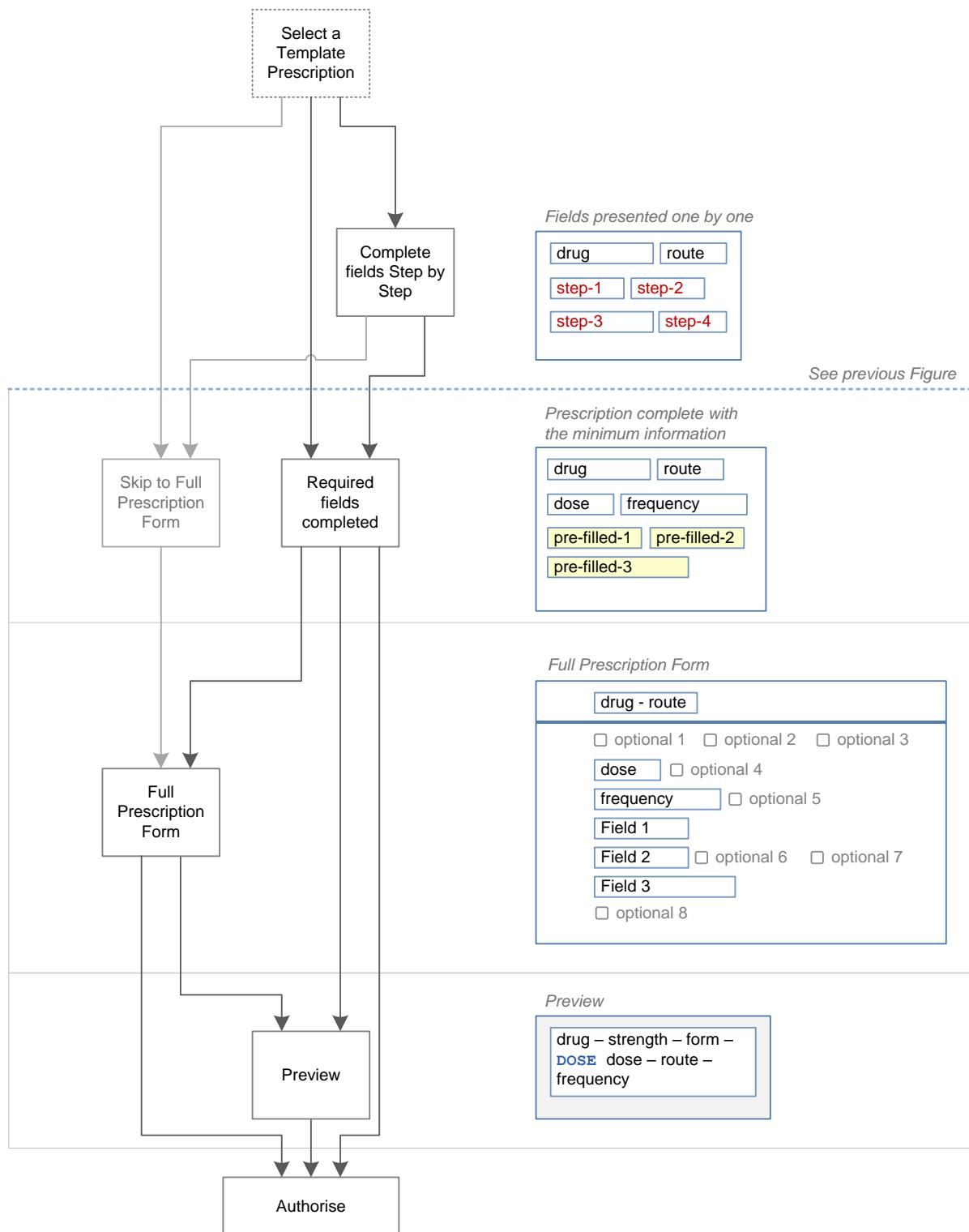
Figure 2: Overview of the Prescribing Process and Corresponding User Interface Prescribing Steps (Part 2 of 2)

Note

Validation and error handling is out of scope (see section 1.2.2).

The process of creating a prescription can begin with a new, blank prescription. It may also begin by selecting an item, such as a drug name, elsewhere in the application and using it to begin the prescribing process.

For example, prescribing may be started by:

- Selecting a drug name from a reference tool (for example, the *British National Formulary*[6] (BNF))
- Selecting a drug name from a care plan or care pathway

By selecting a drug name elsewhere in the application, the first part of the prescribing process (in which a drug is selected from a list) can be skipped. When a medication is selected from a list of current or past medications for the current patient, the drug name and other attributes can be carried through to the prescribing process, thus allowing other steps to be skipped. Although some of these tasks may be performed in the view from which they were selected, other tasks may open the medication in the prescribing area:

- Creating a prescription after one or more doses have been administered
- Modifying a prescription
- Suspending or restarting a prescription
- Discontinuing (stopping) a prescription
- Re-prescribing a past medication

Figure 3 shows these entry points in relation to (a simplified) prescribing process. Guidance relating to these alternative entry points for the prescribing process is provided in section 3.
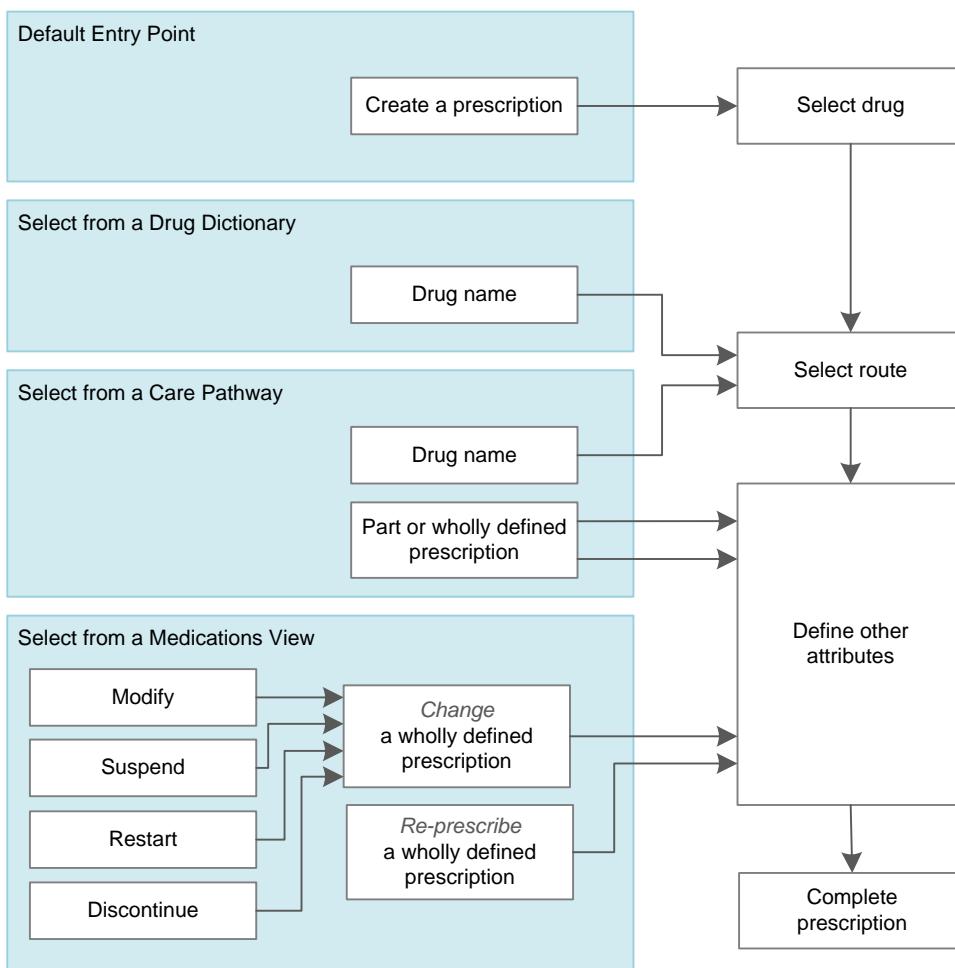
Figure 3: Entry Points

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[6]British National Formulary **{R16}**: http://www.bnf.org/bnf/

Figure 4 represents the user interface process for prescribing. The sections in this document are presented in the same order as the process in this diagram.
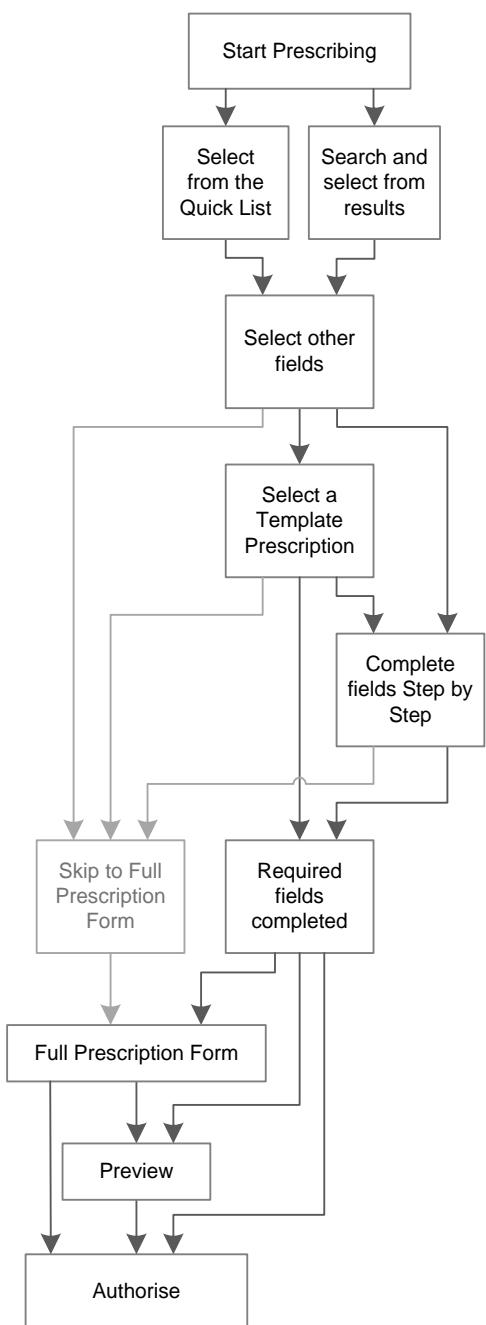
Figure 4: Overview of the Prescribing Process

Figure 5 shows the specific user interface areas for which there is guidance in this document. They are displayed in the same order as the steps in the prescribing process illustrated in Figure 4.
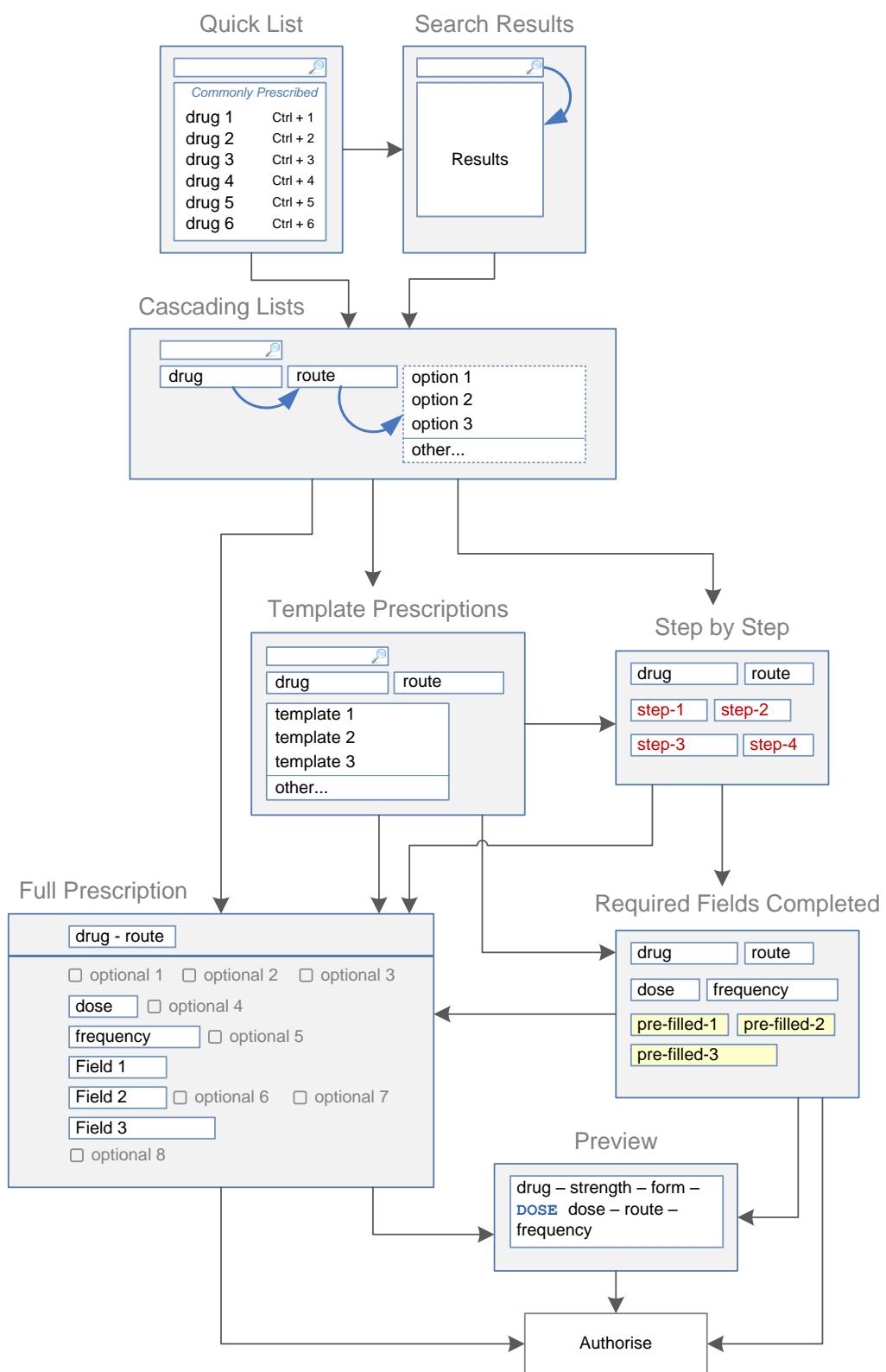
Figure 5: User Interface Prescribing Steps

2.1   Rationale Summary

Each table of guidance includes a rationale that summarises the design analysis, provides a brief account of related primary and secondary research and lists the key patient safety hazards for the guidance points in that table. The design analysis describes the deciding factors in the assessment of alternative approaches to the user interface design and lists the usability principles that are most pertinent. The desk research section lists the publications that have informed the guidance. The patient safety section lists the hazards that are mitigated by the guidance and provides a brief description of how those hazards have been mitigated. Finally, the user research section describes findings from user feedback and user testing sessions that were used to inform the iterative design process.

The following principles and existing standards provided benchmarks throughout the process of developing the guidance:

Usability Principles (specifically for Search and Prescribe):

- Mitigate the risks of mis-selection and misinterpretation

- Increase efficiency by prioritising the prescription of commonly prescribed medications over less commonly prescribed medications

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries

- Encourage simplicity of design by promoting user interface approaches that help to avoid overly complex displays and interactions that require many controls

- Ensure that the prescribing process can be supported in multiple layouts and is flexible enough to be presented in different screen dimensions

- Maximise scalability such that the prescribing process can be modified to accommodate additional information, steps or shortcuts

- Manage users expectations and improve their efficiency by providing a clear framework with consistent logic for the placement of user interface elements and the interactions that they support

- Minimise the potential for important information to be hidden from view

- Adhere to a user interface strategy that gives the impression of making progress within a single space (that has all the necessary information immediately or readily available) and avoids the impression of needing to move between many different spaces.

General Usability Principles (see APPENDIX A):

- Jakob Nielsen's *Ten Usability Heuristics*[7]

- Ben Shneiderman's eight golden rules of interface design **{R18}**

- ISO 9241: *Presentation of information* **{R19}**

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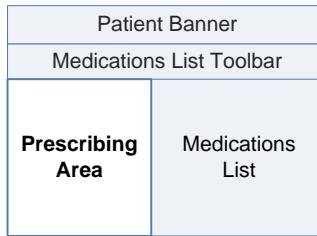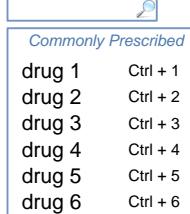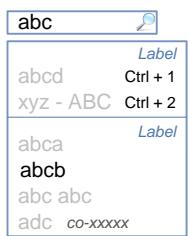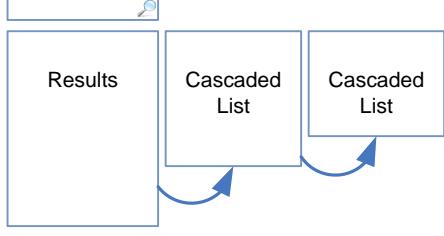
[7] Nielsen, J – Ten Usability Heuristics **{R17}**: http://www.useit.com/papers/heuristic_list.html

Existing Guidance:

- NHS NPfIT – *ePrescribing Functional Specification* **{R12}**

- NHS NPfIT – *Guidelines for the Design and Presentation of Medication Elements Required in Electronic Prescribing or Medication Ordering Systems* **{R20}**

- ISMP – *Draft Guidelines for Safe Electronic Communication of Medication Orders*[8]

- NHS NPfIT – *dm+d Implementation Guide (Secondary Care)* **{R4}**

2.2 Summary of Guidance

Table 7 summarises the content of this document by outlining each area of guidance (along with a cross reference to the relevant section) and providing a visual example to illustrate how it might be implemented:

Areas of Guidance	Visual Summary
Section 3 Prescribing Area	Patient Banner / Medications List Toolbar / **Prescribing Area** / Medications List
Section 4 Quick Lists	*Commonly Prescribed* / drug 1 Ctrl + 1 / drug 2 Ctrl + 2 / drug 3 Ctrl + 3 / drug 4 Ctrl + 4 / drug 5 Ctrl + 5 / drug 6 Ctrl + 6
Section 5 Drug Search	abc / *Label* / abcd Ctrl + 1 / xyz - ABC Ctrl + 2 / *Label* / abca / abcb / abc abc / adc *co-xxxxx*
Section 6 Cascading Lists	Results / Cascaded List / Cascaded List

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[8] ISMP – ISMP MedicationSafetyAlert! – It's Time for Standards to Improve Safety with Electronic Communication of Medication Orders – Draft Guidelines for Safe Electronic Communication of Medication Orders **{R21}**: http://www.ismp.org/Newsletters/acutecare/articles/20030220.asp

Areas of Guidance	Visual Summary
Section 7 Required Attributes	
Section 8 Prescription Forms	
Section 9 Input Controls	
Section 10 Preview and Authorise	

Table 7: Summary of Guidance

3   GUIDANCE DETAILS FOR A PRESCRIBING AREA

3.1   Introduction

When the prescribing process is initiated, an area will be presented in which the controls for prescribing are displayed. Although the dimensions and layout of this area are dictated by the design and technology of the specific clinical application, guidance is provided to ensure consistency in areas where there are potential patient safety hazards. The guidance in this section mitigates specific hazards relating to how the prescribing area may interact with other views, such as a list of a patient's medications, and how the display of that list may interact with other user interface elements, such as the patient banner.

Figure 6 shows entry points for the prescribing process. The right-hand side of the diagram is a simplified version of the process illustrated in Figure 4. The left-hand side of the diagram illustrates some of the possible ways in which prescribing can be started, including some examples of drug names and medications that can be selected elsewhere in the application and carried forward into the prescribing process. The guidance in this section relates to the context in which the prescribing process is launched.
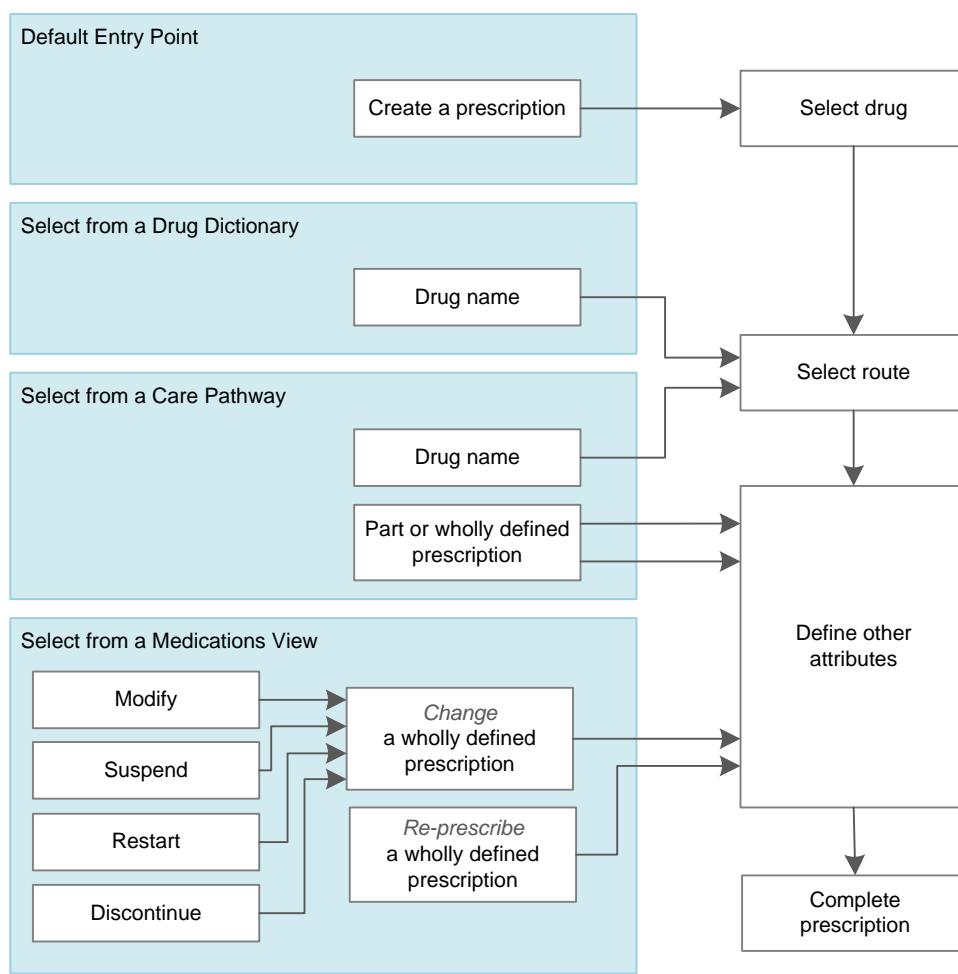
Figure 6: The Prescribing Process – Entry Points

3.2   Principles

All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Ensure that the prescribing process can be supported in multiple layouts and is flexible enough to be presented in different screen dimensions:

  - Guidance does not specify the shape or dimensions of the prescribing area so that it can remain flexible and can be displayed alongside other views

- Manage users expectations and improve their efficiency by providing a clear framework with consistent logic for the placement of user interface elements and the interactions that they support:

  - The consistent placement of toolbars that are part of medications views and of the patient banner ensure that prescribers know where to look for specific information

3.3   Guidelines
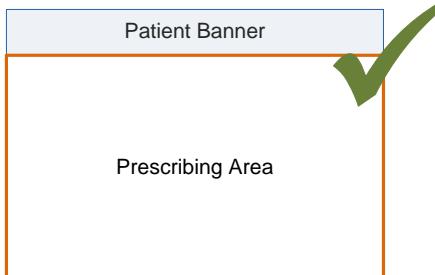
3.3.1   Relating Prescribing to Context

This section describes important considerations when accessing other views whilst entering information into a prescription form. For example, views such as those for checking other medications, current diagnoses, allergies and test results (to name a few) may be essential to inform the prescribing process.

Views that are displayed concurrently with prescribing should be assessed to check for patient safety risks introduced by the interactions (or perceived interactions) between the two views and by the impact of restricting the dimensions of any view that would normally be displayed full screen.

ID	Guideline	Conformance	Evidence Rating
MSP-0010	Do not allow the prescribing area to occlude the Patient Banner	Mandatory	Medium
MSP-0020	Allow a patient's current medications to be accessed whilst prescribing, preferably by allowing current medications to be displayed simultaneously	Recommended	High
MSP-0030	Support switching to, or simultaneous presentation of, other views without losing prescription information entered so far	Recommended	Medium
MSP-0040	If it is possible to navigate away from the prescribing area before completing a prescription, ensure that a clear indication that there is an incomplete prescription remains displayed on screen	Recommended	High
MSP-0050	Do not allow the prescribing area to be positioned such that it separates the controls (such as those on a toolbar) from the view to which they relate (see *Medications Management – Medications List* **{R1}**)	Recommended	Low

Usage Examples
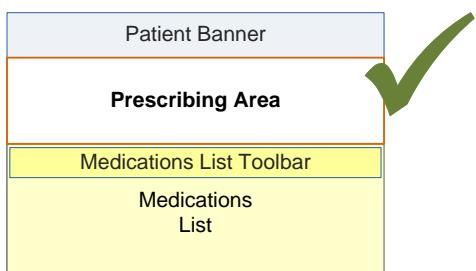
Patient Banner / Prescribing Area ✓	In this correct example, the prescribing area does not occlude the Patient Banner (MSP-0010)
Patient Banner / Prescribing Area ✗	This example is incorrect because the prescribing area has occluded the Patient Banner (MSP-0010)
Prescribing Area ✗	This example is incorrect because the prescribing area fills the screen and obscures the Patient Banner (MSP-0010)
Patient Banner / **Prescribing Area** / Medications List Toolbar / Medications List ✓	In this correct example, a prescribing area is displayed above a list of current medications (MSP-0020)
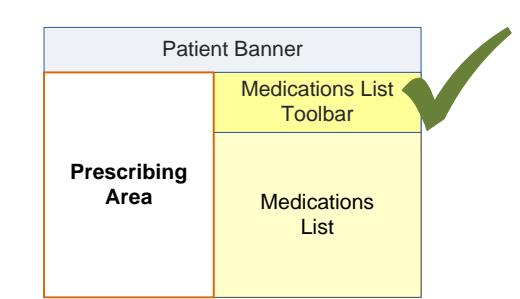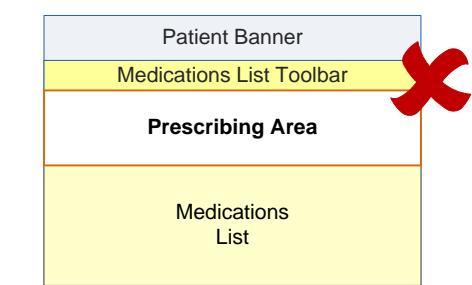
In this correct example, a prescribing area is displayed alongside a list of current medications and the toolbar for the Medications List view remains associated (MSP-0050)

This example is not recommended because the prescribing area separates the medications list controls (represented by the medications list toolbar box) from the list of current medications (MSP-0050)

Rationale

Design Analysis:

Guidance from *Design Guide Entry – Patient Banner* **{R22}** is reiterated here to emphasise the importance of maintaining a link between a prescribing window and a means of identifying which patient the prescription is being created for. Ensuring that the Patient Banner is always visible when a prescription is being created (MSP-0010) helps to mitigate the risk that a drug is prescribed for the wrong patient.

Prescribers are generally expected to review a patient record before they make the decision to prescribe a medication. Nonetheless, the information that informs their prescribing decisions may be too much to hold in their short-term memory so it is likely to be useful if they can access such information from other views and then return to prescribing (MSP-0020, MSP-0030).

If this is achieved by displaying the prescribing area alongside a medications list, then it is important that the two areas (Prescribing Area and Medications List) can be reduced to the required dimensions without introducing further risks. If a view such as the Medications List View is displayed alongside, the prescriber must be able to identify whether that list is displaying current or past medications. Thus, the relationship between the toolbar (which includes a control that displays 'current' or 'past') must be clearly associated with the list (MSP-0050).

If two areas (such as Prescribing Area and Medications List) cannot be displayed alongside one another, such that the user must switch between them, there is still some dependency on the user's short-term memory for the transfer of information from one to the other. In this style of interaction there are two risks to be mitigated:

- That the system does not retain information entered so far when switching away from the prescription
- That the user switches to a Medications List View, is distracted by information in that view and forgets to return to the prescription to complete it, potentially assuming that it is complete

If information is lost when switching away from an incomplete prescription, then the user will be discouraged from doing so and is more likely to rely on his or her short-term memory than to switch to another view to check information (MSP-0040).

Desk Research:

In *Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors* **{R11},** Koppel and others conducted a study to find out what CPOE-related factors enhance the risk of prescription errors. In their findings, they report a number of 'human-machine flaws' and one of these (reported by 55% of house staff) relates to the inability of prescribers to identify the patient whilst they are prescribing because of fragmented displays. The Patient Banner is designed to mitigate this by always being displayed when a task is being completed that relates to a single patient, so that there is always an on-screen reference to the current patient.

The *ePrescribing Functional Specification* **{R12}** requirement GEN.OS.005 indicates that the identification of the patient for whom drugs are being prescribed is to be clear, consistent and visible at all times while medication pathways are being accessed.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Visibility of system status – The Patient Banner clearly communicates the patient for whom the drug is being prescribed and, if the prescriber switches away from this view, the system maintains a notification on screen so that the prescriber knows that there is an incomplete prescription still open

- Recognition rather than recall – By allowing the prescriber to refer to information outside of the prescribing area, there is no need to rely on recall of any information available in other views

- Error prevention – Ensuring that the patient banner is always visible makes it less likely that a drug can be prescribed for the wrong patient

- User control and freedom – If prescribers begin the prescribing process and then find that they need to refer to other information, such as a test result, during the prescribing process, a system that allows them access to other views during prescribing prevents the need to cancel the prescription and start again

User Research:

In Study ID 69 (see APPENDIX B) the study participants indicated that access to current medications was important during prescribing and that the ability to access this information without having to switch views is preferable.

4   GUIDANCE DETAILS FOR QUICK LISTS

4.1   Introduction

The process of prescribing begins with the selection of a drug to prescribe. Drugs are presented in a Quick List and in search results. The Quick List is displayed when the prescribing process is started and search results are displayed when text is entered into a search text entry box. This section provides guidance for Quick Lists and section 5 provides guidance for searching for drug names.

The guidance in this section is part of the first step in the prescribing process, which is shown with a grey background in Figure 7:
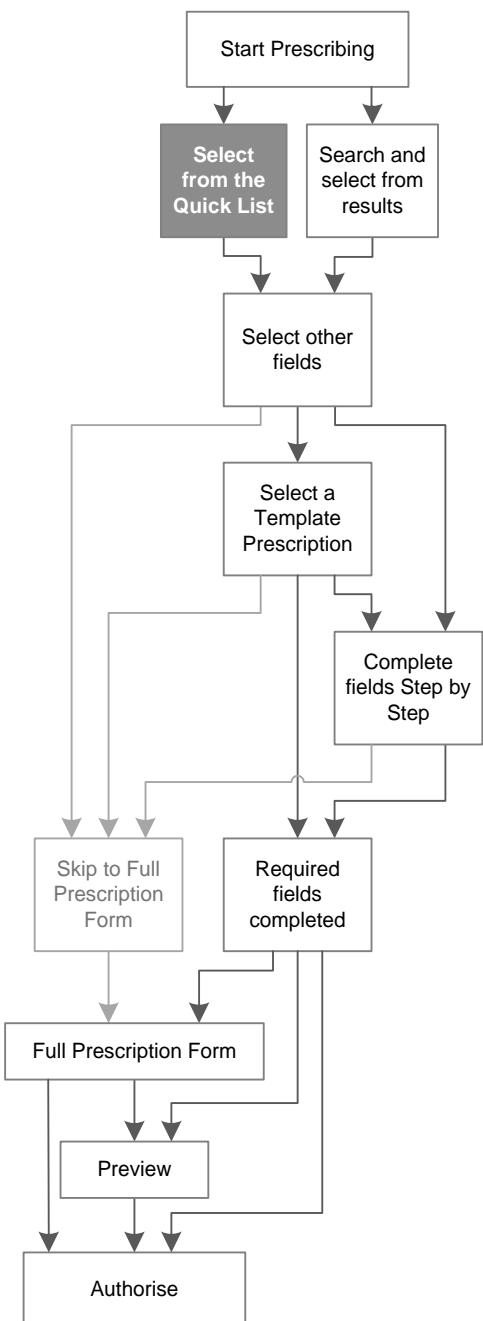
Figure 7: The Prescribing Process – Select Drug

Figure 8 is an extract from Figure 5 to illustrate the user interface prescribing steps covered in this section showing the Quick List step and links to other steps:
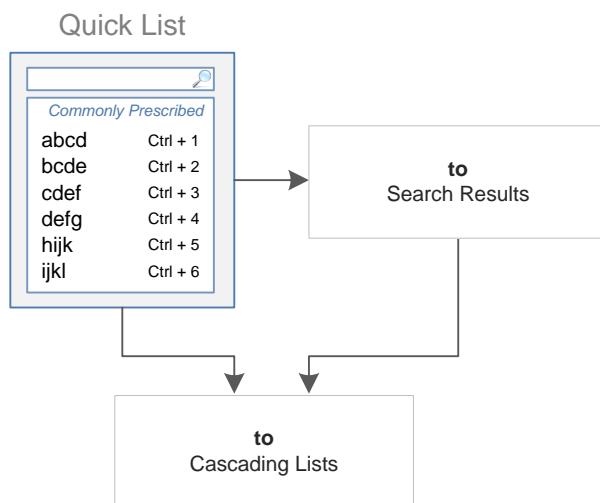
Figure 8: User Interface Prescribing Steps – The Quick List

4.2   Principles

All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Mitigate the risks of mis-selection and misinterpretation:

  - Mitigate the risk of incorrect selection of a drug name from the Quick List

  - Mitigate the potential for the Quick List to be mistaken as a suggested list of drugs to prescribe

  - Mitigate the risk of misinterpretation of the Quick List itself and the list items within it

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries:

  - The Quick List allows drug names to be presented at the start of the prescribing process
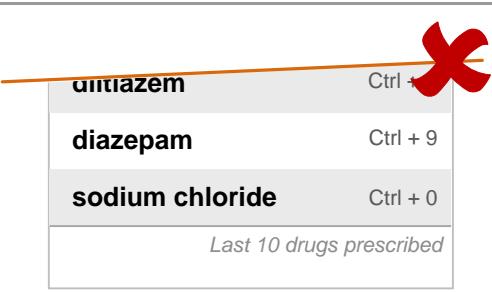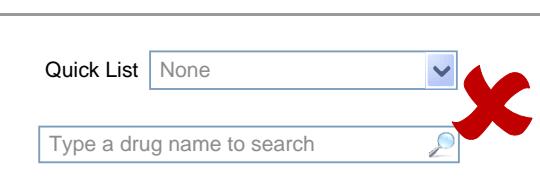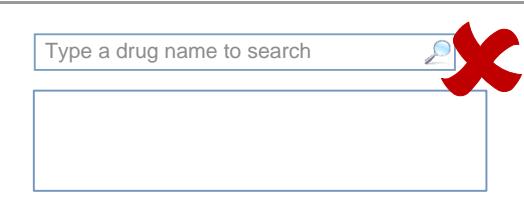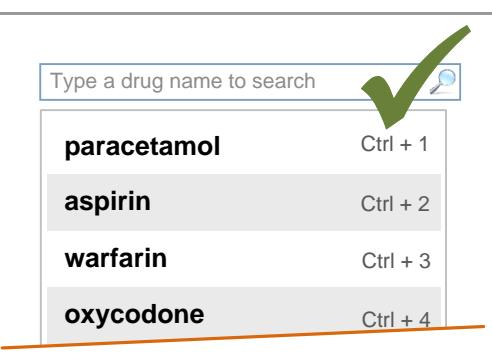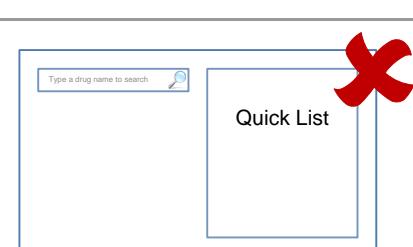
4.3   Guidelines

4.3.1   Displaying a Quick List

ID	Guideline	Conformance	Evidence Rating
MSP-0060	Support the display of a Quick List containing preselected drug names	Mandatory	Medium
MSP-0070	Minimise the frequency with which the contents of the Quick List change	Recommended	Medium
MSP-0080	When one or more Quick Lists are provided, display one by default when the prescribing process is started	Mandatory	Medium
MSP-0090	Include a description of the contents of the Quick List at the top or bottom of the list	Mandatory	Medium
MSP-0100	Display the Quick List below (or as a drop-down list extension of) the search text input box	Recommended	Low
MSP-0110	Do not support navigation (such as expanding and collapsing or drilling down) within a Quick List	Mandatory	Medium
MSP-0120	Limit the number of drugs in the Quick List such that they can be displayed in full without a scroll bar	Mandatory	Medium

Usage Examples

Type a drug name to search ✔ 🔍	In this correct example, the Quick List is displayed by default when the prescribing process is started (MSP-0080), its contents have been preselected (MSP-0060) and it contains a label ('10 commonly prescribed medications') that describes the contents (MSP-0090)

paracetamol	Ctrl + 1
aspirin	Ctrl + 2
warfarin	Ctrl + 3
oxycodone	Ctrl + 4
furosemide	Ctrl + 5
amoxicillin	Ctrl + 6
co-amoxiclav	Ctrl + 7
diltiazem	Ctrl + 8
diazepam	Ctrl + 9
sodium chloride	Ctrl + 0

10 commonly prescribed medications

diltiazem Ctrl + ✗ **diazepam** Ctrl + 9 **sodium chloride** Ctrl + 0 *Last 10 drugs prescribed*	This example is incorrect because the frequency with which the Quick List is changed has not been minimised. The example shows a Quick List containing the 'Last 10 drugs prescribed' and is thus updated every time it is displayed (MSP-0070)
Quick List [None ▼] [Type a drug name to search 🔍]	This example is incorrect because the Quick List control does not have a default so there is no list to display when prescribing begins (MSP-0080)
[Type a drug name to search 🔍]	This example is incorrect because a Quick List has not been displayed by default (MSP-0080)
[Type a drug name to search ✓🔍] **paracetamol** Ctrl + 1 **aspirin** Ctrl + 2 **warfarin** Ctrl + 3 **oxycodone** Ctrl + 4	In this correct example, the Quick List is displayed below the search text input box (MSP-0100)
[Type a drug name to search 🔍] Quick List	This example is not recommended because the Quick List is not displayed below the search results (MSP-0100)
furosemide Ctrl + ✗ ⊟ **amoxicillin** Ctrl + 5 AMIX Ctrl + 6 ALMODAN Ctrl + 7 **co-amoxiclav** Ctrl + 8	This example of a Quick List is incorrect because expand and collapse controls have been provided (MSP-0110)

	This example of a Quick List is incorrect because a scroll bar (a form of navigation) has been provided (MSP-0120)

Rationale

Design Analysis:

The Quick List is designed to remove the need to search for some of the drugs that are prescribed most frequently. It can only add value if it is faster or easier to use than searching for a drug name and is thus more effective if it contains a few drugs for which the shortcut keys can be learned (MSP-0060, MSP-0070). Since most drug names can be found quickly by typing in a few letters, the Quick List must be immediately accessible if it is to be useful (MSP-0080). It also needs to be short in length (MSP-0120) since there is limited value in spending time scrolling or navigating a Quick List (or series of Quick Lists) if the entry of a few characters in the search text input box is enough to find the drug (MSP-0110).

Since Quick Lists provide immediate access to a list of drug names without the need to search, their contents need to be carefully managed and it may not be appropriate to include certain drugs in the list. For example, it may not be appropriate to include drugs such as those specified in *Look-alike/sound-alike drugs*[9] (or any drug that is often selected or prescribed when a different drug was intended). The guidance therefore assumes that the drugs in a Quick List will be preselected (MSP-0060) and that an appropriate Quick List will only be provided to users where relevant.

Whilst it may be possible to configure more than one Quick List, it is only useful to display one Quick List at a time for each user (MSP-0080) for the same reasons that the list should be kept short. Since the Quick List contains only a few selected drugs, and is not filtered by any search criteria, the drug names will not all begin with the same letters and the risk of selection error is reduced.

The Quick List is displayed in the same space as search results since it is a similar mechanism for accessing a similar list from which to select a drug name. Since a novice or first time user may misinterpret the list or the purpose of the list, its contents should be adequately described with a label (MSP-0090).

Guidance recommends that the Quick List is displayed below the search text input box to clarify the similarity in purpose of both lists and to avoid potential confusion from the display of both a Quick List and a search results list simultaneously (MSP-0100).

If a Quick List is populated automatically, it may be possible for the placement of drug names adjacent in a list to cause unexpected juxtapositions. For example, the following may appear adjacent in a list:

- Commonly confused drug names (see also section 5.3.14)
- Alternative drugs with similar or identical pharmaceutical properties
- A generic drug and a branded version of the same generic drug (see also section 6.3.4)

Mis-selection or confusion as a result of these juxtapositions can be mitigated by reviewing Quick Lists when first implemented and again each time they are changed so that the list order can be manually altered if necessary. Since these activities are associated with system configuration, guidance is not provided for managing the order of Quick Lists.

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[9] The Joint Commission – National Patient Safety Goals – NPSG.03.03.01 – Look-alike/sound-alike drugs **{R23}**:
http://www.jointcommission.org/AccreditationPrograms/BehavioralHealthCare/Standards/09_FAQs/NPSG/Medication_safety/NPSG.03.03.01/look_alike_sound_alike_drugs.htm

Desk Research:

The *ePrescribing Functional Specification* **{R12}** includes a requirement (GEN.OS.082) in which it is stated that lists of favourite drugs should not be produced by individual users without their contents being reviewed and potentially updated centrally. Guidance for the Quick List (MSP-0060) reflects this principle of maintaining central control.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

■ Flexibility and efficiency of use – A Quick List allows the prescriber to select a drug from a list instead of having to search for it, without impacting the efficiency of the process of searching for a drug. (The Quick List is displayed by default and no extra steps are needed to dismiss it before starting a drug search.)

User Research:

In Study ID 37 (see APPENDIX F), participants who were asked about the Quick List considered it to be useful providing it contained drugs that were relevant to them. The participants estimated that a trust-wide list of commonly prescribed drugs would not be as useful as a list constructed for their specific context or specialty.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ The presence of a Quick List influences the choice of drug inappropriately for inexperienced users	■ This guidance document includes an assumption (see section 1.3) that prescribers know what they want to prescribe before they initiate the prescribing process
	■ The limited length of the Quick List (MSP-0120) reduces the number of available choices. This reduces the likelihood that there will be a drug in the Quick List that is similar to or an alternative for the one that the prescriber has in mind and thus reduces the likelihood that the presence of such a drug may influence choice
	■ If a progressive search is supported (see section 5.3.3), some inexperienced users may find it easier to type in letters than to read the contents of a Quick List. (It is expected that a Quick List would become more useful over time as users become more familiar with its contents)
■ The user thinks that the Quick List is all there is	■ Text labels at the top or bottom of the search results list are used to describe the contents of the list (MSP-0090)
	■ The presence of the search text input box and the in-field prompt within it (see section 5.3.1) mitigate this risk by clearly indicating that it is possible to search for a drug

4.3.2 Quick List Contents

Important

This section contains guidance for which there may be alternative solutions. Accordingly, the conformance ratings in this section apply only where the guidance is adopted.

The Rationale section contains a summary of the known risks which are addressed in this section and which must be addressed by any alternative solution. For more information, see the Alternative Design Solutions note in section 1.

ID	Guideline	Conformance	Evidence Rating
MSP-0130	Allow only items that can be displayed in a search results list to be included in a Quick List	Mandatory	Medium
MSP-0140	Supplement Quick List entries with shortcut keys	Mandatory	Medium
MSP-0150	Display shortcut keys to the right of each entry in the Quick List	Mandatory	Medium
MSP-0160	Use alternate row shading in the Quick List, as in the search results list	Recommended	Medium

Usage Examples

paracetamol Ctrl + 1	In this correct example, the Quick List contains only items that can be displayed in a search results list. The entries are supplemented with shortcut keys that are displayed to the right of each entry in the list and the list uses alternate row shading (MSP-0130, MSP-0140, MSP-0150, MSP-0160)
aspirin Ctrl + 2	
warfarin Ctrl + 3	
oxycodone – OXYCONTIN Ctrl + 4	

paracetamol – DOSE 500 mg Ctrl + 1	This example is incorrect because the Quick List contains items ('Dose', '500 mg' and 'modified-release') that cannot be displayed in a search results list (MSP-0130)
aspirin Ctrl + 2	
morphine – modified-release Ctrl + 3	
oxycodone Ctrl + 4	

Type a drug name to search	This example is not recommended because alternate row shading has not been used in the Quick List (MSP-0160)
paracetamol Ctrl + 1	
aspirin Ctrl + 2	
warfarin Ctrl + 3	
oxycodone Ctrl + 4	
furosemide Ctrl + 5	
amoxicillin Ctrl + 6	
co-amoxiclav Ctrl + 7	
diltiazem Ctrl + 8	
diazepam Ctrl + 9	
sodium chloride Ctrl + 0	
10 commonly prescribed medications	

Rationale

Design Analysis:

The Quick List is designed to be a shortcut that removes the need to search for some of the drugs that are prescribed most frequently. (See the rationale in section 4.3.1.)

The selection of a drug to prescribe is part of a process in which a series of selections are made to quickly define the prescription details. The Quick List is a shortcut for the first part of this process.

The introduction of anything other than a drug name (or any item that can be displayed in a search results list) increases the cognitive load associated with processing the list. This is because it takes longer to review a list containing a mixture of list item types (drug names and template prescriptions) than a list of the same item types (just drug names). For example, displaying a template prescription that contains a dose and frequency as well as a drug name runs the risk of it being seen as a shortcut (by pre-filling many fields) and that only requires some fields defined by the template to be modified. In this case, selecting a template prescription in the Quick List may not actually be any faster than selecting drug name, route and then a template prescription that contains the intended values. As a workaround, it also introduces the risk that some of the values are not changed from the template values to the intended value before the prescription is submitted. Thus guidance maintains the Quick List as an alternative for searching by ensuring that its contents are of the same nature as those that might be displayed in a search results list (MSP-0130) and applying the same formatting (MSP-0160).

The display of template prescriptions in a Quick List is not recommended because it allows the prescriber to select a template prescription and authorise in two mouse clicks (or equivalent keyboard interactions). When adjacent template prescriptions are for different drugs, the risk that the wrong drug is prescribed is thus greater. By separating the selection of drug name, route and other attributes in order to display template prescriptions:

- The selections remain quick and takes little cognitive processing
- There is greater feedback for each selection
- There is more time and information to support noticing a mis-selection before the prescription is authorised
- The contents of the Quick List remain succinct and thus more likely to be committed to memory

The Quick List becomes more effective when its contents are familiar to the user so that shortcut keys can be learned and Quick List entries can be selected quickly (MSP-0140, MSP-0150).

Desk Research:

As reported in *The Use of Tall Man Lettering to Minimise Selection Errors of Medicine Names in Computer Prescribing and Dispensing Systems,* the selection of a drug name combined with dose and strength is associated with greater incidence of mis-selection errors than the selection of drug name alone[10].

Although specifically for Web pages and applications, the World-Wide Web Consortium (W3C) *Web Content Accessibility Guidelines 1.0*[11] is a recognised standard for accessibility. Guideline 9 recommends designing for device-independence and guideline 9.5 states 'Provide keyboard shortcuts to important links (including those in client-side image maps), form controls, and groups of form controls.' (MSP-0140).

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Flexibility and efficiency of use – If the Quick List contains drugs that prescribers often prescribe, it can improve their efficiency when they choose to use the Quick List (instead of searching)

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is mitigated by the guidance:

Potential Hazards:	Mitigations:
■ An incorrect drug is prescribed because a template prescription was mis-selected from a Quick List and then authorised without review	■ Template prescriptions will not appear in a Quick List since it contains only items that can be displayed in a search results list (MSP-0130)
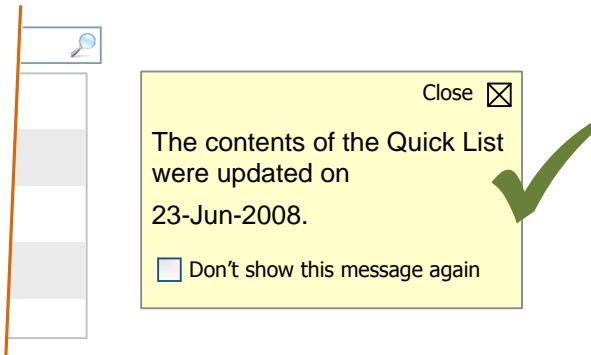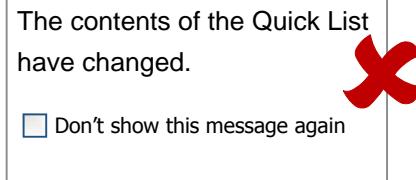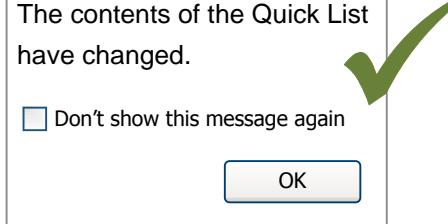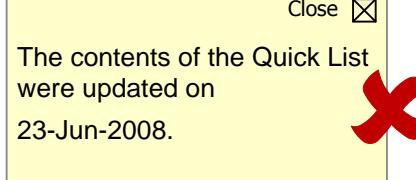
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[10] The Use of Tall Man Lettering to Minimise Selection Errors of Medicine Names in Computer Prescribing and Dispensing Systems **{R24}** : http://www.ccforpatientsafety.org/patient-safety-solutions/

[11] Web Content Accessibility Guidelines 1.0 **{R25}**: http://www.w3.org/TR/WAI-WEBCONTENT/

4.3.3   Notifying When a Quick List Has Changed

ID	Guideline	Conformance	Evidence Rating
MSP-0170	Display a notification when the contents of a Quick List have changed since it was last presented to the current user	Mandatory	High
MSP-0180	Provide a control for closing the Quick List notification	Mandatory	Medium
MSP-0190	Provide a control for disabling the notification so that it is not displayed again (until the Quick List is changed again)	Mandatory	Medium
MSP-0200	Display the Quick List notification every time the Quick List is displayed (until the user selects an option that disables it)	Mandatory	Medium
MSP-0210	Do not display the notification such that it obscures the contents of the Quick List	Recommended	Low
MSP-0220	Close the notification automatically when either a drug is selected from the Quick List or text is entered into the search text input box	Recommended	Low
MSP-0230	Do not allow a drug to be selected from the Quick List by using the keyboard until the notification has been closed	Mandatory	Medium

Usage Examples

Close ⊠ The contents of the Quick List were updated on 23-Jun-2008. ☐ Don't show this message again ✔	This correct example of a Quick List notification includes a control for closing this instance of the message and a check box to ensure that the message is not displayed again (MSP-0170, MSP-0180, MSP-0190)
The contents of the Quick List have changed. ☐ Don't show this message again ✘	This example is incorrect because it does not include a control for closing the notification (MSP-0180)
The contents of the Quick List have changed. ☐ Don't show this message again OK ✔	This correct example includes a control for closing the notification and a check box to ensure that the notification is not displayed again (MSP-0180, MSP-0190)
Close ⊠ The contents of the Quick List were updated on 23-Jun-2008. ✘	This example is incorrect because the notification does not provide a control for ensuring that the notification is not displayed again (MSP-0200)

This example is not recommended because the notification obscures the contents of the Quick List (MSP-0210)

This example is not recommended because the notification remains visible after text has been entered into the search text input box (MSP-0220)

Rationale

Design Analysis:

The Quick List improves efficiency for users who prefer to select a drug name from a familiar list instead of typing letters to search for a drug. The benefits of the Quick List depend partially on familiarity with the list and partially on the brevity of the list. If the list is changed, there is a risk that the wrong entry will be selected, especially if the prescriber has learned a shortcut key or series of keystrokes and executes them without explicitly reviewing his or her selection. When the Quick List changes, it is thus important to provide an interruption to the prescriber's normal sequence of keystrokes or clicks and ensure that the changes to the list are explicitly reviewed (MSP-0170).

The notification need only be displayed whilst the Quick List is open since it aims to draw attention to the changes and to ensure that such changes are noticed before a shortcut key can be used (MSP-0230). Thus the notification can be closed as soon as text is typed to search for a drug name or a selection is made from the Quick List (MSP-0220). Although shortcut keys cannot be used whilst the notification is open, a selection can still be made using the keyboard (by navigating using arrow keys) or other direct selection (such as selecting using a mouse). Thus the notification should not obscure the Quick List (MSP-0210).

If the notification is ignored, it should be displayed again every time the Quick List is displayed (MSP-0200) until the prescriber acknowledges it (MSP-0190). Once acknowledged, the notification need not be displayed again until the next change to the contents of the Quick List.

The guidance strikes a balance between preventing the selection of a Quick List item in error (as a result of the contents of the list having changed) whilst at the same time not introducing extra steps that would reduce the efficiency of using a Quick List at all.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Error prevention – The notification is designed to prevent a learned shortcut or series of keystrokes from being used without reviewing selections on screen to avoid this behaviour from selecting the wrong drug when the contents of the Quick List have changed

- User control and freedom– The notification can be closed for this instance such that it will appear when the Quick List is next open, or the prescriber can choose to disable it so that it will not appear again until the Quick List is next changed

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is mitigated by the guidance:
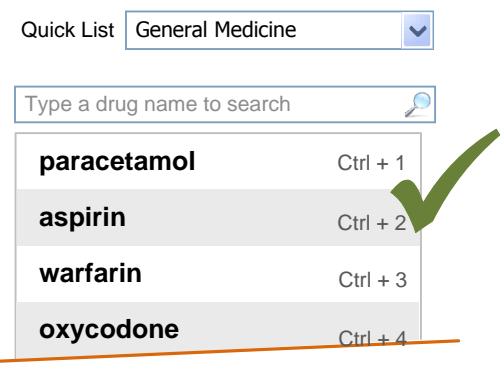
Potential Hazards:	Mitigations:
▪ The user becomes over-reliant on shortcut keys (or sequences of key strokes) and the Quick List has changed	▪ A notification is displayed when the contents of the Quick List has changed (MSP-0170) ▪ Whilst a notification is displayed, shortcut keys or sequence of key strokes do not result in the selection of a Quick List entry (MSP-0230)

4.3.4   Accommodating Multiple Quick Lists

ID	Guideline	Conformance	Evidence Rating
MSP-0240	Limit the number of Quick Lists that are available to an individual user to the minimum that are contextually appropriate	Recommended	Medium
MSP-0250	When multiple Quick Lists are available to a single user, provide a means of navigating between them	Mandatory	Low
MSP-0260	When multiple Quick Lists are necessary, display the currently selected Quick List in the control that is used to select a Quick List	Mandatory	Medium
MSP-0270	When multiple Quick Lists are necessary, use the words 'Quick List' in a label for the Quick List control or within the control	Recommended	Medium

Usage Examples

In this correct example, where multiple Quick Lists are necessary, a combo box is provided for the selection of a Quick List and the control has a default value (MSP-0250, MSP-0260)

This example of a Quick List control is not recommended because it does not include the text 'Quick List' (MSP-0270)

Rationale

Design Analysis:

Multiple Quick Lists are not recommended (MSP-0240) because the Quick List can only add value if it is faster or easier to use than searching for a drug name and is thus more effective if it contains a few drugs for which the shortcut keys can be learned (see the rationale in section 4.3.1). However, they may be useful for users who work in more than one context or may otherwise benefit from access to Quick Lists that are populated with drugs relevant to different tasks, contexts or specialties.

Following on from the rationale in section 4.3.1, the Quick List is most useful if it is immediately available when prescribing is started. Thus, even when there is more than one Quick List defined, one of them should be the default.

If multiple Quick Lists are defined, clear labelling is needed (MSP-0270) to clearly communicate the currently selected list (MSP-0260). It must also be possible to navigate between Quick Lists (MSP-0250).

Desk Research:

The *ePrescribing Functional Specification* **{R12}** includes a requirement (GEN.OS.082) to support the display of different formularies for specific users, groups of users, specialties or locations. Whilst formularies are out of scope, the principle of providing access to multiple manually defined lists is reflected by the guidance in this section.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Flexibility and efficiency of use – Access to more than one Quick List avoids an inappropriately constrained Quick List

User Research:

All participants in Study ID 37 (see APPENDIX F) considered the Quick List to be useful for specific areas (such as on a post-operative cardiac ward or for the management of anaemia) in which there can be relatively small variation in prescribing. However, participants also pointed out that some staff work in a variety of situations that might require different lists. For these situations, it may be relevant to allow the context to define which Quick List is displayed or to allow the user to select an appropriate Quick List (that may then remain the default for that session).

5   GUIDANCE DETAILS FOR DRUG SEARCH

5.1   Introduction

This section and section 4 provide guidance for the selection of a drug to prescribe (from a Quick List or from search results). Section 4 provides guidance for Quick Lists. This section provides guidance for searching for drug names, displaying a list of search results and selecting a drug to prescribe.

The guidance in this section is part of the first step in the prescribing process, which is shown with a grey background in Figure 9:
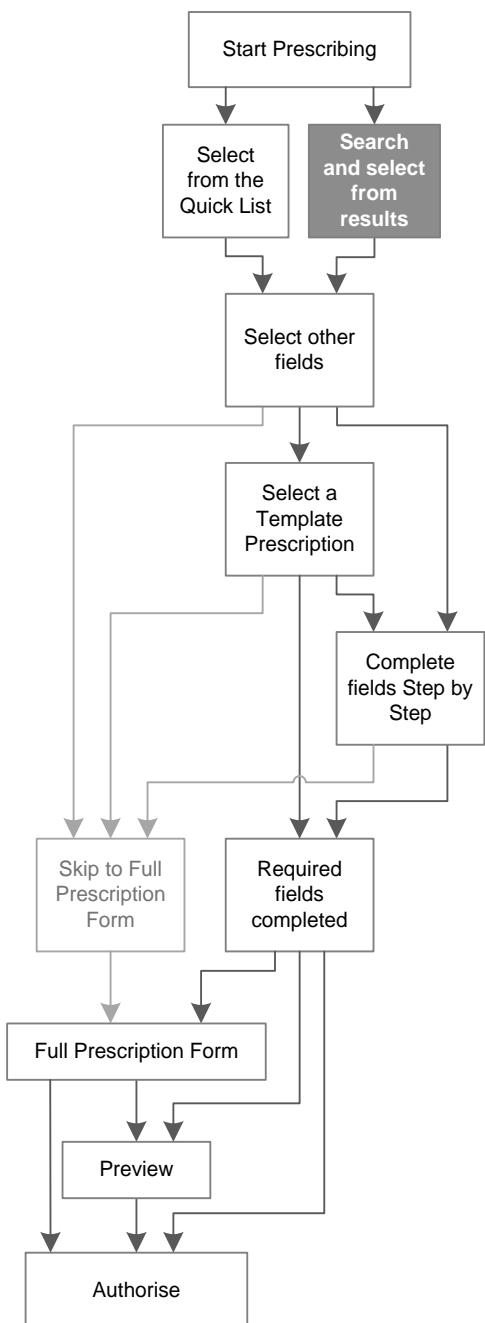
Figure 9: The Prescribing Process – Select Drug

The following prescribing tasks were used to inform assessment of design alternatives in order to maintain an appropriate focus during the development of guidance:

- Find a drug that I prescribe every day

- Find a drug when I only know the brand name

- Find a drug that contains more than one ingredient and I only know one of them

- Find a drug to prescribe when the name of the drug has changed or is misspelled

- Select a medication from a list of search results containing medications that are easily misread or confused with another drug name

These prescribing tasks address specific known patient safety hazards associated with electronic prescribing and ensure that guidance is user-focused.

The following tasks were used as a checklist during the creation of the guidance to ensure that it remained sufficiently flexible:

- Prescribing very long drug names with an unusually large number of characters (for example, 'Diphtheria + Haemophilus influenzae type B + Pertussis + Poliomyelitis + Tetanus vaccine')

- Less common prescribing practices requiring greater user control (for example, prescribing a medication with an unusual or unlicensed route)

- Defining search criteria which have a large number of matches to display in the search results

- Working with a prescribing area when screen space is limited

This guidance aims to mitigate the following patient safety hazards:

- Risk of mis-selection when drug names that look or sound similar are displayed in a list

- Risks associated with lack of familiarity with combination drugs (co-drugs)

- Risks associated with the display of, and navigation within, long lists

Figure 10 is an extract from Figure 5 and illustrates the user interface prescribing steps that are covered in this section showing the drug search step and links to and from other steps:
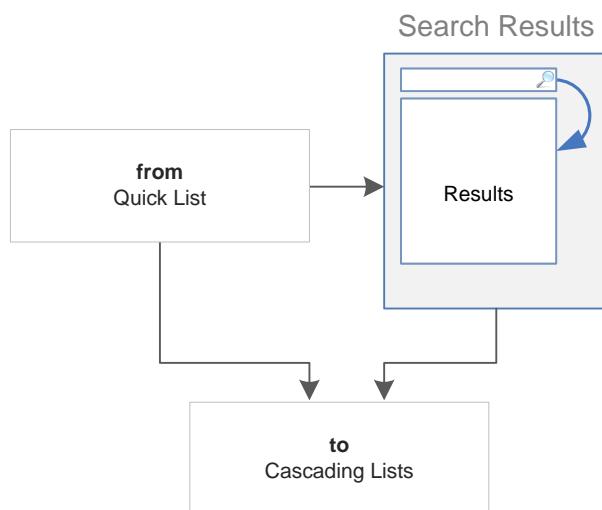
Figure 10: User Interface Prescribing Steps – Drug Search
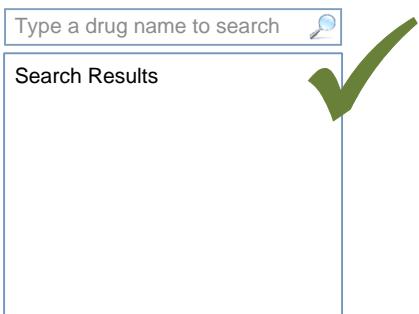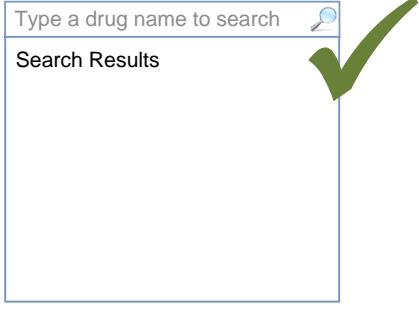
5.2   Principles
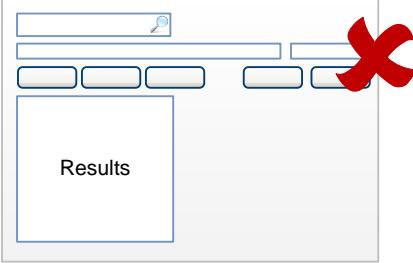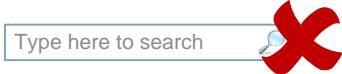
All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Mitigate the risks of incorrect selection and misinterpretation:
  - A limited list height, coupled with progressive searching (the progressive updating of search results as more letters are typed) encourages selection of drug names from shorter lists
  - Formatting of drug names that are known to be mis-selected and the use of supplementary text in search results helps to avoid potential misinterpretation
  - The potential for misinterpretation is mitigated by encouraging a simple user interface in which the need for copious or complex user interface elements (such as controls and labels) is minimised

- Increase efficiency by prioritising the prescription of commonly prescribed medications over less commonly prescribed medications:
  - Guidance for drug search results lists encourages the prioritisation of results so that commonly prescribed medications can appear higher in the list

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries:
  - Search results can be formatted and supplemented with additional text (such as the ingredients of a co-drug) to help avoid inappropriate selections
  - Handling of generic and brand names ensures that a brand name cannot be prescribed without the generic name being displayed, allowing generic equivalents to be prescribed and encouraging generic prescribing

- Adhere to a user interface strategy that gives the impression of making progress within a single space (which has all the necessary information immediately or readily available) and avoids the impression of needing to move between many different spaces:
  - When search results lists are extended (so that all results can be seen instead of only the first page), the list is expanded in context
  - The search results are displayed such that they replace the Quick List

5.3   Guidelines

5.3.1   Positioning the Search Text Input Box

ID	Guideline	Conformance	Evidence Rating
MSP-0280	Do not allow the search results list to be positioned such that it is separated from the search text input box by other controls or by a significant space	Mandatory	High
MSP-0290	Clearly describe the scope of the search	Mandatory	High
MSP-0300	Use an in-field prompt in the search text input box to describe the scope of the search	Recommended	High

Usage Examples

Type a drug name to search 🔍 / Search Results ✔	In this correct example, the search results appear directly below the search text input box and the scope of the search is described briefly in the search text input box (MSP-0280, MSP-0290, MSP-0300)
Type a drug name to search 🔍 / Search Results ✔	In this correct example, the search results are displayed as a drop-down list extension of the search text input box (MSP-0280)
🔍 / Results ✖	This example is incorrect because the search results appear on the right and are not clearly associated with the search text input box on the left (MSP-0280)

	This example is incorrect because the search text input box has been separated from the search results (MSP-0280)
	This example is incorrect because the scope of the search is not clear (MSP-0290)

Rationale

Design Analysis:

The guidance for positioning the search text input box (MSP-0280) aims to:

- Remove the need for additional labelling and controls by placing the search text input box directly above the search results
- Ensure that the dynamically updating search results list (see section 5.3.3) is visible as text is being entered in the search text input box

Since a clinical application is likely to have more than one search mechanism, it is important to be clear when a search has a specific scope. Providing this information directly in the search text input box reduces the need for additional labelling or signposting and places the information where users' attention is likely to be focused when they need that information. By providing this cue in the search text input box, it is more likely to be noticed before text is entered and can thus prevent time being wasted on discovering the scope of the search by entering text and reviewing a list of search results (MSP-0290).

Desk Research:

The *Windows User Experience Interaction Guidelines*[12] states that a prompt should be used in preference to a label (MSP-0300). The use of a prompt in a text input box is particularly useful when:

- Screen space is at such a premium that using a label or instruction is undesirable, such as on a toolbar
- The prompt is primarily for identifying the purpose of the text box in a compact way. It must not contain crucial information that the user needs to see while using the text box

User Research:

All 14 participants in Study ID 69 (see APPENDIX B) correctly anticipated that they should type letters in order to return search results when the search text input box contained the in-field prompt 'Type the drug name to search' (MSP-0290, MSP-0300). The study also used wireframes in which this text was omitted and, when reviewing these wireframes, one participant was unsure how to proceed in the absence of the in-field prompt.
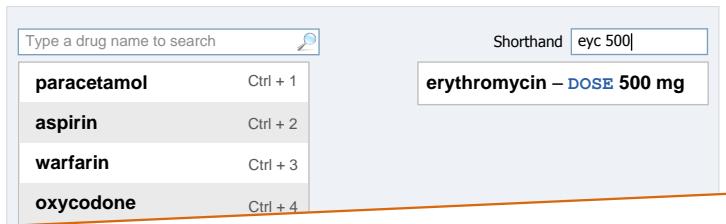
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[12] Microsoft – Windows User Experience Interaction Guidelines – Guidelines, Controls, Command Buttons **{R26}**:
http://msdn.microsoft.com/en-us/library/aa511453.aspx#defaults
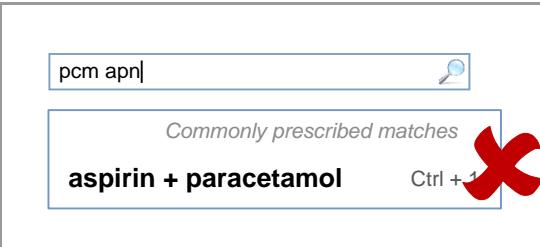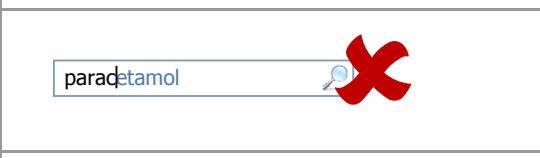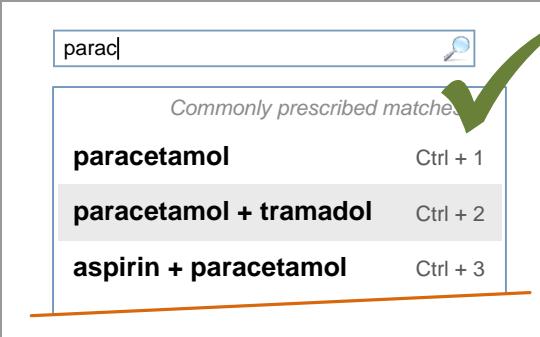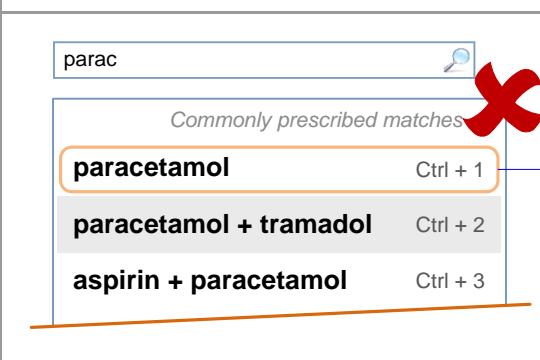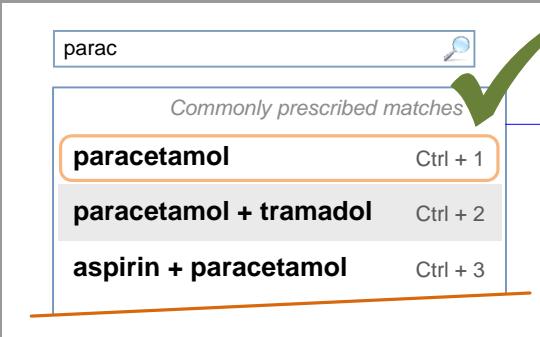
5.3.2   Defining Text Input Box Behaviour

This section includes guidance that refers to the use of codes to search for drugs. Codes are arbitrary or ad-hoc sets of numbers or letters that are typed into a search text input box in order to quickly access a specific drug name.
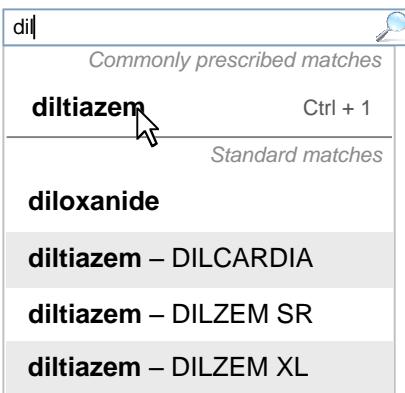
ID	Guideline	Conformance	Evidence Rating
MSP-0310	Do not support entry of codes in the search text input box. (This does not preclude the use of spelling matching or the provision of an alternative box for entering codes)	Mandatory	Medium
MSP-0320	Do not provide auto-complete in the search text input box	Mandatory	Medium
MSP-0330	Retain focus in the search text input box until a selection is made in the search results list	Mandatory	High
MSP-0340	When focus is first switched to the results list, set focus to the first entry in the list by default	Mandatory	High
MSP-0350	When space is limited (such that the search results lists may obscure other information), support the replacement of the search text input box with an input control in which the selected drug name is displayed	Recommended	Low
MSP-0360	When a search results list has been replaced with a control in which the selected drug name is displayed, re-display the search text input box, the search criteria and the search results list when this control is selected	Recommended	Low

Usage Examples

In this sequence of correct examples, codes are entered into a separate text entry box (MSP-0310)

1

Type a drug name to search 🔍		Shorthand [ ]
paracetamol	Ctrl + 1
aspirin	Ctrl + 2
warfarin	Ctrl + 3
oxycodone	Ctrl + 4

2

Type a drug name to search 🔍		Shorthand [eyc 500	]
paracetamol	Ctrl + 1	**erythromycin** – DOSE **500 mg**
aspirin	Ctrl + 2
warfarin	Ctrl + 3
oxycodone	Ctrl + 4
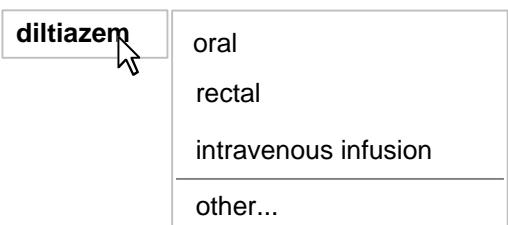
pcm apn *Commonly prescribed matches* **aspirin + paracetamol** Ctrl + 1 ✗	This example is incorrect because the entry of codes in the search text input box is supported and has been matched to search results (MSP-0310)
parac̲etamol ✗	This example is incorrect because the text that has been typed is supplemented with an auto-complete prompt (MSP-0320)
parac ✓	In this correct example, only the text that has been typed is displayed in the search text input box (MSP-0310, MSP-0320)
parac ✓ *Commonly prescribed matches* **paracetamol** Ctrl + 1 **paracetamol + tramadol** Ctrl + 2 **aspirin + paracetamol** Ctrl + 3	In this correct example, five letters have been entered and the focus remains in the search text input box as the search results list is displayed (MSP-0330)
parac ✗ *Commonly prescribed matches* **paracetamol** Ctrl + 1 Focus has been set automatically **paracetamol + tramadol** Ctrl + 2 **aspirin + paracetamol** Ctrl + 3	This example of a search results list is incorrect (assuming the user has not selected paracetamol) because focus has been automatically set to the first item in the search results list (MSP-0330)
parac ✓ *Commonly prescribed matches* **paracetamol** Ctrl + 1 The keyboard has been used to set focus to the search results list **paracetamol + tramadol** Ctrl + 2 **aspirin + paracetamol** Ctrl + 3	In this correct example, the user has changed the focus to the search results list (for example, by using the TAB key) and this has caused the first item in the list to have focus (MSP-0330, MSP-0340)

1

dil|

🔍

Commonly prescribed matches

diltiazem   Ctrl + 1

Standard matches

diloxanide

diltiazem – DILCARDIA

diltiazem – DILZEM SR

diltiazem – DILZEM XL

✔

| 1 | 2 | 3 |

In this sequence of correct examples in which the search results are displayed as a drop-down extension of the search text input box:

1. Search results are displayed as a drop-down extension of the search text input box

2. When a drug name is selected, the list collapses (MSP-0350), the search text input box displays the selection and a (cascading) list of routes is displayed

3. When the drug name is reselected (without having made a selection in the cascading list), the list of search results is reopened with the selected drug highlighted and the search criteria redisplayed in the search text input box (MSP-0360)

2

diltiazem

oral

rectal

intravenous infusion

other...

3

dil|

🔍

Commonly prescribed matches

diltiazem   Ctrl + 1

Standard matches

diloxanide

diltiazem – DILCARDIA

diltiazem – DILZEM SR

diltiazem – DILZEM XL

Rationale

Design Analysis:

Efficient selection of a drug to prescribe depends on a simple search mechanism that:

- Presents few options quickly given a minimum input
- Presents the options in a format that facilitates rapid scanning and accurate selection from a list of results

Achieving this efficiency requires a balance between:

- Reducing the cognitive load associated with scanning and selecting from a list
- Providing mechanisms for accessing drug names quickly, especially those most frequently used

Design Analysis for Coded Entry versus Progressive Search:

The guidance is informed by a limited analysis using Keyboard-Level Model — Goals, Objects, Methods and Selection (KLM-GOMS) **{R27}** of alternative mouse and keyboard focused approaches. This included the use of both coded entry and cascading selection (see section 6). Whilst the analysis was not detailed enough to predict times taken to select a drug in each design, it suggested that the use of coded entry could be about one second faster than cascading selection using keyboard shortcuts. However, coded entry is not without potential problems (see paragraphs below).

Coded entry is a mechanism for quick prescribing that depends on recall of codes for a limited number of drugs. It speeds up the process of prescribing by minimising the need to read, navigate and select from lists, especially for frequently prescribed medications. Coded entry is useful in a system that presents long lists from which selections need to be made or have complex processes for finding a drug to prescribe.

This guidance presents a framework that provides alternative mechanisms for search and selection that help to:

- Reduce the lengths of lists
- Prioritise commonly prescribed drugs
- Minimise characters needed in the search text input box
- Provide additional alternative accelerators for quick access to commonly prescribed drugs and predefined prescriptions

When these mechanisms are combined, they help to reduce the cognitive load of the user, are comparable to coded entry for frequently prescribed drugs and provide additional benefits for finding all drugs.

However, when combined with spelling matching, coded entry may increase the risks of misinterpretation and mis-selection, since the relationship between codes entered and matches in the results list is difficult to communicate with clarity. Other issues with coded entry include:

- The need to create and maintain a list of codes
- Ensuring consistency in the creation of codes
- Providing an effective mechanism for alerting users when codes have changed
- Avoiding clashes between codes and spelling matches

If coded entry is used, a separate control or area is needed for entering codes to provide support for feedback as codes are being entered. The provision of a control for entering codes must be separate from the search text input box (MSP-0310). This allows feedback to be provided as codes are entered and can be used to mitigate issues such as misinterpretation, mis-selection and 'clashes' between codes and spelling matches.

Design Analysis for Auto-Completion:

Auto-completion is effective for minimising the number of letters that need to be typed before a specific result is found and selected but may increase the risk of mis-selection. A progressive search achieves similar benefits (see section 5.3.3), but instead of providing a single match, like auto-complete, it requires a selection to be made from a list. Auto-complete introduces the risk that:

- An auto-completed drug name is accepted unintentionally
- The auto-complete suggestion may inappropriately influence the prescriber's choice

Unlike a static search (that requires the text to be submitted before results are displayed), entering additional characters in progressive matching reduces the number of search results. Editing those characters also changes the search results. Efficient editing of the search text requires that the focus remains in the search text entry box. This avoids the need to navigate from the search results list back to the search text input box before additional text can be typed or existing text edited (MSP-0320).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error prevention – Avoiding typing codes into a search text input box, reduces the potential for display of unintended matches in a search results list

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is mitigated by the guidance:

Potential Hazards:	**Mitigations:**
■ Auto-complete prompts the user to select inappropriately	■ MSP-0320 mandates that auto-complete is not used in a drug search text entry box

5.3.3 Displaying Results with Progressive Matching

ID	Guideline	Conformance	Evidence Rating
MSP-0370	Display results using progressive matching where possible	Recommended	Medium
MSP-0380	In the absence of progressive matching, provide a static search that submits text in the search text input box by pressing the ENTER key and/or activating a control (such as a button) to submit the search	Recommended	High

Usage Examples

1

fi|

🔍

filgrastim

morphine – FILNARINE

✓ 1 2

In this correct example, the search results list shortens as more letters are typed in so that there are fewer matches (MSP-0370)

2

filnar|

🔍

morphine – FILNARINE

fi|

🔍   Search

filgrastim

morphine – FILNARINE

✓

In this correct example of a search that does not have progressive matching; a button has been provided for displaying the search results (MSP-0380)

Rationale

Design Analysis:

Guidance on the search results list (and Quick List) aims to:

- Encourage a search-based approach to finding drug names
- Support only limited browsing
- Limit the cognitive steps for selecting a drug to prescribe

A progressive search (MSP-0370) improves the efficiency of the user by supporting strategies, such as typing in letters, until the search results are short enough for the desired result to be noticeable in the search results list. This helps the user make the selection quickly and easily. This approach allows attention to move quickly between the search text input box and the search results. This is considered to be more efficient than a static search in which attention shifts from the text input box to search results and back in a more sequential way.

Selection of all the text entered in the search text input box is easier in a static search, since returning focus to the search text input box automatically selects the whole contents and allows it to be replaced with new text. The need to retain focus in the search text input box to support adding and correcting of individual letters is a more common need than to replace the entire contents of the search text input box.

Where technology cannot support a progressive search, a static search may be provided in which search criteria are submitted by using a button (MSP-0380). This approach is less effective as a tool for accessing shorter lists since the prescriber must make a decision about how many letters to enter before submitting the search results (rather than responding to the changing list length that is visible in a progressive search).

> **Note**
>
> A progressive search may support the use of the ENTER key to submit the search criteria in addition to presenting the results automatically (but with a slight delay).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Flexibility and efficiency of use – The progressive search allows users to access a short list of search results faster. The short list reduces cognitive load thus reducing the time it takes for them to find and select the drug to prescribe

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
- A drug name is mis-selected in the search results list	- **This risk is not wholly mitigated by guidance** - Search results are prioritised (see section 5.3.12) and listed in matched order before alphabetical order to maximise logical grouping (see section 5.3.8) - The list is limited in length (see section 5.3.5) and progressive matching is recommended (MSP-0370) to encourage selection from shorter lists
- A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	- Progressive matching encourages the typing of more letters for shorter lists of search results (MSP-0370) - Search results lists are limited in height (see section 5.3.5) - Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (see section 5.3.7) - Search results are ordered such that generic names are listed before brand names (see section 5.3.8) - Search results are displayed in matched order and then alphabetically (see section 5.3.8) - Search results are prioritised (see section 5.3.12) - Brand names are supplemented with generic names (when they exist) (see section 5.3.17) - Brand names are displayed after the generic name (when they exist) in a single list item (see section 5.3.17) - If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters
- The scroll bar in a list of search results is not noticed and the prescribers assume that the drug they want is not available for prescribing	- The limited list length avoids the use of a scroll bar so that it is clearer when there are further results off screen (see section 5.3.5) - The provision of a progressive search for achieving fewer search results (MSP-0370) - A clear, noticeable and consistent way of communicating the extent of the search results, including the provision of text such as 'Showing 10 of 40 matches' at the end of a list of search results and the provision of a control such as a button labelled 'Show All' at the end of a list of search results (see section 5.3.5)
- A long list of search results is returned and an inappropriate selection is made in preference to navigating further through the list	- The list is limited in length and the length remains consistent (see section 5.3.5) - A progressive search provides a mechanism for achieving fewer search results and puts the users in control of the length of the search results list by allowing them to type in additional letters and see the list updated as they type (MSP-0370).
- Alternate row shading is mistaken for selection or highlighting when there are only two or three list items in a list or section	- **This risk is not wholly mitigated by guidance** - Alternate row shading should be subtle (see section 5.3.16) - When results are displayed using progressive matching (MSP-0370) the initial list of results is more likely to contain greater than three drugs in any one section of the list and the user is thus familiar with presence and meaning of the alternate row shading before the list is shortened such that this risk is introduced

5.3.4   Providing Feedback for a Progressive Search

ID	Guideline	Conformance	Evidence Rating
MSP-0390	Require a minimum of two characters before displaying search results	Mandatory	High
MSP-0400	When only one character has been entered, display a message that explains why there are no results and reports the two-character minimum	Mandatory	Medium
MSP-0410	When two or more characters have been entered and no matches were found, display a message that clearly indicates a search has been performed and no matches were found	Mandatory	Medium
MSP-0420	When a message is displayed, maintain a minimum height equivalent to at least three rows of results and a width that is at least as wide as the search text input box	Recommended	Low

Usage Examples

p|	
Please type in at least 2 characters	In this correct example, when only one letter has been typed in the search text input box, a message is displayed that explains why there are no results and reports the two-character minimum (MSP-0390, MSP-0400)

p|	
No results	This example is incorrect because the message displayed does not explain that there are no results because only one character has been entered (MSP-0400)

p|	
	This example is incorrect because fewer than two characters have been entered and there is no message displayed (MSP-0400)

pax|	
No matches were found	In this correct example, the message clarifies that a search was performed and no matches were found, the search results area has a height of at least three rows and the width is at least that of the search text input box (MSP-0410, MSP-0420)

pax | 🔍 ❌	This example is not recommended because the width of the search results area is less than the width of the search text input box (MSP-0420)
No matches were found		

pax | 🔍 ❌	This example is not recommended because the height of the search results is less than three rows of results (MSP-0420)
No matches were found	

Rationale

Design Analysis:

Since progressive searching does not require the text in the search input text box to be submitted using a control, it is especially important to provide feedback of the progress of a search. When using a static search, clicking the control to submit a search removes the focus from the search text input box. A progressive search retains focus in the search text input box (see section 5.3.2), so that even this minor feedback is not available to reassure users that their search is being processed. It is therefore important to provide:

- Feedback when a search is being processed but results are not yet displayed
- Clearly visible (MSP-0420) feedback when the search has been processed but there are no matches to display (MSP-0410)

The two-character minimum (MSP-0390) is designed to return shorter lists of matches. It is based on a limited analysis of two and three-character searches matched against the beginnings of generic drug names in the dm+d (June 2008). The simplistic analysis suggests an average of three matches for three-character searches, and 16 matches for two-character searches.

When there are no search results, a message is needed (MSP-0400) to:

- Inform or remind the user of the two-character minimum
- Reassure the user that the search has been processed
- Allow the user to differentiate between the message about the two-character minimum and a message about a completed search for which no matches were found

A short delay is useful to encourage the entry of more letters and to avoid the need to retrieve search results for only one character when further characters are about to be entered.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Visibility of system status – The messages displayed in the search results area (when there are no results to display) provides feedback on the status of the search and reassurance that the search is working
- Help users recognise, diagnose and recover from errors –If a drug name is mis-spelled when being entered in the search text input box, the messages displayed in the search results area provide feedback that the search has been successful and allows users to correct their spelling or simply remove letters to search on fewer letters
- User control and freedom – The users have control over how many search results they see because they can (in most cases) shorten the list by typing more letters in but they can also access the full list of search results if they choose

5.3.5 Limiting the Height of a Search Results List

ID	Guideline	Conformance	Evidence Rating
MSP-0430	Display search results in a list that is only as high as needed to show the successful matches or up to a defined maximum height.	Mandatory	Medium
MSP-0440	When the number of matches is too large to be displayed in the maximum list height, display a message at the end of the search results list that contains counts of the displayed results and total matches	Mandatory	Medium
MSP-0450	When the number of matches is too large to be displayed in the maximum list height, place a control for displaying the full list at the end of the search results list	Mandatory	Medium
MSP-0460	Allow the height of the search results list to grow to an upper limit to accommodate the number of results matched	Mandatory	Low

Usage Examples

In this correct example, the height of the search results list is no larger than it needs to be to display the matches (MSP-0430)

This example is incorrect because the height of the search results is greater than it needs to be to display the matches (MSP-0430)

In this correct example, the results are limited by the height of the search results area and a message is provided at the end of the search results list to indicate the number of search results displayed and the total number. A control is provided for accessing the full list (MSP-0440, MSP-0450).

yellow soft paraffin

paracetamol + pseudoephedrine

paracetamol + sodium salicylate

ascorbic acid + paracetamol

| Previous | Page 1 of 4 | Next |

This example is incorrect because pagination is used to navigate the results list. It is also incorrect because there is no message containing counts of the displayed results and number of total matches (MSP-0440, MSP-0450).

1

parac 🔍

Commonly prescribed matches

paracetamol   Ctrl + 1

paracetamol + phenylephrine   Ctrl + 2

paracetamol + pseudoephedrine   Ctrl + 3

paracetamol + tramadol   Ctrl + 4

aspirin + paracetamol   Ctrl + 5

Standard matches

paracetamol + sodium salicylate

| 1 | 2 |

In this sequence of correct examples (MSP-0460):

1. A list of matches is displayed for the five characters entered in the search text input box

2. Deleting two characters results in more matches. The matches are displayed in a limited height window.

2

par 🔍

Commonly prescribed matches

paracetamol	Ctrl + 1
paroxetine	Ctrl + 2
paracetamol + phenylephrine	Ctrl + 3
paracetamol + pseudoephedrine	Ctrl + 4
paracetamol + tramadol	Ctrl + 5
aspirin + paracetamol	Ctrl + 6

Standard matches

paraldehyde

parathyroid hormone

parecoxib

paracetamol + sodium salicylate

Showing 10 of 40 matches.   Show all

Rationale

Design Analysis:

The search results list length is limited (MSP-0430) in order to encourage the entry of more letters so that a shorter results list can be returned. A shorter results list will be immediately noticeable since the window shrinks in height to fit the results. This approach is one that promotes searching over browsing on the basis that:

- Searching is expected to be more efficient when looking for a specific drug name
- Browsing is more appropriate when it is important to expose the user to more options in a way that also communicates the structure of those options

One of the benefits of a progressive search is that it effectively supports the strategy of typing in enough letters to get a single match or short list of matches. By allowing the height of the search results list to change as the length of the results list changes, the changes in length can be picked up by peripheral vision, which allows the user's attention to remain on typing in the search text input box. With a background that is different in tone to the colours used in the search results list, this visual cue is an even stronger indication of the changing search results list height.

Alternative design solutions that were assessed include:

- An unlimited search results list that is displayed with a scroll bar when necessary
- Search results lists broken down into pages with navigation controls for moving between the pages

Those two approaches are less effective than the recommended approach at achieving the following benefits:

- Encourage the typing of more letters to avoid the user having to use a control to access a longer list of search results
- Avoid longer lists to reduce the chances of mis-selection errors
- Avoid longer lists to speed up selection from a list with fewer choices
- Reduce the cognitive load associated with reviewing and selecting from a longer list
- Discourage the use of the prescribing tool as a drug dictionary (for browsing or for entering brand names to look up the generic name)

By allowing the full list of search results to be displayed, the drug search supports an approach to finding a medication that is closer to browsing than searching whilst still encouraging the use of the progressive search to access and therefore select from shorter lists.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Aesthetic and minimalist design – Limiting the height of the search results list keeps the drug search interface simple and removes the need for navigation controls that are unnecessary in an efficient progressive search that returns only drug names (and synonyms)
- Error prevention – Limiting the height of a search results lists limits the number of results immediately available for selection and thus reduces opportunity for mis-selection
- Flexibility and efficiency of use – The limited height of search results encourages the use of the progressive drug search and this is considered to be more efficient at supporting the task of finding a specific drug than browsing
- User control and freedom – Although the list of search results is limited, users still have the choice of extending the list so that they can browse a larger set of search results

Hazard Risk Analysis Summary:
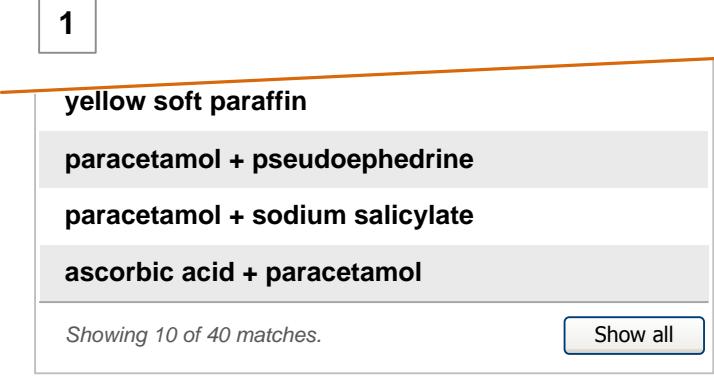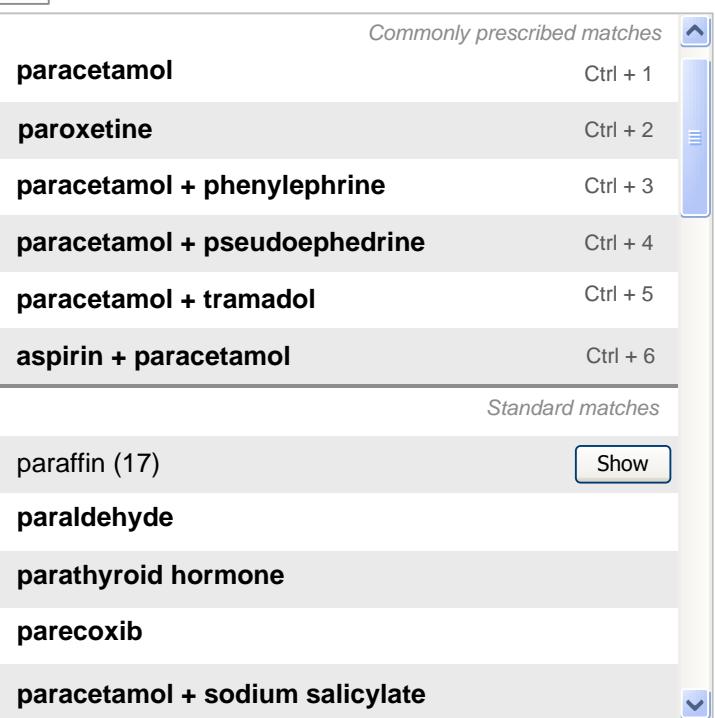
From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:
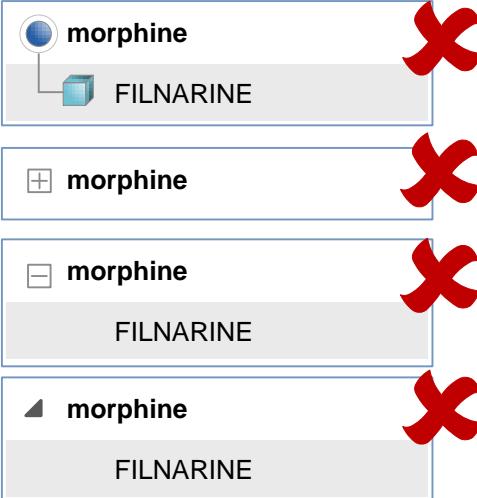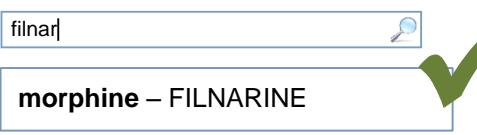
Potential Hazards:	Mitigations:
- The scroll bar in a list of search results is not noticed and the prescribers assume that the drug they want is not available for prescribing	- The limited list length (MSP-0430) avoids the use of a scroll bar so that it is clearer when there are further results off screen - The provision of a progressive search for achieving fewer search results (see section 5.3.3) - A clear, noticeable and consistent way of communicating the extent of the search results, including the provision of text such as 'Showing 10 of 40 matches' at the end of a list of search results (MSP-0440) and the provision of a control such as a button labelled 'Show All' at the end of a list of search results (MSP-0450)
- A long list of search results is returned and an inappropriate selection is made in preference to navigating further through the list	- The list is limited in length and the length remains consistent (MSP-0430) - A progressive search provides a mechanism for achieving fewer search results and puts the users in control of the length of the search results list by allowing them to type in additional letters and see the list updated as they type (see section 5.3.3).
- A drug name is mis-selected in the search results list	- **This risk is not wholly mitigated by guidance** - The list is limited in length (MSP-0430) and progressive matching is recommended (see section 5.3.3) to encourage selection from shorter lists - Search results are prioritised (see section 5.3.12) and listed in matched order before alphabetical order to maximise logical grouping (see section 5.3.8)
- A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	- Progressive matching encourages the typing of more letters for shorter lists of search results see section 5.3.3) - Search results lists are limited in height (MSP-0430) - Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (see section 5.3.7) - Search results are ordered such that generic names are listed before brand names (see section 5.3.8) - Search results are displayed in matched order and then alphabetically (see section 5.3.8) - Search results are prioritised (see section 5.3.12) - Brand names are supplemented with generic names (when they exist) (see section 5.3.17) - Brand names are displayed after the generic name (when they exist) in a single list item (see section 5.3.17) - If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters

5.3.6   Extending the Search Results List

ID	Guideline	Conformance	Evidence Rating
MSP-0470	When a limited list has been extended by selecting the control to display a full list, extend the list by providing a scroll bar	Mandatory	Medium
MSP-0480	Keep search results 'flat'. Do not provide expand or collapse mechanisms or tree-style browsing within the search results	Mandatory	Medium
MSP-0490	When a selection has been made in a results list that has a scroll bar, allow the scroll bar to be used such that the selection can be scrolled out of view	Mandatory	Medium
Usage Examples			
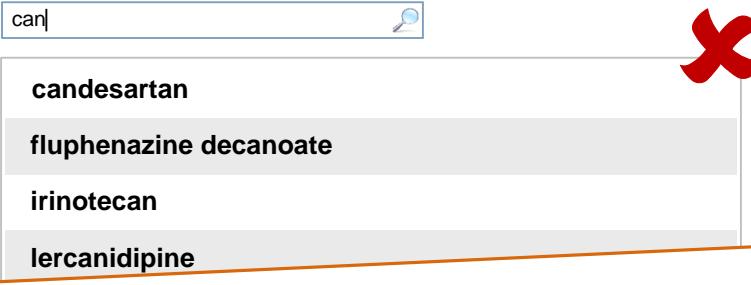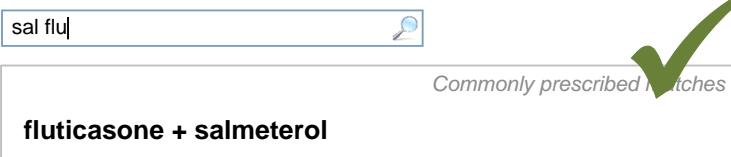
1

yellow soft paraffin
paracetamol + pseudoephedrine
paracetamol + sodium salicylate
ascorbic acid + paracetamol
Showing 10 of 40 matches.   Show all

In this sequence of correct examples (MSP-0470):

1. A search results list is displayed and the 'Show All' button is selected

2. The full list is displayed with a scroll bar.

2

Commonly prescribed matches	
paracetamol	Ctrl + 1
paroxetine	Ctrl + 2
paracetamol + phenylephrine	Ctrl + 3
paracetamol + pseudoephedrine	Ctrl + 4
paracetamol + tramadol	Ctrl + 5
aspirin + paracetamol	Ctrl + 6
Standard matches	
paraffin (17)	Show
paraldehyde	
parathyroid hormone	
parecoxib	
paracetamol + sodium salicylate	

These four examples are incorrect because the search results are not flat (MSP-0480)

In this correct example, the search results are flat (MSP-0480)

Rationale

Design Analysis:

Tasks such as browsing drugs by drug classifications, finding alternatives for specific drugs, or browsing drugs by indication or therapeutic intent are considered to be better supported by knowledge support tools such as paper or electronic copies of reference sources (for example, the BNF **{R16}**). Mechanisms for browsing within and between lists are kept to a minimum so that the focus on simple search and selection is maintained. This simplicity is maintained by (initially) keeping lists short to avoid the need for a scroll bar but still providing a mechanism by which the full list (with a scroll bar) can be accessed (MSP-0470, MSP-0480).

When a search results list is extended (by selecting the control that shows all matches for the search text), the need to provide additional controls for navigating backwards and forwards should be avoided. The scroll bar achieves this by simply converting the existing limited list into one that can display the full set of matches.

Although the list is limited, it may sometimes be necessary or useful for users to ask to see the full list (by activating a control). For example, a user may not be sure of the spelling and the letters he or she has entered do not return the drug the user is looking for. In this case, the user may prefer to enter fewer letters and simply browse the list instead of taking time to use a knowledge support tool to look up the drug name spelling. The list is therefore displayed in a way that allows it to be extended (by activating a control) to make it clear that the action of extending it simply opens the 'window' that changes the number of drugs that the user can see in the list (MSP-0470). Once extended, it behaves like any other selection list with a scroll bar (MSP-0490).

See also the rationale in section 5.3.5.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- User control and freedom – Although the list of search results is limited, users still have the choice of extending the list so that they can browse a larger set of search results

5.3.7 Matching Input Text to Results

ID	Guideline	Conformance	Evidence Rating
MSP-0500	Match the text in the search text input box to generic drug names and brand names respectively	Mandatory	High
MSP-0510	Match text entered into the search text input box to beginning of any word (and not to substrings or endings of words)	Mandatory	High
MSP-0520	Support multiple word searching by allowing the entry of letters separated with a space and matching those against multiple words	Mandatory	High

Usage Examples

can ⌕ **candesartan** **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **bifonazole** – CANESTEN AF ONCE DAILY **fluconazole + clotrimazole** – CANESTEN DUO ✔	In this correct example, the search for 'can' has returned matches for both generic drug names and brand names (MSP-0500)
can ⌕ **candesartan** **cannabidiol + delta-9-tetrahydrocannbiol** **topotecan** **irinotecan** ✖	This example is incorrect because the search for 'can' has only returned matches for generic drug names and has not returned matches for brand names. It is also incorrect because the search results include matches for the ends of words. (MSP-0500, MSP-0510)
can ⌕ **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **bifonazole** – CANESTEN AF ONCE DAILY **fluconazole + clotrimazole** – CANESTEN DUO **clotrimazole + hydrocortisone** – CANESTEN HC ✖	This example is incorrect because the search for 'can' has only returned matches for brand names and has not returned matches for generic drug names (MSP-0500)

This example is incorrect because the search for 'can' has returned matches where the string 'can' appears in the middle of a word (MSP-0510)

In this correct example, entries separated with a space are matched to multiple words (MSP-0520)

Rationale

Design Analysis – Matching Brand Names:

Returning matches on brand names in the search results (MSP-0500) is designed to support the following scenarios:

- The brand name is known and the generic equivalent or active ingredient is not known
- Prescribers know that they need to prescribe by brand and they search for that brand
- Prescribers know that they need to prescribe by brand and they search for the generic name
- The drug does not have a generic name (for example, 'Gaviscon' or 'Dioralyte') in the dm+d **{R5}**

When the brand name is used because the generic name is not known, the guidance ensures that the prescriber will find out the generic name. The prescriber can then choose to prescribe a generic equivalent even when the drug has been found and selected by searching for the brand name.

Design Analysis – Minimum Characters for a Drug Search:

A basic analysis of drug names (equivalent to VTMs in the dm+d **{R5}**) was used to determine how many characters are likely to be needed in order to return a single result when the characters are matched only against the beginnings of words in a drug name.

Matches on endings of words are not recommended (MSP-0510) for two reasons:

1. There are many two-character combinations that would result in long lists where the text has been matched at both beginnings and endings of words, and long lists are less useful
2. Matching on endings of words is only really useful when prescribers do not yet know the name of the drug they want to prescribe. The task of finding that drug name would be better supported by a reference tool such as the BNF **{R16}**

Design Analysis – Multiple Word Matching:

Multiple word searches allow a relatively long list of matches to be quickly shortened to include very few results, or only the desired drug name. For example, a search for 'paracetamol' returns many generic drug names with multiple active ingredients whereas a search for 'para asp' would return only one match ('paracetamol + aspirin'), making it much faster to find the desired drug name. Multiple word searches are supported by existing electronic prescribing systems and are not associated with any specific patient safety risks. Therefore, the guidance allows for the continuation of the user strategies associated with this behaviour (MSP-0520).

> **Note**
>
> In many cases, brand names begin with the same letters as the generic name for that brand. For example, a prescriber may type 'nif' and see results that match generic nifedipine and brand names for nifedipine products. The prevalence of the drug nifedipine in the search results could cause a prescriber to switch to thinking that they are browsing a list of nifedipine products. Guidance assumes that the prescriber knows what they want to prescribe (see section 1.3) and is thus not optimised for the task of browsing for alternative brand names.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and Efficiency – Multiple word searches allow the user to type in only four characters (two sets of two characters separated by a space) that are likely to result in a single match

- Aesthetic and minimalist design – The combination of matching letters to both generic names and to multiple words provides an effective search mechanism that produces a simple list of matches

User Research:

Feedback from participants involved in Study ID 37 (see APPENDIX F) suggests that prescribers often know the brand name and not the generic name. Participants confirmed that it would be useful to be able to find a generic drug name by searching for the brand name.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A list of search results happens to include more than one brand name for the same generic drug. The prescriber expects to see all the brands for that generic drug.	■ **This risk is not mitigated by the guidance** ■ Since guidance assumes that prescribers know the name of the generic drug or brand name that they are looking for (see section 1.3), prescribers are not expected to be browsing the list to choose a brand name
■ A list item is mis-selected because a drug name appears more than once in a list	■ Search results lists contain only drug names (generic and brand) (MSP-0500) ■ Results are ordered such that a brand drug is less likely to appear next to an equivalent generic drug (see section 5.3.8) ■ Cascading lists are not displayed until a drug name has been selected (see section 6.3.1)
■ A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	■ Progressive matching encourages the typing of more letters for shorter lists of search results (see section 5.3.3) ■ Search results lists are limited in height (see section 5.3.5) ■ Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (MSP-0510) ■ Search results are ordered such that generic names are listed before brand names (see section 5.3.8) ■ Search results are displayed in matched order and then alphabetically (see section 5.3.8) ■ Search results are prioritised (see section 5.3.12) ■ Brand names are supplemented with generic names (when they exist) (see section 5.3.17) ■ Brand names are displayed after the generic name (when they exist) in a single list item (see section 5.3.17) ■ If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters
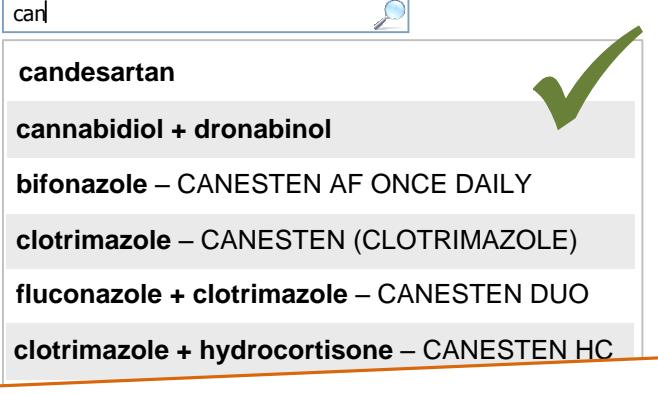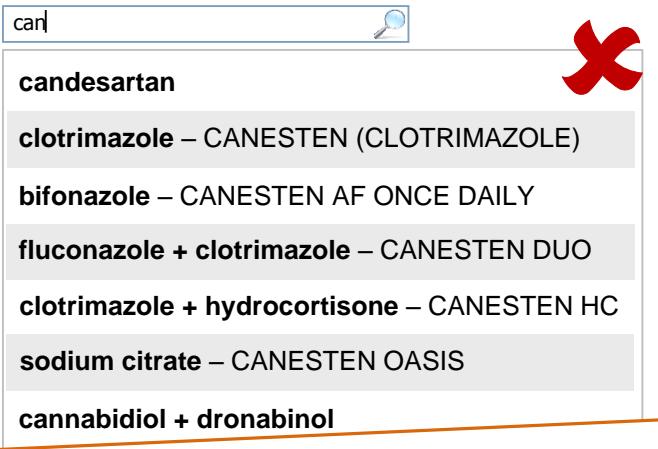
5.3.8   Ordering Search Results

Important

This section contains guidance for which there may be alternative solutions. Accordingly, the conformance ratings in this section apply only where the guidance is adopted.

The Rationale section contains a summary of the known risks which are addressed in this section and which must be addressed by any alternative solution. For more information, see the Alternative Design Solutions note in section 1.

ID	Guideline	Conformance	Evidence Rating
MSP-0530	List search results in matched order, such that matches are prioritised by proximity to the beginning of the drug name and matches in generic drug names are prioritised above matches in brand names	Mandatory	High
MSP-0540	Where relevancy ranking is not implemented, List search results alphabetically within each set that have the same text matched	Mandatory	High

Usage Examples	

In this correct example, the search results are listed in matched order (within each of the sections) (MSP-0530)

This example is incorrect because the drugs in the 'Standard matches' section are listed in alphabetical order (MSP-0530)

can 🔍 **candesartan** **cannabidiol + dronabinol** **bifonazole** – CANESTEN AF ONCE DAILY **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **fluconazole + clotrimazole** – CANESTEN DUO **clotrimazole + hydrocortisone** – CANESTEN HC ✔	In this correct example, matched drug names are listed before matched brand names (MSP-0530) The brand names beginning with the matched text 'CAN' are listed alphabetically within the set of generic names and within the set of brand names (MSP-0540)
can 🔍 **candesartan** **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **bifonazole** – CANESTEN AF ONCE DAILY **fluconazole + clotrimazole** – CANESTEN DUO **clotrimazole + hydrocortisone** – CANESTEN HC **sodium citrate** – CANESTEN OASIS **cannabidiol + dronabinol** ✘	This example is incorrect because the matched brand names are listed alphabetically with the matched drug names (MSP-0530)

Rationale

Design Analysis:

By ordering results in matched order (MSP-0530) before alphabetic order (MSP-0540), drug names are logically grouped before they are alphabetically ordered. For example, when searching for 'para', the drug 'aspirin + paracetamol' will appear before 'paracetamol' when ordered purely alphabetically. When listed in matched order, 'aspirin + paracetamol' appears along with other drugs in which the second component has been matched. A matched order groups associated co-drugs and matched brand names together in the search results, creating a logical structure that allows prescribers to recognise the section of the list that their match may appear in.

Brand names are listed below generic names on the assumption that searching by generic name is (or will become) more likely and prescribing by generic name should be promoted (see section 1.3).

An alphabetically ordered list can be helpful when scanning a list for a specific drug name. However, mitigating the risk of mis-selection is a greater priority than facilitating scanning for a specific drug name. The progressive search is also designed to support the entry of text to reduce the need for scanning the list to look for a specific drug name.

Many of the pairs of look-alike, sound-alike drug names that are on the ISMP's *List of Confused Drug Names*[13] do not begin with the same letters. When the pairs are both generic drug names, they cannot appear in the same list (because two letters are needed to search). Thus, the alphabetic ordering mitigates the risk that these drug names are mis-selected as a result of appearing in the same list.

Other pairs of look-alike, sound-alike drug names include those that contain one generic and one brand name (such as 'ketorolac' and 'KETALAR'). These are mitigated by guidance in section 5.3.17. For guidance on handling look-alike sound-alike drug names when they do appear in the same search results list, see section 5.3.14.

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[13] ISMP – List of Confused Drug Names **{R28}**: http://www.ismp.org/tools/confuseddrugnames.pdf

Desk Research:

The *ePrescribing Functional Specification* **{R12}** includes a guideline (GEN.OS.40) that refers to the need to be able to search by brand name and a guideline (GEN.DR.003) that refers to the need for a generic name to be included when a brand name is displayed.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Match between system and the real world – The list order is designed to display the search results in an order that appears natural and logical (based on the task of prescribing, the search criteria entered and the scope of the search results list)

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

| Potential Hazards:	Mitigations:
■ A drug name is mis-selected in the search results list	■ **This risk is not wholly mitigated by guidance**
	■ Search results are prioritised (see section 5.3.12) and listed in matched order before alphabetical order to maximise logical grouping (MSP-0530)
	■ The list is limited in length (see section 5.3.5) and progressive matching is recommended (see section 5.3.3) to encourage selection from shorter lists
■ A list item is mis-selected because a drug name appears more than once in a list	■ Search results lists contain only drug names (generic and brand) (see section 5.3.7)
	■ Results are ordered such that a brand drug is less likely to appear next to an equivalent generic drug (MSP-0530, and see section 5.3.17)
	■ Cascading lists are not displayed until a drug name has been selected (see section 6.3.1)
■ A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	■ Progressive matching encourages the typing of more letters for shorter lists of search results (see section 5.3.3)
	■ Search results lists are limited in height (see section 5.3.5)
	■ Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (see section 5.3.7)
	■ Search results are ordered such that generic names are listed before brand names (MSP-0530)
	■ Search results are displayed in matched order and then alphabetically (MSP-0540)
	■ Search results are prioritised (see section 5.3.12)
	■ Brand names are supplemented with generic names (when they exist) (see section 5.3.17)
	■ Brand names are displayed after the generic name (when they exist) in a single list item (see section 5.3.17)
	■ If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters

5.3.9 Using Groups to Limit Search Results

ID	Guideline	Conformance	Evidence Rating
MSP-0550	For specific searches that return significantly more results (most of these will be three or four character searches), support the display of groups in the search results list	Recommended	Medium
MSP-0560	When a group is displayed in a search results list, provide a control (such as a button) that, when selected, replaces the original text in the search text input box with the full title of the group and replaces the original search results with the results within the group.	Recommended	Medium
Usage Examples			

In this correct example, a group has been created for matches containing 'paraffin' for a context in which paraffin is less commonly prescribed (MSP-0550)

This example of a search results used in a context in which paraffin is rarely or never prescribed is not recommended because the list contains many matches for paraffin.(MSP-0550)

paraffin 🔍	In this correct example, the contents of a group are displayed and the search criteria in the search text input box have been updated to display the search criteria corresponding to that group (MSP-0560)
paraffin hard	
liquid paraffin	
white soft paraffin	
liquid paraffin + magnesium hydroxide	
liquid paraffin + white soft paraffin	
soft paraffin + wool fat	
white soft paraffin + zinc oxide	
hard paraffin + liquid paraffin + soft paraffin + wood alchohols	

Rationale

Design Analysis:

Based on a simplistic analysis of the drug names in the dm+d (see section 5.3.4), there are likely to be some combinations of three and four characters (such as 'hom', 'sod', 'hyd', 'chl', 'met', 'flu', 'home', 'sodi', 'hydr', 'chlo', 'pota' and 'calc') that will return a large number of search results. When these results contain significant sets of clearly related drugs with similar names (for example, paraffin or sodium) they can be replaced with a single entry to significantly reduce the number of search results (MSP-0550). The single entry can provide access to this sub-set of matches by displaying the set when the control is activated. The selection of the single entry that represents the set is effectively the same as entering the search criteria which the set have in common and these search criteria can therefore be shown in the search text input box (MSP-0560).

As discussed in the rationale for section 5.3.6, this approach is one that promotes searching over browsing by keeping the search results list flat and minimising navigation within and between lists. The search results list always displays a flat list of results. Those results can be replaced with a new list by changing the search criteria. Changing the search criteria can be done by typing text in the search text input box or by clicking a group button. The two approaches thus conform to the same list behaviour.

Although this is an effective means of breaking down a long list of results, it is only recommended for groups of significant numbers of less commonly prescribed drugs. This is because it introduces extra complexity to the search results list and risks taking the focus away from encouraging the entry of more characters in the search text input box in order to generate a shorter results list.

Desk Research:
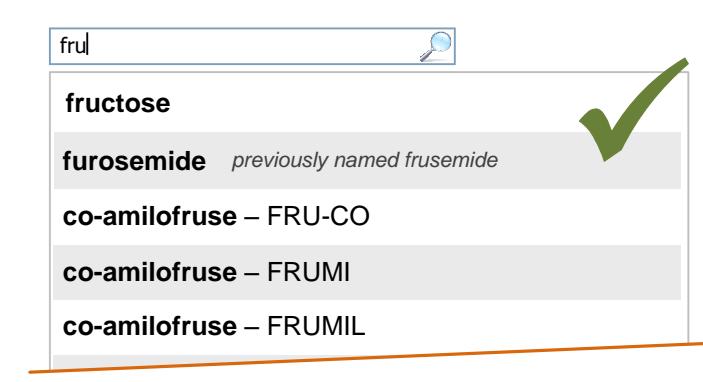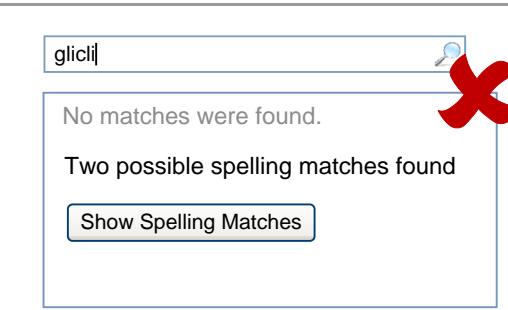
Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

■ Aesthetic and minimalist design – Groups allow long lists of similar drug names that are less frequently prescribed to be removed from the initial search results list so that drugs more likely to be prescribed appear in the list

5.3.10   Supporting Spelling Matches and Synonyms

See section 5.3.15 for guidance on formatting spelling matches and synonyms in the search results lists.

ID	Guideline	Conformance	Evidence Rating
MSP-0570	Support spelling matches	Recommended	Medium
MSP-0580	Support synonyms such that a drug name for which a synonym has been defined is displayed when the synonym is matched	Recommended	Low
MSP-0590	When there are spelling matches or synonyms to display, list them along with other results in the search results list	Recommended	Low
Usage Examples			

asprin

Commonly prescribed matc...

asp<mark>i</mark>rin   Ctrl + 1

asp<mark>i</mark>rin + paracetamol   Ctrl + 2

Standard matches

asp<mark>i</mark>rin + caffeine

asp<mark>i</mark>rin + dipyridamole

asp<mark>i</mark>rin + isosorbide mononitrate

asp<mark>i</mark>rin + metoclopramide

asp<mark>i</mark>rin + papaveretum

In this correct example, spelling matches are included in the search results (MSP-0570)

glicli

No matches were found.

This example is not recommended because spelling matches are not provided (MSP-0570)

fru **fructose** **furosemide** *previously named frusemide* **co-amilofruse** – FRU-CO **co-amilofruse** – FRUMI **co-amilofruse** – FRUMIL	In this correct example, the drug furosemide is matched because it has 'frusemide' defined as a synonym (MSP-0580)
glicli No matches were found. Two possible spelling matches found Show Spelling Matches	This example is incorrect because the spelling matches are not displayed along with other results (MSP-0590)

Rationale

Design Analysis:

The guidance for spelling matches (MSP-0570) is designed to allow users to find the drugs they are searching for in the results list (MSP-0590), even when they have mis-typed or mis-spelled the name of the drug. Alternative approaches may slow down the process, or interrupt the flow, by reporting the presence of matches and requiring acknowledgement before displaying those matches. This guidance places more emphasis on allowing the drug name to be found, in the same way as those that are matched directly, than on ensuring that the correct spelling is learned.

By supporting matching against synonyms (MSP-0580), the drug search can provide support for finding drugs when the drug name has changed (such as from 'frusemide' to 'furosemide') and when a more familiar name is commonly used instead of the correct generic drug name. For example, 'saline' is often used to refer to sodium chloride and could be displayed as a synonym for sodium chloride in the search results list providing such a synonym is found to be safe.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Help users recognise, diagnose, and recover from errors – By displaying spelling matches, users are still likely to find the drug they are looking for in the search results and learn the correct spelling in the process

- Aesthetic and minimalist design – Displaying the spelling matches directly in the search results list keeps the searching area free of additional controls or results lists that might be needed to facilitate alternative approaches to supporting spelling matches

5.3.11   Co-Drugs and Their Ingredients

ID	Guideline	Conformance	Evidence Rating
MSP-0600	Supplement co-drugs with text that lists the ingredients of the co-drug	Mandatory	High
MSP-0610	Format text that lists the ingredients of co-drugs such that it is differentiated from the drug name	Mandatory	High

Usage Examples

co-cod 🔍 *Commonly prescribed matches* **co-codamol** *codeine + paracetamol* Ctrl + 1 *Standard matches* **co-codaprin** *codeine + aspirin* ✔	In this correct example, the matches that are co-drugs are supplemented with text that lists the ingredients of the co-drug (MSP-0600)
co-am 🔍 *Commonly prescribed matches* **co-amilofruse** *amiloride + furosemide* Ctrl + 1 **co-amoxiclav** *amoxicillin + clavulanic acid* Ctrl + 2 *Standard matches* **co-amilozide** *amiloride + hydrochlorothiazide* ✔	In this correct example, the matches that are co-drugs include grey italic text that lists the ingredients of the co-drug (MSP-0610)
co-am 🔍 *Commonly prescribed matches* **co-amilofruse amiloride + furosemide** Ctrl + 1 **co-amoxiclav amoxicillin + clavulanic acid** Ctrl + 2 *Standard matches* **co-amilozide amiloride + hydrochlorothiazide** ✘	This example is incorrect because, the matches that are co-drugs do not include grey italic text that lists the ingredients of the co-drug (MSP-0610)

Rationale

Design Analysis:

Prescribing co-drugs requires knowledge of the active ingredients since they are not easy to infer from the drug name. Always supplementing the drug name with a description of its active ingredients can mitigate the risk that the drug is prescribed with imperfect knowledge of those ingredients (MSP-0600).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error Prevention – Displaying the ingredients of co-drugs helps prevent them from being prescribed when the prescriber has made an erroneous assumption about their active ingredients

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is mitigated by the guidance:
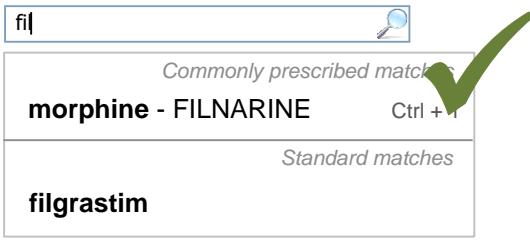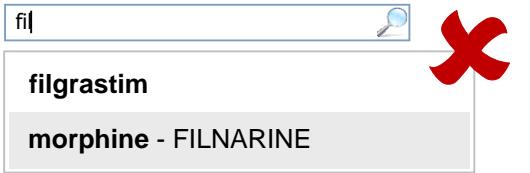
Potential Hazards:	Mitigations:
■ A prescriber is unfamiliar with a co-drug and makes an incorrect assumption about its ingredients	■ Co-drugs are supplemented with text that describes their active ingredients (MSP-0600)

5.3.12   Prioritising Results

Drug search results, cascading lists (see section 6) and other selection lists can be divided into sections in order to bring prioritised list items to the top of a list. See section 6.3.3 for guidance on prioritisation within cascading lists and section 9.3.3 for guidance on prioritisation within selection lists used as input controls.

ID	Guideline	Conformance	Evidence Rating
MSP-0620	Display prioritised results in a separate section that appears above other results in the list	Recommended	Medium
MSP-0630	Separate the prioritised results from standard matches with a horizontal line	Recommended	Medium
MSP-0640	Provide a label for the prioritised results that gives a brief indication of how they are prioritised	Recommended	Medium
MSP-0650	Ensure that the labels are sufficiently different from list items in the search results	Recommended	Medium
MSP-0660	Label results that are not prioritised with 'Standard Matches'	Recommended	Medium
MSP-0670	When there are no prioritised matches, omit the prioritised section, horizontal line and label	Recommended	Medium
Usage Examples			

In this correct example, prioritised matches appear above a horizontal line, and standard matches appear below the line. Both sections are labelled at the beginning of the section and the results that are not prioritised are labelled 'Standard Matches' (MSP-0620, MSP-0630, MSP-0640, MSP-0650).

This example is not recommended because the search results have not been prioritised (MSP-0620)

fil| 🔍 ❌ **commonly prescribed matches** **morphine** - FILNARINE Ctrl + 1 **standard matches** **filgrastim**	This example is not recommended because the labels for the two sections are not sufficiently different from the search result list items (MSP-0650)
can| 🔍 ✔ candesartan **cannabidiol + dronabinol** **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **bifonazole** – CANESTEN AF ONCE DAILY **fluconazole + clotrimazole** – CANESTEN DUO **clotrimazole + hydrocortisone** – CANESTEN HC	In this correct example, there are no prioritised matches for the text entered in the search text input box, therefore the prioritised section does not appear (MSP-0670)
can| 🔍 ❌ *Commonly prescribed matches* *Standard matches* candesartan **cannabidiol + dronabinol** **clotrimazole** – CANESTEN (CLOTRIMAZOLE) **bifonazole** – CANESTEN AF ONCE DAILY **fluconazole + clotrimazole** – CANESTEN DUO **clotrimazole + hydrocortisone** – CANESTEN HC	This example is not recommended because the prioritised section 'Commonly prescribed matches' should not appear when there are no matches to display (MSP-0670)

Rationale

Design Analysis:

Prioritisation can provide a mechanism of promoting certain drugs, such as commonly prescribed drugs (or other locally defined priorities). Promoted drug names are displayed at the top of the list so that they are first in the reading order (MSP-0620) and are clearly labelled (MSP-0640) so that the reason for, or method of, prioritisation is clear. Prioritised matches are separated from standard matches (MSP-0630) so that the order in which search results are displayed can be applied in each section respectively and there is no confusion or apparent inconsistency in the list.

There are alternative approaches to prioritising drugs that may have different merits depending on the context in which they are used. The matches that appear in the prioritised section could be those that are prescribed most frequently by an individual or by a specific location or trust or by manually maintaining a list. In some cases, it may be appropriate to use the prioritised section to promote the use of medications that are on formulary and demote those that are off-formulary. Further analysis would have to be completed before guidance could recommend the use of a particular approach to prioritisation.

The prioritised section is only needed when there are prioritised matches to be displayed (MSP-0670). Similarly, the label for the standard matches section is only needed to differentiate it from the prioritised section and is thus not needed when there are no prioritised matches (MSP-0660).

The guidance is designed to promote clear differentiation between the labels and the drug names in the search list so that the list can be scanned without additional information (for example, no labels or warnings interrupting the scanning of the list (MSP-0650)).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – Accelerators are provided for prioritised medications so that they remain at the top of the list and are easier to find and select
- Aesthetic and minimalist design – Ensuring that the search results are most prominent (reducing both the presence of, and emphasis on, other elements of the search results lists) minimises distractions from scanning the drug names and maximises the emphasis on the drug names

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
- A drug name is mis-selected in the search results list	- **This risk is not wholly mitigated by guidance**
	- The list is limited in length (see section 5.3.5) and progressive matching is recommended (see section 5.3.3) to encourage selection from shorter lists
	- Search results are prioritised (MSP-0620) and listed in matched order before alphabetical order to maximise logical grouping (see section 5.3.8)
- A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	- Progressive matching encourages the typing of more letters for shorter lists of search results (MSP-0370)
	- Search results lists are limited in height (see section 5.3.5)
	- Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (see section 5.3.7)
	- Search results are ordered such that generic names are listed before brand names (see section 5.3.8)
	- Search results are displayed in matched order and then alphabetically (see section 5.3.8)
	- Search results are prioritised (MSP-0620)
	- Brand names are supplemented with generic names (when they exist) (see section 5.3.17)
	- Brand names are displayed after the generic name (when they exist) in a single list item (see section 5.3.17)
	- If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters

5.3.13   Shortcut Keys in Search Results

ID	Guideline	Conformance	Evidence Rating
MSP-0680	Display keyboard shortcuts for prioritised matches only	Recommended	Medium
MSP-0690	Display keyboard shortcuts on the same line as each match. Display them right-aligned after each match	Recommended	Medium

Usage Examples

In this correct example, shortcut keys are provided for prioritised matches only (MSP-0680). The shortcut keys are displayed as grey italics on the same line as each match and are right-aligned (MSP-0690)

This example is not recommended because shortcut keys should not be provided for standard matches (MSP-0680)

Rationale

Design Analysis:

Shortcut keys are recommended so that prioritised drug names can be easily selected using the keyboard (MSP-0680). Shortcut keys are a supplementary way of selecting results that supplements the standard keyboard navigation keys for moving the focus and selecting list items.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – Shortcut keys provide accelerators for prioritised drugs in the list
- Recognition rather than recall – The display of shortcut keys clearly indicates that there are accelerators and tells users which keys they can use

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ The user becomes over-reliant on a combination of letters types into the search text input box and a shortcut key (or sequences of key strokes) and the prioritised drugs for this combination of letters have changed	■ **This risk is not wholly mitigated by guidance** ■ The risk could be mitigated by the removal of shortcut keys (MSP-0680) when a newly added drug appears in a prioritised list. However, this approach has not been tested

5.3.14   Formatting Commonly Mis-Selected Matches

ID	Guideline	Conformance	Evidence Rating
MSP-0700	Where drug names associated with mis-selection errors are listed in the search results, use formatting to draw attention to them	Mandatory	High
MSP-0710	Where drug names associated with mis-selection errors are listed in the search results, highlight the row with a pale background colour	Recommended	Low
MSP-0720	Where drug names associated with mis-selection errors are listed in the search results, supplement the drug name with a brief warning message	Mandatory	Medium
MSP-0730	Display mis-selection warning messages in grey italics and in a smaller font size than the drug name	Recommended	Medium

Usage Examples

quin **quinagolide** **quinapril** **quiNIDine** *this drug is often mis-selected* **quiNINE** *this drug is often mis-selected* **quinine bisulphate** **quinine dihydrochloride** **quinine hydrochloride** ✓	In this correct example, Tall Man lettering has been used to draw attention to drug names associated with mis-selection errors and the row has been highlighted with a pale colour (MSP-0700, MSP-0710)
quin **quinagolide** **quinapril** **quinidine** *this drug is often mis-selected* **quinine** *this drug is often mis-selected* **quinine bisulphate** **quinine dihydrochloride** **quinine hydrochloride** ✓	In this correct example, search results that are associated with known mis-selection errors are highlighted with a pale background colour and are supplemented with a brief warning messages in grey italics (MSP-0700, MSP-0710, MSP-0720, MSP-0730)

quin **quinagolide** **quinapril** **quinidine** *this drug is often mis-selected* **quinine** *this drug is often mis-selected* **quinine bisulphate** **quinine dihydrochloride** **quinine hydrochloride**	This example is not recommended because the commonly mis-selected drugs are not highlighted with a pale background colour (MSP-0700)
quin **Please select carefully.** This list contains similar looking or similar sounding drug names that are often mis-selected. **quinagolide** **quinapril** **quinidine** **quinine** **quinine bisulphate** **quinine dihydrochloride** **quinine hydrochloride**	This example is incorrect because the specific drugs that are often mis-selected are not marked with text or highlighting (MSP-0700, MSP-0710, MSP-0720, MSP-0730)

Rationale

Design Analysis:

A consistently placed generic message at the beginning of a search results list is less likely to capture attention than a message placed alongside the drug name, where attention is focused when a selection is made from the list.

Selection of a drug name from a search results list is just one of a number of steps that must be completed to prescribe. There are other mechanisms for mitigating the risks of mis-selection at other stages in the prescribing process. However, it is still considered a significant enough risk for both formatting and text to be used to draw attention to these drugs in the search results list.

Desk Research:

Patient safety risks associated with mis-selection of drug names are widely reported in the NHS article *Safety in doses: medication safety incidents in the NHS[14]* and the World Health Organization (WHO) news release *WHO Collaborating Centre for Patient Safety Releases Nine Life-Saving Patient Safety Solutions[15]*.

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[14] NHS NPSA – The fourth report from the Patient Safety Observatory – PSO/4 – Safety in doses: medication safety incidents in the NHS **{R6}**: http://www.nrls.npsa.nhs.uk/favicon.ico

[15] The Joint Commission International – WHO Collaborating Centre for Patient Safety Releases Nine Life-Saving Patient Safety Solutions **{R29}**: http://www.ccforpatientsafety.org/patient-safety-solutions/

The US Food and Drug Administration (FDA) Office of Generic Drugs *Name Differentiation Project*[16] requested manufacturers of 16 look-alike drug names to use a system known as 'Tall Man' lettering to mitigate the risk that they are mistaken for similar looking drug names. However, as reported in *The Use of Tall Man Lettering to Minimise Selection Errors of Medicine Names in Computer Prescribing and Dispensing Systems* **{R24}**, findings from studies of Tall Man lettering are not conclusive and Tall Man lettering has been statistically proven to be useful in only very specific circumstances. The only experiment within this study that tested the selection of drug names within a selection list also included dose and formulation as part of that selection list and noted that error was more related to dose and formulation or a combination of these than with look-alike medication names. The most effective of the three Tall Man lettering variants used in the study was also found to significantly affect the time for the action of selecting a medication.

Tall Man lettering has been found to be useful when:

- Distinguishing names in same-different judgement tasks when participants understood the purpose of Tall Man lettering

- Improving recognition memory by increasing attention (and slowing down reading speed)

- Improving selection from an array when lettering is simulated as packaging

In short, there is no conclusive evidence that Tall Man lettering is effective at mitigating selection errors in lists of drug names when presented as part of a prescribing process that builds the prescription step by step. Therefore, this guidance recommends the use of other mechanisms for drawing attention to the potential for mis selection. Unlike Tall Man lettering, these mechanisms are specific to the selection of a drug name from a list of drug names and are not expected to be implemented throughout a prescribing system to appear whenever the drug name is displayed.

The *ePrescribing Functional Specification* **{R12}** includes a requirement (GEN.OS.94) to specifically address the risk of mis-selection when drugs that are known to be mis-selected are displayed in selection lists.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error prevention – Formatting of commonly mis-selected matches helps to prevent the mis-selection of an unintended drug in the list

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is mitigated by the guidance:

Potential Hazards:	Mitigations:
- A look-alike or sound-alike drug is selected in error	- Formatting (MSP-0700) and supplementary text warnings (MSP-0720) are used to mark look-alike sound-alike drugs at the point of selection

5.3.15   Formatting Spelling Matches and Synonyms

This section includes guidance for formatting spelling matches and synonyms when they appear in a search results list. See section 5.3.10 for guidance on supporting spelling matching and synonyms.

ID	Guideline	Conformance	Evidence Rating
MSP-0740	Use background colour to highlight differences in characters between text that has been entered and spelling matches	Recommended	Medium
MSP-0750	When spelling matches are displayed, ensure that there is sufficient colour and contrast differences between text and both background highlighting and spelling matching highlighting	Mandatory	Medium
MSP-0760	When spelling matches are displayed, ensure that there is sufficient colour and contrast differences between background highlighting and spelling matching highlighting	Mandatory	Medium
MSP-0770	For drug names that are displayed when matched on a synonym, supplement the drug name with a message that includes the synonym	Mandatory	Medium

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[16] US Federal Drug Administration (FDA) Center for Drug Evaluation and Research (CDER) – Name Differentiation Project **{R30}**: http://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm164587.htm

Usage Examples

asprin | 🔍 ✔	In this correct example, the difference between the text entered and the spelling matches is highlighted in the search results list (MSP-0740, MSP-0750, MSP-0760)
Commonly prescribed match	
asp<mark>i</mark>rin　　　　　　Ctrl + 1	
asp<mark>i</mark>rin + paracetamol　Ctrl + 2	
Standard matches	
asp<mark>i</mark>rin + caffeine	
asp<mark>i</mark>rin + dipyridamole	
asp<mark>i</mark>rin + isosorbide mononitrate	
asp<mark>i</mark>rin + metoclopramide	
asp<mark>i</mark>rin + papaveretum	

salmeterol | 🔍	This example is incorrect because all text that was matched has been highlighted (MSP-0740)
Commonly prescribed matches	
<mark>salmeterol</mark>　　Ctrl + ❌	
fluticasone + <mark>salmeterol</mark>　Ctrl + 2	

fru | 🔍	In this correct example, a synonym has been matched and the relevant drug name has been supplemented with a message that includes the synonym (MSP-0770)
fructose	
furosemide　　*previously named frusemide* ✔	
co-amilofruse – FRU-CO	
co-amilofruse – FRUMI	
co-amilofruse – FRUMIL	

Rationale

Design Analysis:

Any form of highlighting in the search results list draws attention away from the contents of the list, and makes it more difficult to scan the drug names quickly. The guidance therefore minimises the use of highlighting by highlighting the differences instead of the matched text (MSP-0740).

The highlighting of search results is a solution that is commonly used on Web pages when search results consist of a paragraph of text rather than a short name. However, when search results are usually only one or two words in length, this approach results in an unnecessarily large quantity of highlighting that is more likely to hinder readability of the list than to help identify the one drug name that the prescriber is looking for.

The colour and contrast used for the highlighted text should be chosen such that the potential for reducing readability of the search results is minimised (MSP-0750, MSP-0760).

When a search is tightly scoped:

- The matched text is easier to see and predict

- The expectation is that one result will be exactly what is being searched for

- Highlighting all matches is not likely to help draw attention to the drug name that is being searched for
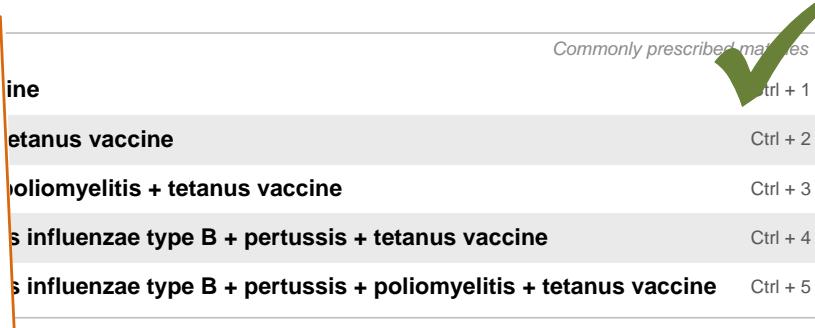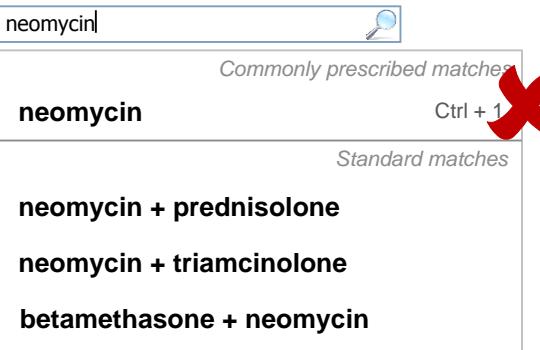
In this guidance, only the results that are exceptions to the rules are highlighted. By restricting highlighting to the differences between the text entered in the search text input box and the spelling matches in the list, the highlights draw attention to exceptional matches, as well as communicating the specific difference in spelling.
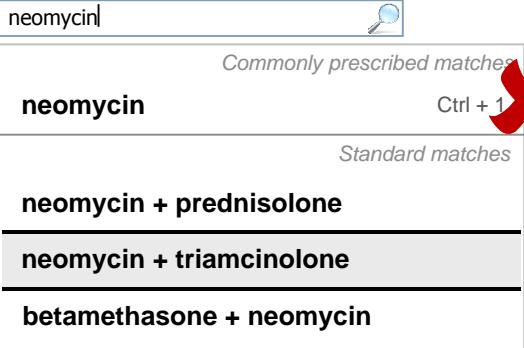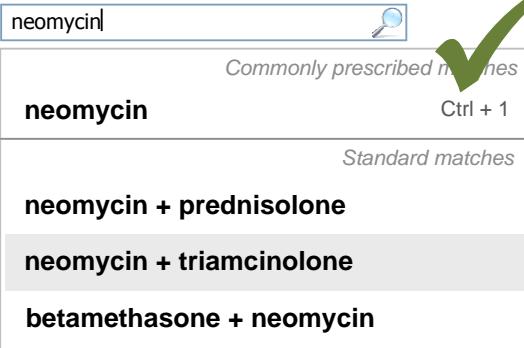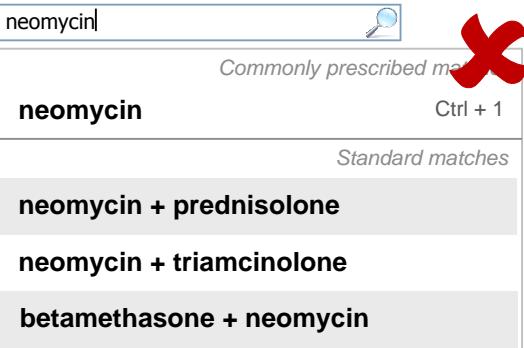
Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Help users recognise, diagnose and recover from errors – The formatting draws attention to the specific differences between the text entered and the 'spelling matches' thus allowing users to recognise that they (potentially) mis-spelled the drug name and to identify the correct spelling

5.3.16 Formatting Search Results Lists

ID	Guideline	Conformance	Evidence Rating
MSP-0780	Use subtle alternate shading of matches in the search results list	Mandatory	Medium
MSP-0790	Avoid the use of strong horizontal lines to separate individual list results	Mandatory	Medium
MSP-0800	Re-start alternate shading at the beginning of a new section in a search results list	Mandatory	Medium
Usage Examples			

This correct example shows the use of subtle alternate shading of matches in the list (MSP-0780)

This example is incorrect because no shading has been used to help differentiate lines in the list (MSP-0780)

neomycin

Commonly prescribed matches

neomycin   Ctrl + 1

Standard matches

neomycin + prednisolone

neomycin + triamcinolone

betamethasone + neomycin

This example is incorrect because strong horizontal lines have been used to separate the matches in the search results (MSP-0790)

---

neomycin

Commonly prescribed matches

neomycin   Ctrl + 1

Standard matches

neomycin + prednisolone

neomycin + triamcinolone

betamethasone + neomycin

In this correct example, the list results are alternately shaded, with the second result in the list being the first one to have a shaded background (MSP-0800)

---

neomycin

Commonly prescribed matches

neomycin   Ctrl + 1

Standard matches

neomycin + prednisolone

neomycin + triamcinolone

betamethasone + neomycin

This example is incorrect because the alternate row shading continues from one section to the next. It should be restarted at the beginning of the 'Standard matches' section so that the first item in that section does not have a shaded background (MSP-0800)

Rationale

Design Analysis:

The alternate row shaded background (MSP-0780) is designed to mitigate the risk of mis-selection and help to associate the drug names with the shortcut keys without reducing the readability of the search results. Maintaining readability of the list by minimising formatting (MSP-0790) is considered to be a higher priority than using formatting to clearly differentiate individual lines in the list. A subtle shaded background is therefore recommended above the use of horizontal lines.

When static lists are presented with strong alternate row shading, and there are only two or three items in the list, the strong shading can be mistaken for selection or highlighting on first use. Subtle shading helps reduce the likelihood of this misinterpretation. This is less of an issue when the list is dynamic because an initial list is likely to be longer. This thus allows users to become familiar with alternate row shading before the list is shortened as they type further characters into the search text input box.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error prevention – Alternate row shading is recommended in search results lists to help avoid mis-selection when drugs are selected from the list

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is partially mitigated by the guidance:

Potential Hazards:

- Alternate row shading is mistaken for selection or highlighting when there are only two or three list items in a list or section

Mitigations:

- **This risk is not wholly mitigated by guidance**
- Alternate row shading should be subtle (MSP-0780)
- When results are displayed using progressive matching (see section 5.3.3), the initial list of results is more likely to contain greater than three drugs in any one section of the list. The user is thus familiar with the presence and meaning of the alternate row shading before the list is shortened such that this risk is introduced

5.3.17   Generic Drug Names and Brand Names

ID	Guideline	Conformance	Evidence Rating
MSP-0810	When brand names that have a generic name are matched, display the generic drug name and supplement it with the brand name	Mandatory	Medium
MSP-0820	Separate generic drug names and brand names with a hyphen that has a space either side	Mandatory	Medium
MSP-0830	Do not display brand names unless they have been matched with text entered in the search text input box	Mandatory	Medium
MSP-0840	Display generic and brand names in the same order as described in *Medications Management – Medication Line* **{R3}**	Recommended	Medium

Usage Examples	

In this correct example, the text entered in the search text input box matches only brand names. Both the brand names and the generic names are listed in the search results and a hyphen is used to separate the brand name from the drug name (MSP-0810, MSP-0820).

canesten| 🔍 ❌

CANESTEN (CLOTRIMAZOLE)

CANESTEN AF ONCE DAILY

CANESTEN DUO

CANESTEN HC

CANESTEN OASIS

This example is incorrect because only brand names are listed in the search results (MSP-0810)

---

clotrim 🔍 ❌

Commonly prescribed matches

clotrimazole	Ctrl + 1
clotrimazole – CANESTEN	Ctrl + 2
clotrimazole + hydrocortisone – CANESTEN	Ctrl + 3
clotrimazole + fluconazole – CANESTEN	Ctrl + 4

This example is incorrect because the brand name CANESTEN has not been matched by the text in the search text input box, and should not appear in the results list (MSP-0830)

---

canesten| 🔍 ❌

Commonly prescribed matches

CANESTEN (CLOTRIMAZOLE) – **clotrimazole**	Ctrl + 1
CANESTEN AF ONCE DAILY – **bifonazole**	Ctrl + 2
CANESTEN DUO – **clotrimazole + fluconazole**	Ctrl + 3
CANESTEN HC – **clotrimazole + hydrocortisone**	Ctrl + 4

Standard matches

CANESTEN OASIS – **sodium citrate**

This example is not recommended because the generic and brand names are displayed in a different order than in a medication line (MSP-0840)

Rationale

Design Analysis:

The guidance aims to encourage generic prescribing by always displaying the generic name (if there is one) for each item in a search result list (MSP-0810). Also, only displaying brand names in the search results when the text entered in the search text input box is matched against text in a brand name (MSP-0830). This approach facilitates prescribing by generic name, even when only the brand name is known, since it allows the brand name to be entered in the search text input box and the generic name to be displayed alongside the matched brand names in the search results.

The display of brand name first and generic name second helps to mitigate mis-selection risks associated with look-alike and sound-alike drug names. Drug name pairs such as 'ketorolac' and 'KETALAR' which are on the ISMP's *List of Confused Drug Names* **{R28}** are not likely to be displayed next to one another in a search results list when the list is ordered such that generic names appear earlier in the list than those with brand names. Furthermore, by supplementing brand names with the generic name (MSP-0810), the two drug names are displayed in the list as 'ketorolac' and 'ketamine – KETALAR' further reducing the potential for confusion even if they were displayed next to one another in the list. Guidance in *Medications Management – Medication Line* **{R3}** further mitigates the risk of mis-selection in this example since the brand name is displayed in capital letters and the two names are displayed with the generic name first and the brand name second (MSP-0840).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Aesthetic and minimalist design – By matching brand names in the search results list and displaying them alongside generic names, the drug search facilitates searching for brand names and discovering the generic names

- Consistency and standards – The generic and brand names are listed in the same order as indicated in *Medications Management – Medication Line* **{R3}** and in a prescription form (MSP-0840, MSP-0820), with the same formatting to separate them

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A list item is mis-selected because a drug name appears more than once in a list	■ Search results lists contain only drug names (generic and brand) (see section 5.3.7)
	■ Results are ordered such that a brand drug is less likely to appear next to an equivalent generic drug (see section 5.3.8 and MSP-0810)
	■ Cascading lists are not displayed until a drug name has been selected (see section 6.3.1)
■ A drug name is mis-selected because it appears next to or in the same list as a look-alike or sound-alike drug name	■ Progressive matching encourages the typing of more letters for shorter lists of search results (see section 5.3.3)
	■ Search results lists are limited in height (see section 5.3.5)
	■ Drugs are displayed by searching and search results are matched to the beginnings of words so search results share the same initial letters (see section 5.3.7)
	■ Search results are ordered such that generic names are listed before brand names (see section 5.3.8)
	■ Search results are displayed in matched order and then alphabetically (see section 5.3.8)
	■ Search results are prioritised (see section 5.3.12)
	■ Brand names are supplemented with generic names (when they exist) (MSP-0810)
	■ Brand names are displayed after the generic name (when they exist) in a single list item (MSP-0840)
	■ If *Medications Management – Medication Line* **{R3}** guidance is followed, brand names are differentiated by displaying them in capital letters

6 GUIDANCE DETAILS FOR CASCADING LISTS

6.1 Introduction

After a drug has been selected, either from the Quick List or a list of search results, a number of other attributes are needed to determine the type of medication that is being prescribed. This section provides guidance for cascading lists as a means of facilitating the definition of those attributes.

Figure 11 shows the full user interface prescribing process in which the steps covered in this section are shown with a grey background:
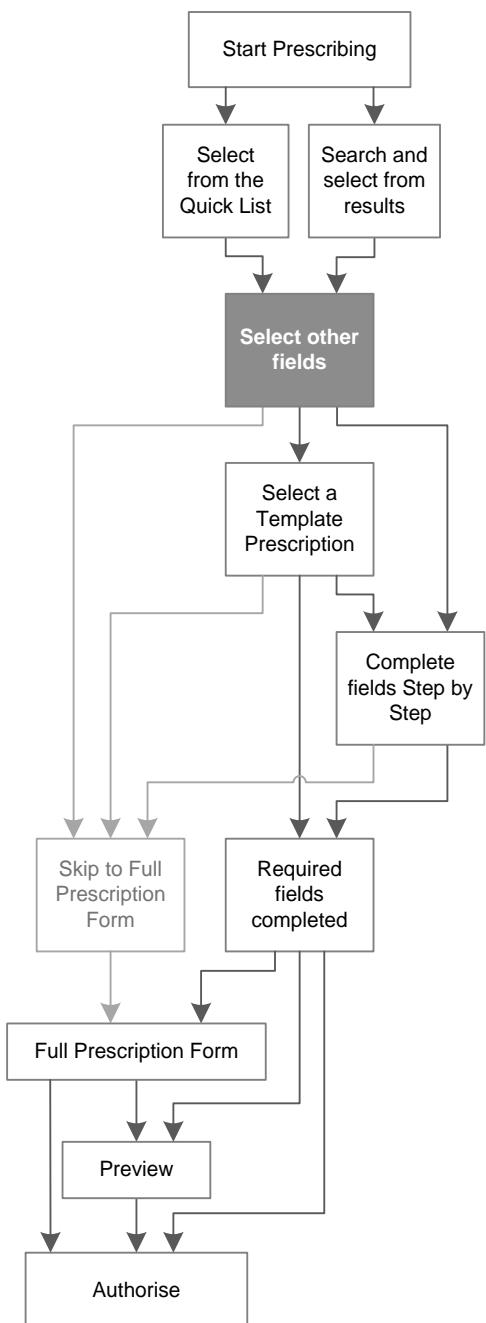
Figure 11: The Prescribing Process – Select Further Attributes

Figure 12 is an extract from Figure 5 to illustrate the user interface prescribing steps covered in this section showing the cascading list step and links to and from other steps:
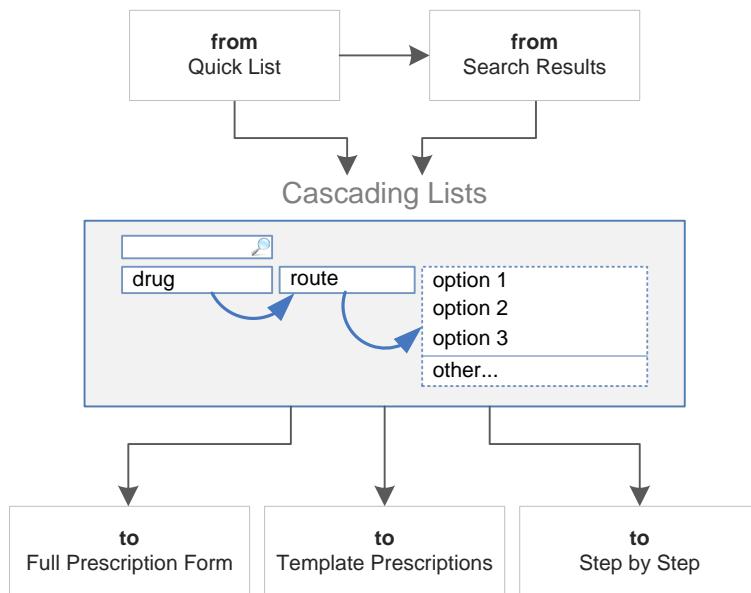
Figure 12: User Interface Prescribing Steps – Cascading Lists

6.2   Principles

All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Mitigate the risks of mis-selection and misinterpretation:
  - Lists can be kept open so that feedback for selections is maximised
  - The contents of lists are limited by the previous selection, so a mis-selection is more likely to be noticed because of the contents of the following list

- Encourage simplicity of design by promoting user interface approaches that help to avoid overly complex displays and interactions that require many controls:
  - Cascading lists allow the majority of a prescription to be defined using a series of identical user input controls

- Ensure that the prescribing process can be supported in multiple layouts and is flexible enough to be presented in different screen dimensions:
  - Cascading lists can be displayed opened or closed depending on the available space and can wrap onto a new line if necessary

- Adhere to a user interface strategy that gives the impression of making progress within a single space (which has all the necessary information immediately or readily available) and avoids the impression of needing to move between many different spaces:
  - Cascading lists are presented within the same space, with each list supplementing the last

6.3 Guidelines

6.3.1 Providing Cascading Lists

Important

This section contains guidance for which there may be alternative solutions. Accordingly, the conformance ratings in this section apply only where the guidance is adopted.

The Rationale section contains a summary of the known risks which are addressed in this section and which must be addressed by any alternative solution. For more information, see the Alternative Design Solutions note in section 1.

ID	Guideline	Conformance	Evidence Rating
MSP-0850	Display a cascading list on the selection of drug name and up to two further cascading lists for basic prescription attributes	Mandatory	High
MSP-0860	Present a second list when a selection is made in the search results list	Mandatory	Medium
MSP-0870	Allow the width of the search results list to extend into available space to accommodate the longest entry when first presented	Mandatory	High
MSP-0880	Allow different cascading lists (such as route and form or route and strength) to be presented depending on the drug selected	Recommended	Medium
MSP-0890	Limit the options presented within cascading lists to those that are relevant to the previous selection	Mandatory	High
Usage Examples			

In this sequence of correct examples (MSP-0850):

1. A list of search results is displayed

2. A cascading list is displayed when a drug name is selected in the search results list

3. A second cascading list that is displayed when a selection is made in the first cascading list

1

dilt 🔍

diltiazem

oral

cutaneous

other...

2

dilt 🔍

diltiazem | **oral** | **modified-release**

cutaneous | oral liquid

other... | other...

In this sequence of correct examples (MSP-0860):

1. A cascading list is displayed when the drug diltiazem is selected from the search results list

2. The selection of a route causes display of a cascaded list of forms

1 | 2

---

paraldehyde

parathyroid hormone

paracetamol + sodium salicylate

Showing 10 of 40 matches. | Show all

← available space →

In this correct example of the lower part of a search results list, the list width accommodates the longest search results entry (MSP-0870)

---

paraldehyde

parathyroid hormone

paracetamol + sodium salicylate

Showing 10 of 40 matches. | Show all

← available space →

This example of the lower part of a search results list is incorrect because it has not used available space to expand in width to accommodate the longest search results entry (MSP-0870)

1

salbut 🔍

salbutamol	inhaled – breath-actuated inhaler
	inhaled – dry powder inhaler
	inhaled – metered dose inhaler
	inhaled – nebuliser
	oral
	oral – modified-release
	other...

2

salbutamol	inhaled – nebuliser
DOSE 2.5 mg	four times a day
DOSE 5 mg	four times a day
other...	

In this sequence of correct examples (MSP-0880):

1. Selecting a drug name in search results displays a cascading list

2. Selecting in that cascading list displays template prescriptions
.

| 1 | 2 |

1

salbut 🔍

salbutamol	inhaled – breath-actuated inhaler
	inhaled – dry powder inhaler
	inhaled – metered dose inhaler
	inhaled – nebuliser
	oral
	oral – modified-release
	other...

2

salbutamol	inhaled – nebuliser	**DOSE 2.5 mg**	four times a day
		DOSE 5 mg	four times a day
		other...	

In this sequence of correct examples (in which there is enough room to display the template prescriptions to the right of the cascading lists) (MSP-0880):

1. Selecting a drug name in search results displays a cascading list

2. Selecting in that cascading list displays template prescriptions

| 1 | 2 |

1

salbut 🔍

salbutamol

inhaled

oral

other...

In this sequence of correct examples (MSP-0880):

1. Selecting a drug name in the search results displays a cascading list

| 1 | 2 | 3 |

2. Selecting in that cascading list displays template prescriptions

2

salbut 🔍

salbutamol

inhaled	breath-actuated
oral	dry powder
other...	metered dose
	nebuliser
	other...

3

salbut 🔍

salbutamol

inhaled	tablets and capsules
oral	modified-release preparations
other...	liquids and solutions
	other...

salbut 🔍

salbutamol

inhaled	breath-actuated
oral	dry powder
other...	metered dose
	nebuliser
	tablets and capsules
	modified-release preparations
	liquids and solutions

This example is incorrect because the options displayed in the cascading list have not been limited to those that are relevant to the previous selection (MSP-0890)

Rationale

Design Analysis:

Cascading lists allow the most important aspects of a prescription to be defined by making a few selections from short lists (MSP-0850, MSP-0860). They achieve the following:

- The most important information for a large percentage of prescriptions can be defined with a few selections

- Selections are easier to make because they are part of a short list

- The sequence and structure of cascading lists is consistent

- The contents of cascading lists will become familiar very quickly

- The cascading lists can be likened to 'multiple choice answers' whereas a set of empty fields is more like a set of 'questions' and the cognitive weight of the former is considered to be much lighter

- The lists and contents can change depending on previous selections (MSP-0880)

Some of the usage examples in this section show routes or combinations of route and form in cascading lists. Cascading lists could also be used to select from other sets of options (such as regular oral, one-off injections, continuous infusions and regular injections). However they are divided, the information presented in cascading lists should be enough to determine the type of medication and thus a list of relevant template prescriptions and a set of required fields.

Cascading lists are most effective at mitigating the risk of mis-selection when they are kept open. However, they can also be treated as dynamic width selection lists (MSP-0870) and presented using sentence layout (see section 7.3.7). This means that the cascading lists are flexible enough to work with most layout schemes and in spaces with restricted widths or heights.

Desk Research:

Guidance requires the options that are displayed in cascading lists to be limited according to the previous selections (MSP-0890). This matches a requirement (GEN.OS.094) in the *ePrescribing Functional Specification* **{R12}** to limit administration routes for specific drugs (such as vinca alkaloids).

The ePrescribing *Guidelines for hazard review of ePrescribing systems*[17] advises that when drug forms are selectable, they should be limited to those appropriate for the drug name selected (guideline 4.1) and that route selections should be limited to those that are pertinent to the medicine combinations selected (guideline 4.4)

As reported in *The Use of Tall Man Lettering to Minimise Selection Errors of Medicine Names in Computer Prescribing and Dispensing Systems,* the display of drug names combined with dose and strength is associated with greater incidence of mis-selection errors than the selection of drug name alone **{R24}**. The combination of guidance on Drug Search (see section 5) and Cascading Lists (see section 6) ensures that the drug name and attributes needed to define the type of medication being prescribed are selected before dose and strength options are presented. This also means that the dose and strength options presented can be limited to those relevant for the medication type and the specific drug name that has been selected.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency – Cascading lists help to focus on entering the relevant information in the right order without having to review a much large set of fields and determine which need to be completed

- Error prevention – By presenting limited lists whose contents are tailored according to previous selections, the opportunities for mis-selections are reduced

- Help users recognise, diagnose and recover from errors – By keeping the cascading lists open even when a selection has been made, users can see their selection within the context of the list it was selected from and have a greater opportunity to notice when they have mis-selected

---

[17] NHS ePrescribing: Guidelines for hazard review of ePrescribing systems **{R31}**:
http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/hazard_framework.pdf

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ The name of the drug being prescribed is not noticed at the top of the form and is not the intended drug	■ The options presented after a drug is selected are filtered to be relevant to that drug (MSP-0850) ■ The drug name remains at the top of the form when switching to a detailed prescription and is visible throughout, even when the prescription is long enough to need a scroll bar (see section 8.3.3)
■ Selections in the search results list and cascading lists are mis-interpreted because they are not (or may not be) horizontally aligned	■ **This risk is not wholly mitigated by guidance** ■ The cascading list that is displayed on selection contains only options that are relevant to the selection and thus may not contain the expected options (MSP-0880, MSP-0890) in the event of a mis-selection ■ Cascading lists are presented one at a time after a selection has been made in the previous list (MSP-0860) ■ When space is limited such that cascading lists obscure other information, the list collapses (see section 6.3.2)
■ A list item is mis-selected because a drug name appears more than once in a list	■ Search results lists contain only drug names (generic and brand) (see section 5.3.7) ■ Results are ordered such that a brand drug is less likely to appear next to an equivalent generic drug (see section 5.3.8) ■ Cascading lists are not displayed until a drug name has been selected (MSP-0850)

6.3.2   Displaying Cascading Lists

ID	Guideline	Conformance	Evidence Rating
MSP-0900	When a cascaded list is displayed and the search results list remains open, reduce the width of the search results list as necessary (following *Medications Management – Medication Line* **{R3}** for wrapping)	Recommended	Medium
MSP-0910	Do not allow any of the results or cascaded lists to obscure one another	Mandatory	High
MSP-0920	Maintain visibility of selections, and the list from which they were selected (including the search results), throughout the cascade select, as long as there is enough space to do so without obscuring other information	Recommended	Medium
MSP-0930	When the width of the search results list is reduced and a scroll bar is displayed, expand the list to show all results	Recommended	Low

Usage Examples

Commonly prescribed matches		
paracetamol		
paroxetine		
paracetamol + tramadol		
paracetamol + pseudoephedrine		
paracetamol + phenylephrine		
aspirin + paracetamol		

Commonly prescribed matches

paracetamol

paroxetine

paracetamol + tramadol

paracetamol + pseudoephedrine

paracetamol + phenylephrine

aspirin + paracetamol

Standard matches

ascorbic acid + paracetamol

caffeine + paracetamol

diphenhydramine + paracetamol

Showing 9 of 32 matches.

Show all

oral

rectal

intravenous infusion

other...

✔

In this correct example (in which the search results list is kept open after a selection), the width of the search results list has been restricted to accommodate the cascaded list (MSP-0900)

Commonly pres...

paracetamol

paroxetine

aspirin + paracetamol

paracetamol + tramadol

paracetamol + pseudoephedrine

paracetamol + phenylephrine

Standard matches

ascorbic acid + paracetamol

caffeine + paracetamol

diphenhydramine + paracetamol

Showing 9 of 32 matches.

Show all

oral

rectal

intravenous infusion

other...

✖

This example is incorrect because the width of the search results list has not been reduced to accommodate the next cascading list (MSP-0900) and because the cascaded list obscures the search results list (MSP-0910)

1

Commonly prescribed matches
paracetamol
paroxetine
aspirin + paracetamol
paracetamol + tramadol
paracetamol + pseudoephedrine
paracetamol + phenylephrine
Standard matches
ascorbic acid + paracetamol
caffeine + paracetamol
diphenhydramine + paracetamol
domperidone + paracetamol
isometheptene + paracetamol

Showing 9 of 32 matches.   Show all

In this sequence of correct examples:

1. A list of search results is displayed

2. A cascading list is displayed on selection of a drug, causing the width of the search results list to be reduced. The search results list is automatically expanded (MSP-0930) and has a scroll bar so that the selection can be kept in view (MSP-0920).

2

paroxetine
paracetamol + phenylephrine
paracetamol + pseudoephedrine
paracetamol + tramadol
aspirin + paracetamol
Standard matches
ascorbic acid + paracetamol
caffeine + paracetamol
diphenhydramine + paracetamol
domperidone + paracetamol
isometheptene + paracetamol

oral
other...

Commonly prescribed matches	oral	This example is not recommended because the selected drug is not visible and the user would have to scroll down in the first list to see it (MSP-0920)
paracetamol	rectal	
paroxetine	intravenous infusion	
paracetamol + phenylephrine	other...	
paracetamol + pseudoephedrine		
paracetamol + tramadol		
aspirin + paracetamol		
paroxetine *Standard matches*		
caffeine + paracetamol		
ascorbic acid + paracetamol		
diphenhydramine + paracetamol		
domperidone +		

1

dil 🔍

Commonly prescribed matches

diltiazem

Standard matches

diloxanide

diltiazem – DILCARDIA

diltiazem – DILZEM SR

diltiazem – DILZEM XL

oral

rectal

intravenous infusion

other...

2

🔍

tches

tches

oral

rectal

intravenous infusion

other...

modified-release oral solid

oral liquid

other...

In this correct example, the lists from which 'diltiazem' and 'oral' were selected are visible throughout the cascade selection (MSP-0920)

1	2

1

dilt 🔍

Commonly prescribed matches

diltiazem

oral

rectal

intravenous infusion

other...

2

🔍

tches

oral

modified-release oral solid

oral liquid

other...

This example is not recommended because the lists from which 'diltiazem' and 'oral' were selected are not visible (MSP-0920)

1	2

This example is not recommended because the lists from which 'diltiazem' and 'oral' were selected are not visible (MSP-0920)

Rationale

Design Analysis – List Widths:

When a search results list is displayed without a cascaded list, there is no need to restrict the width of the list to accommodate the cascading lists that are not yet displayed. By allowing the full width available in the prescribing area to be used, the risks associated with wrapping drug names are mitigated as far as possible. Once a selection has been made, and a cascaded list is displayed, the search results column can narrow so that the cascaded list can appear in a consistent place (MSP-0900). When this narrowing happens, the drug selected in the search results should remain visible. In some unusual cases, this may require a scroll bar to be introduced (as if the list had been manually extended, see section 5.3.6) and the drugs originally at the top of the list may be scrolled out of view.

Reducing the width of the search results list may cause drug names to wrap and the limited height may then cause fewer matches to be visible than before the cascaded list appeared. The loss of visibility of the last few items in that search results list is outweighed by the benefit of providing visibility of, and access to, the search results list whilst selections are made in the cascading lists. It is expected that a prescriber will rarely return to the search results list to select an alternative drug after already selecting options in the cascading lists.

This approach to managing the width of the search results lists avoids the following potential risks:

- Truncation of drug names (see *Medications Management – Medication Line* **{R3}**) or items in cascading lists

- The unnecessary partial display (partially off-screen) of a cascading list as a result of limited screen space, when a reduced width search results list would bring the cascading list back into view

When a cascading list is presented with options that are not expected (because of a mis-selection) the intended selection is still visible, thus allowing the mistakes to be confirmed

Design Analysis – Maintaining Visibility of Selections:

Keeping the selection lists open as prescribers make their selections allows them to continue seeing their selections in context (MSP-0910, MSP-0920). Visibility of both the list and their selection may improve the speed at which prescribers notice when they have mis-selected. The list that is presented after a selection has been made is also providing visual feedback. When this list does not present the options expected, it is even more likely to help the prescriber spot a mis-selection.

Keeping the cascading lists open so that selections are displayed within the list from which they were selected achieves the following:

- Provides positive feedback for the selection

- Improves feedback for mis-selections since the intended selection is still visible (but not selected or highlighted)

- When a cascading list is presented with options that are not expected (because of a mis-selection) the intended selection is still visible, thus allowing the mistakes to be confirmed and corrected quickly

- Cascading lists also enhance a sense of place and provide feedback for progress through the simple two to three-step selections

The cascade select approach is designed to keep the right balance between:

- A system that allows medications to be prescribed with an absolute minimum of interaction

- A system that mitigates the risks of being able to complete a prescription without paying enough attention to the details

Cascading lists guide selections in such a way that reduces the potential for mistakes and inappropriate selections.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Help users recognise, diagnose and recover from errors – By retaining the cascading lists open even when a selection has been made, and ensuring that they are not obscured, users can see their selection within the context of the list it was selected from and have a greater opportunity to notice when they have mis-selected

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:
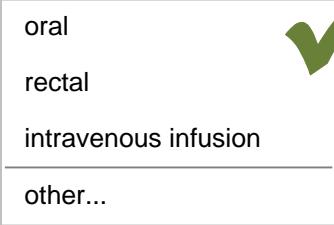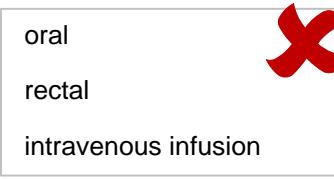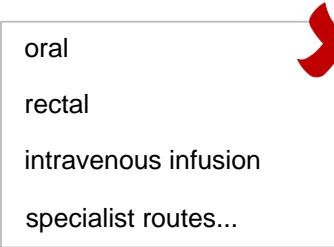
Potential Hazards:	Mitigations:
- A prescriber mis-selects a prescription element because lists contain too many similar options	- MSP-0920 requires that selections in cascading lists remain visible until the last cascading list (until template prescriptions are presented or fields are presented step by step)
- A selection list in the prescribing area may obscure important information in a list of current medications	- Pressing the ESC key or clicking outside of a list are mechanisms that can be used to close a list without making a selection (see section 9.3.1)
	- Selection lists can collapse once a selection has been made if necessary to preserve visibility of other information (MSP-0920)
- Selections in the search results list and cascading lists are mis-interpreted because they are not (or may not be) horizontally aligned	- **This risk is not wholly mitigated by guidance**
	- The cascading list that is displayed on selection contains only options that are relevant to the selection and thus may not contain the expected options (see section 6.3.1) in the event of a mis-selection
	- Cascading lists are presented one at a time after a selection has been made in the previous list (see section 6.3.1)
	- When space is limited such that cascading lists obscure other information, the list collapses (MSP-0920)
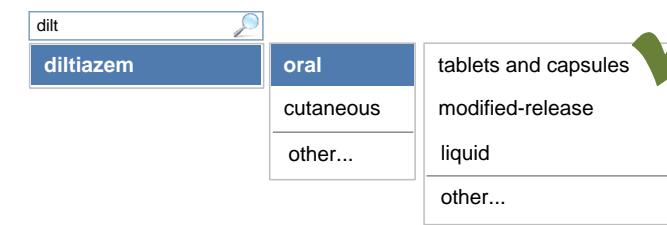
6.3.3 Contents of Cascading Lists

Drug search results, cascading lists and other selection lists can be divided into sections in order to bring prioritised list items to the top of a list. See section 5.3.12 for guidance on prioritisation within a search results list and section 9.3.3 for guidance on prioritisation within selection lists used as input controls.

ID	Guideline	Conformance	Evidence Rating
MSP-0940	Include a list item in each cascading list that provides access to values that are not in the list (where they exist)	Mandatory	Medium
MSP-0950	Place the list item that provides access to values that are not in the list last in the list and separate it from the rest of the list items with a horizontal line	Mandatory	Medium
MSP-0960	Do not provide keyboard shortcuts for the item that provides access to values that are not in the list	Mandatory	Medium
MSP-0970	Where relevant, allow a selection to be made from a cascading list that differentiates preparations with different bio-availability properties (such as modified release)	Recommended	Medium
Usage Examples			

oral rectal intravenous infusion other... ✔	In this correct example, the cascading list includes a list item ('other…') that provides access to other values that are not in the list and this list item is separated from the main list with a horizontal line (MSP-0940, MSP-0950)
oral rectal intravenous infusion ✘	This example is incorrect because the cascading list does not include a list item ('other…') that provides access to other values that are not in the list (MSP-0940)
oral rectal intravenous infusion specialist routes... ✘	This example is incorrect because the list item ('other…') that provides access to other values that are not in the list is not separated from the other options in the list with a horizontal line (MSP-0950)

In this correct example, the selection list differentiates between modified-release and non-modified release preparations (MSP-0970)

Rationale

Design Analysis:

Cascading lists are designed for quick and safe selection of drugs and other attributes. Supplementing these lists with a 'catch-all' option allows the same process to remain effective for unusual and specialist prescribing. This approach allows the selection of unlisted options or unusual combinations (for example, unusual route and form combinations) at every step of the process.

The provision of a list item that provides access to values that are not in the list (MSP-0940) provides an exit from the step-by-step approach of the cascading lists that takes the prescriber directly to a detailed prescription form. This approach allows unusual and specialist prescribing to be accommodated within the same process as more common prescribing.

Cascading lists should be used to differentiate modified-release preparations from non-modified-release preparations (MSP-0970). This avoids the display of a list of template prescriptions that contains a mixture of modified-release preparations and non-modified-release preparations.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- User control and freedom – The 'catch all' option allows the user to access less frequently used options and to switch to viewing a prescription form earlier in the process

User Research:

Study ID 46 (see APPENDIX E) recommends avoiding the display of lists containing both modified-release and non-modified-release templates.

6.3.4　Providing Cascading Lists for Brands

When a prescriber selects a brand name from a search results list, there are three possible types of match that affect the options that should be available from the subsequent cascading list:

1. On selection of a brand name that does not have a generic name (such as DIORALYTE or GAVISCON) cascading lists (such as route and form) will be displayed in the same way as those presented for generic drugs. A cascading list may not need to be presented if the brand name is for a single drug or group of drugs that do not need further attributes in order to determine the type of medication (and thus which fields are required). See Figure 13

2. On selection of a brand name that does have a generic equivalent, a cascading list containing both the brand selected and generic equivalents should be displayed. See Figure 14

3. On selection of a brand name for which the display (and selection) of a generic equivalent is not recommended (for example, because an equivalent may not be truly bio-equivalent), cascading lists will be displayed for the brand only. See Figure 15

These three cases are illustrated in Figure 13, Figure 14 and Figure 15:

| dio | 🔍 |

| **loperamide** – DIOCALM ULTRA |
| **loperamide** – DIOCAPS |
| **docusate** – DIOCTYL |
| **hydrocortisone** – DIODERM |
| **valsartan** – DIOVAN |
| DIOCALM |
| DIOCALM COMPLETE |
| DIORALYTE |
| DIORALYTE EFFERVESCENT |
| DIORALYTE RELIEF |

| DIORALYTE – oral |
| other... |

Figure 13: Selection of a Brand Name That Does Not Have a Generic Name

| teno | 🔍 |

| **tenofovir** |
| **tenoxicam** |
| **emtricitabine + tenofovir** |
| **chlortalidone + atenolol + co-tenidone** – TENORET |
| **chlortalidone + atenolol + co-tenidone** – TENORETIC |
| **atenolol** – TENORMIN |

| **atenolol** – oral |
| TENORMIN – oral |
| other... |

Figure 14: Selection of a Brand Name That Has a Generic Equivalent (That Is Recommended to Display)

| dil | 🔍 |

| *Commonly prescribed matches* |
| **diltiazem** |
| *Standard matches* |
| **diloxanide** |
| **diltiazem** – DILCARDIA |
| **diltiazem** – DILZEM |
| **diltiazem** – DILZEM SR |
| **diltiazem** – DILZEM XL |

| DILZEM SR – oral – modified-release |
| other... |

Figure 15: Selection of a Brand Name for Which There Are No Generic Equivalents (That Are Recommended to Display)

ID	Guideline	Conformance	Evidence Rating
MSP-0980	When a brand name is selected for which generic equivalents are available, present a cascading list that includes options for the selected brand and for generic equivalents	Mandatory	Medium
MSP-0990	When a brand name is selected for which there are no generic equivalents displayed, present template prescriptions for the brand (or proceed to a step-by-step approach)	Mandatory	Medium
MSP-1000	When a cascading list is presented that includes options for the selected brand and for generic equivalents, include the drug names (generic and brand respectively) in the cascading list	Recommended	Medium
MSP-1010	When a cascading list includes options for the selected brand and for generic equivalents, divide the list into two parts	Recommended	Medium
MSP-1020	Display generic equivalent options above specific brand options in cascading lists	Recommended	Medium

Usage Examples

In this sequence of correct examples (MSP-0980, MSP-0990 MSP-1000, MSP-1010):

1. The brand 'TENORMIN' is selected in the search results list

2. A cascading list with two parts is presented with options for generic equivalent drugs first and options for the specific brand second.

teno 🔍		This usage example is incorrect because a (recommended) generic equivalent exists and has not been displayed (MSP-0980)
tenofovir	TENORMIN – oral	
tenoxicam	other...	
emtricitabine + tenofovir		
chlortalidone + atenolol + co-tenidone – TENORET		
chlortalidone + atenolol + co-tenidone – TENORETIC		
atenolol – TENORMIN		

teno 🔍		This example is not recommended because the generic equivalent options have been displayed below the branded options in the cascading list (MSP-1020)
tenofovir	TENORMIN – oral	
tenoxicam	**atenolol** – oral	
emtricitabine + tenofovir	other...	
chlortalidone + atenolol + co-tenidone – TENORET		
chlortalidone + atenolol + co-tenidone – TENORETIC		
atenolol – TENORMIN		

Rationale

Design Analysis:

Prescribers may search by brand name because they want to prescribe that specific brand or because they want to find out the generic name and then prescribe an equivalent (see section 5.3.7). When a brand name is selected in the search result list, the prescriber has the following choices:

1. Proceed with prescribing that specific brand

2. Prescribe a generic equivalent

3. Type in text to search for the generic drug name and select it from the search results list (cascading lists will then include options that may not be equivalent to the brand that was searched for originally)

After selections are made from the cascading lists, template prescriptions will be displayed and these may include brand names even if the selections so far have been generic.

Guidance balances the need to be able to prescribe a generic equivalent to a brand name with the need to look up the generic name of a branded drug. It achieves the following:

- Provides easy access to prescribing a generic equivalent (MSP-0980)

- Allows the generic name to be discovered

- Mitigates the risk that the prescriber will search for a brand and then 'switch' to prescribing the generic drug without understanding that the generic is not equivalent

The following alternative design approaches were assessed:

- Reverting to the generic drug name (where one exists) when a brand is selected from the search results list

- Displaying the brand and generic equivalents in a cascading list when a brand is selected from the search results list (this is the recommended approach)

- Displaying the brand and generic drug (not necessarily equivalent to the brand) in a cascading list when a brand is selected from the search results list

- Displaying brands in the search results list such that they cannot be selected

- Not displaying brands (for which there are generic drug names) in the search results list such that every prescription must start with a generic drug (or brand for which there is no generic drug)

Guidance maintains a balance between an approach that forces the prescriber to start again by searching for the generic name and one that avoids the need for a second search when the prescriber wants to switch to a generic equivalent.

In some instances, the selection of a brand name in the search results may be followed by the presentation of a cascading list that only contains a brand. This simply re-confirms the selection of a brand and clearly communicates that there are no equivalents to display.

The following scenarios are possible on selection of a brand name in a search results list:

- Template prescriptions are displayed for the branded drug. The prescriber selects a template prescription or returns to the search input box and searches for the generic name

- The next required fields are presented step by step for the branded drug. The prescriber completes those fields or returns to the search input box and searches for the generic name

- A cascading list is displayed that shows the branded drug and one generic equivalent. The prescriber can continue with the brand or can select the generic equivalent to prescribe generically or to see a list of template prescriptions containing alternative (and equivalent) brands

- A cascading list is displayed that shows more than one branded drug and more than one generic equivalent. The brands and equivalents should be supplemented with information (such as route and form) that allows the prescriber to differentiate these products

Prescribing a generic equivalent may not be a valid choice if all possible prescriptions for the selected brand name require a brand to be specified as part of the prescription.

Once a selection has been made in the cascading list, the next step is the same as if a generic name had been selected in the search results list: template prescriptions are displayed (MSP-0990) and a step-by-step approach may used to complete the prescription (see section 7.3.6).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- User control and freedom – By displaying generic equivalents, the user can choose to switch to generic prescribing (instead of prescribing the specific brand) without having to search for the generic name

- User control and freedom – The guidance promotes generic prescribing whilst allowing the user to search for and prescribe by brand at this stage as well as at later stages of the prescribing process

- Flexibility and efficiency of use – By allowing a brand to be selected and providing an opportunity to switch to a generic equivalent without introducing any further steps, the need to start a new search is avoided thus making the process more efficient

User Research:

Study ID 46 (see APPENDIX E) elicited feedback on alternative design approaches for selecting a brand name and proceeding through to a prescription form. The findings confirmed that the display of a mixture of template prescriptions for both the specific brand and for the generic drug increased the risk of confusion and misinterpretation. Guidance for cascading lists thus ensures that the choice between a specific brand and a generic equivalent is made before template prescriptions are displayed (MSP-0980, MSP-0990).

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ Prescriber searches for a brand name and then prescribes a generic name thinking that the generic is equivalent	■ **This risk is not wholly mitigated by guidance**
	■ Only options for the specific brand and generic equivalents for that specific brand should be presented in cascading lists when a brand name is selected in search results (MSP-0980)

> **Note**
>
> This is a partial mitigation since in some cases a generic name will be pharmaceutically equivalent but not bioequivalent.

7 GUIDANCE DETAILS FOR REQUIRED ATTRIBUTES

7.1 Introduction

The selection of a drug name and some other attributes in cascading lists allows the system to determine the type of drug being prescribed. The definition of the remaining required attributes can be made easier by presenting options that are only relevant to the selected drug type. Template prescriptions (order sentences) are predefined and partially completed prescriptions that allow several attributes to be defined with a single selection from a list.

In the absence of template prescriptions, a prescription can be defined using the step-by-step approach or the full prescription form. In a step-by-step approach some or all of the remaining required fields are presented and completed one by one. Guidance for the step-by-step approach and the remaining steps is covered in section 9.

Figure 16 shows the full user interface prescribing process in which the steps covered in this section are shown with a grey background:
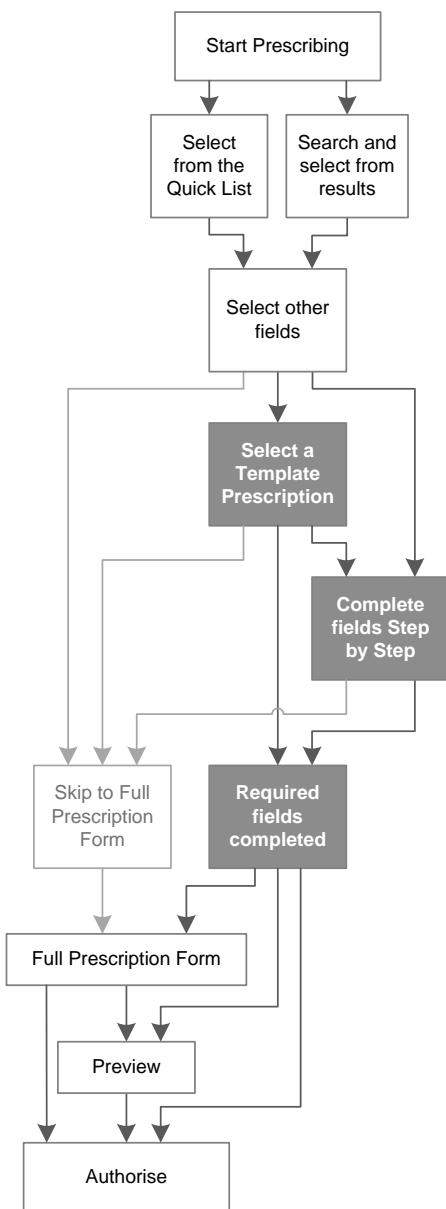
Figure 16: The Prescribing Process – Select a Template Prescription

Figure 17 is an extract from Figure 5 to illustrate the user interface prescribing steps that are covered in this section showing the template prescriptions step and links to and from other steps:
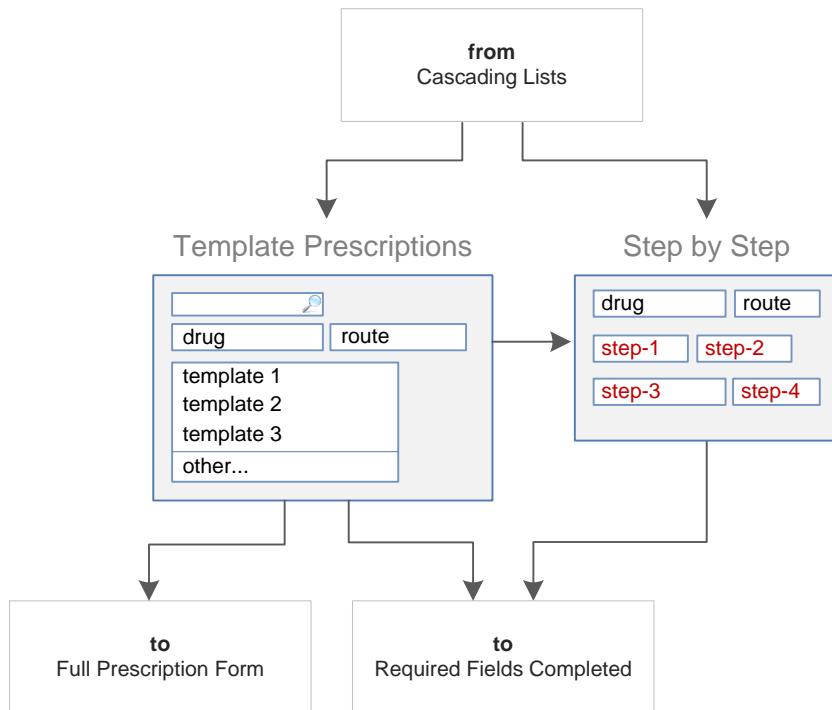
Figure 17: User Interface Prescribing Steps for Completing Required Fields – Template Prescriptions and Step by Step

7.2   Principles
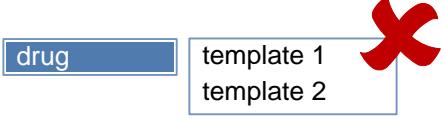
All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Increase efficiency by prioritising the prescription of commonly prescribed medications over less commonly prescribed medications:
  - Template prescriptions are a means of defining commonly prescribed regimens so that many prescription values can be defined with a single selection

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries:
  - The provision of template prescriptions reduces the number of individual selections that need to be made for a prescription and provides access to combinations of values that are unlikely to be invalid
  - Template prescriptions can be used to display standard regimens that an organisation may wish to promote

- Encourage simplicity of design by promoting user interface approaches that help to avoid overly complex displays and interactions that require many controls:
  - Template prescriptions allow several values to be selected at once and those options are displayed in a format similar to a final prescription

- Maximise scalability such that the prescribing process can be modified to accommodate additional information, steps or shortcuts:

- - Template prescriptions can contain whichever values are most useful or relevant and can be supplemented with descriptive text if necessary

- Adhere to a user interface strategy that gives the impression of making progress within a single space (which has all the necessary information immediately or readily available) and avoids the impression of needing to move between many different spaces:

  - As with drug search results and cascading lists, template prescriptions are presented within the same space as a prescription is built up

7.3　Guidelines

7.3.1　Displaying Template Prescriptions

ID	Guideline	Conformance	Evidence Rating
MSP-1030	Require at least drug name and route (or attributes from which the type of medication can be derived) to be selected before template prescriptions are displayed	Mandatory	High
MSP-1040	Display template prescriptions only after selections have been made (manually or automatically) in all other cascading lists	Mandatory	Medium
MSP-1050	Keep the number of template prescriptions displayed to a practical and useful minimum	Recommended	Medium
Usage Examples			

In this correct example, at least drug name and route (or attributes from which the type of medication can be derived) are selected before template prescriptions are displayed (MSP-1030)

In this correct example, at least the drug name and one other option (from which the type of medication can be derived) are selected before template prescriptions are displayed (MSP-1030)

This correct example is an alternative to the previous usage example.

This example is incorrect because template prescriptions are displayed immediately after the drug name. At least one other option (from which the type of medication can be derived) must be selected before template prescriptions are displayed (MSP-1030)

drug | option 1 / option 2 / option 3 | template 1 / template 2 / template 3 / template 4 / template 5

This example is incorrect because template prescriptions are displayed even though a selection has not yet been made from the cascading list (containing 'option 1, option 2, option 3') (MSP-1040)

Rationale

Design Analysis:

Cascading lists are designed to create a quick, two or three step series of selections so that the type of medication can be determined and then either template prescriptions (if available) or a series of further fields (such as dose, frequency and duration) can be presented step by step. After the cascading lists have succeeded in helping the prescriber quickly establish the type of medication being prescribed, they are not needed for the remaining attributes. By using the cascading lists to determine the type of medication (MSP-1030, MSP-1040), the list of possible template prescriptions will be as short as possible. Hence, the principle of selecting from short lists of options can continue with the selection of a template prescription.

Template prescriptions are a means of improving the efficiency of the prescribing process by allowing a number of values to be selected with a single selection. They are also a means of providing access to prioritised sets of values for drugs that are commonly prescribed and, conversely, demoting access to less frequently selected values and combinations.

As with Quick Lists, search results and cascading lists, a list of template prescriptions needs to be kept short to improve efficiency and minimise opportunities for mis-selection (MSP-1050).

Desk Research:

In *Using information technology to reduce rates of medication errors in hospitals* **{R32}**, the use of an ePrescribing system is reported to improve safety by:

- Introducing template prescriptions that include dose route and frequency
- Ensuring that all (prescriptions) are legible and that the prescriber can be identified
- Providing information to the prescriber during the process
- Checking all prescriptions for a number of problems including allergies, drug interactions, overly high doses, drug-laboratory problems and whether the dose is appropriate for the patient's liver and kidney function

A later study, reported in *Prescribing errors in hospital inpatients: their incidence and clinical significance* **{R33}**, found errors in 1.5% of the 36,200 medication orders that were analysed. Most of the errors (54%) were associated with choice of dose. Errors such as the following two (as quoted from the study) could potentially have been mitigated by the provision of template prescriptions:

- 'An elderly patient was prescribed 10 ml IV diazepam (equivalent to 50 mg) to be given when required, instead of the intended 10 mg'
- 'Captopril 250 mg twice daily was prescribed when 25 mg twice daily was intended'

The *ePrescribing Functional Specification* **{R12}** requirement GEN.OS.040 states that a prescribing system must support the selection of a treatment option according to predefined regimens (such as template prescriptions).

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Error prevention – Template prescriptions are displayed only when enough information has been selected from cascading lists so that the list of template prescriptions will be as short as possible thus helping to avoid mis-selection
- Flexibility and efficiency of use – Shorter lists of template prescriptions also lighten the cognitive load of reviewing and selecting from the list

User Research:

All 14 participants in Study ID 69 (see APPENDIX B) understood what the template prescriptions were when they were presented after a drug and route had been selected. The interpretation of template prescriptions is influenced by their contents, the way in which displayed (and formatted) and the point at which they are presented (MSP-1040).

In Study ID 46 (see APPENDIX E) participants reviewed alternative designs in which the template prescriptions were displayed at various stages of the prescribing process, with as little as just the drug name or as much as the drug, route and form being selected before template prescriptions were displayed. The study findings include a recommendation for the approach in which the drug and route are selected before template prescriptions are displayed (MSP-1030).

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A template prescription with an unlicensed dose is selected and prescribed inappropriately	■ **This risk is not mitigated by guidance**
■ A large number (such as 25) of template prescriptions causes a prescriber to select the first one in the list without reading the full list	■ The number of template prescriptions presented in one list is limited by the selection of drug name and further attributes (that define the type of medication) in cascading lists (MSP-1030, MSP-1040) ■ MSP-1050 requires the number of templates prescriptions in a list to be limited
■ A prescriber selects an inappropriate template prescription on the assumption that the template prescriptions presented have been validated against information (such as age, weight, test results, diagnoses and so on available in the patient record	■ **This risk is not mitigated by guidance** ■ Mitigations for this risk are out of scope, see section 1.2.2
■ A prescriber selects the template prescription from the top of the list without reviewing the alternatives	■ **This risk is not mitigated by guidance**

7.3.2   Displaying a Selection Trail

ID	Guideline	Conformance	Evidence Rating
MSP-1060	When a selection has been made in the last cascading list, display a selection trail	Mandatory	Medium
MSP-1070	Where space is limited such that text within the list of template prescriptions may wrap onto a new line, display the whole list of template prescriptions on a new line (below the other input controls)	Mandatory	Medium
MSP-1080	When an item in a selection trail is selected, reopen the lists for all the items in the selection trail	Recommended	Medium
MSP-1090	When lists are reopened before a template prescription has been selected, remove the list of template prescriptions from view	Recommended	Medium
MSP-1100	When lists are reopened, display them all as they were before the template prescriptions were displayed	Recommended	Medium
Usage Examples			

In this correct example, a selection trail consisting of a text box for each selection (drug name and route) is displayed and template prescriptions are shown to the right of the selection trail (MSP-1060)

cla	🔍

clarithromycin	oral	DOSE **250 mg** twice a day
		DOSE **500 mg** twice a day
		other...

cla 🔍

clarithromycin   oral

DOSE **250 mg**	twice a day
DOSE **500 mg**	twice a day
other...	

✔

In this correct example in which space is limited, a selection trail consisting of a text box for each selection (drug name and route) is displayed and template prescriptions are displayed below the selection trail (MSP-1060, MSP-1070)

---

cla 🔍

clarithromycin > oral

DOSE **250 mg**	twice a day
DOSE **500 mg**	twice a day
other...	

✖

This example is incorrect because the selections made in the search results list and two cascading lists are not displayed as text boxes (MSP-1060)

1

cla 🔍

clarithromycin   oral

DOSE **250 mg**	twice a day
DOSE **500 mg**	twice a day
other...	

2

cla 🔍

	Commonly prescribed matches
clarithromycin	
	Standard matches
cladribine	
clavulanic acid + ticarcillin	
cefotaxime – CLAFORAN	
co-cyprindiol – CLAIRETTE	*cyproterone + ethinylestradiol*
azithromycin – CLAMELLE	
clobetasol – CLARELUX	
loratadine – CLARITYN	
sodium cromoglicate – CLARITYN	
clarithromycin – CLAROSIP	
Showing 10 of 14 matches	Show All

| oral |
| oral – modified-release |
| intravenous – infusion |
| other... |

✔

1 **2**

In this sequence of correct examples (MSP-1080, MSP-1090):

1. A selection has been made in the only cascading list and template prescriptions are displayed

2. The selection of an item ('oral') in the selection trail causes both cascading lists to reopen and template prescriptions are removed from view, such that the cascading lists are displayed as they were before the template prescriptions were first displayed.

Rationale

Design Analysis:

Selections made in cascading lists are designed to allow the type of medication to be determined quickly so that a minimum set of required fields can then be displayed. Selections in cascading lists need to be made quickly and accurately. The efficiency of those selections is improved by keeping the lengths of the lists to a minimum. The selection trail (MSP-1060) is designed to improve accuracy by making it easier to notice and to change mis-selections whilst directing attention on the next step.

The selection list provides immediate access to the selections and the lists from which they were selected, thus increasing the chances that the mis-selection is noticed.

The selection trail was assessed alongside alternative approaches that required navigational controls (such as those needed when moving from one page to another). These controls (such as back and forward buttons) were assessed as an alternative means of moving from the process of selecting from cascading lists to the process of selecting a template prescription and vice versa.

The following disadvantages are associated with an approach that requires navigational controls:

- It introduces unnecessary segmentation of the information that can be effectively displayed on screen simultaneously
- Additional controls (such as back and forward buttons) are needed for the approach to be effective
- Moving from one screen to another creates the perception of greater complexity and has a slower response time compared to a series of steps that can be completed in one place and that remain visible and directly accessible

An approach in which an 'undo' control is provided has similar constraints. The provision of an 'undo' control is unnecessary provided the prescriber has visibility of, and direct access to, values already entered into controls so that they can be changed. (MSP-1080, MSP-1090, MSP-1100).

Desk Research:

The selection trail, the re-display of cascading lists and the ability to edit any value entered into an input control are examples of supporting 'undo'. *About Face: The Essentials of Interaction Design* **{R34}** describes the principle of supporting reversal or change of one or more previous actions in a way that enables exploration and avoids implying a user failure.

GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers refers to the principle of 'display inertia'. This principle suggests that when a display is updated to show the effect of a user's actions, the changes should be minimised such that as much of the display as possible remains unchanged. This principle is reflected by guidance that recommends a solution that does not depend on navigation controls (and thus an implied presentation of a new display) **{R35}**.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A drug name is mis-selected in the search results list	■ **This risk is not wholly mitigated by guidance**
	■ The list is limited in length (see section 5.3.5) and progressive matching is recommended (see section 5.3.3) to encourage selection from shorter lists
	■ Search results are prioritised (see section 5.3.12) and listed in matched order before alphabetical order to maximise logical grouping (see section 5.3.8)
	■ Cascading lists are kept open, such that each selection is visible in the context of the list from which it was selected, until enough attributes have been selected to be able to determine the type of medication and to display template prescriptions (MSP-1080 and see section 6.3.1)
■ One or more attributes of a template prescription are mis-read because it wrapped onto a new line	■ Template prescriptions can be displayed at the beginning of a new line after selections have been made from cascading lists (MSP-1070)
	■ Attributes can be combined into a single column to reduce the number of columns (and thus the width of the template prescriptions) and medication line style can be used when space is limited (see section 7.3.3)
	■ Dose is always displayed at the beginning of a template prescriptions and is thus always consistently placed (see section 7.3.3)
	■ The number of attributes defined by a template prescription should be kept to a minimum (see section 7.3.4)

7.3.3   Template Prescription Layout

ID	Guideline	Conformance	Evidence Rating
MSP-1110	Present template prescriptions in a list without column headings	Mandatory	Medium
MSP-1120	Where necessary, combine attributes into a single column to reduce the number of columns	Recommended	Medium
MSP-1130	Display dose or a dose equivalent at the beginning of each template prescription	Mandatory	Medium
MSP-1140	When space is limited, display template prescriptions in the style described in *Medications Management – Medication Line* **{R3}**	Recommended	Medium
MSP-1150	Do not allow horizontal scrolling of a list of template prescriptions	Mandatory	Medium

Usage Examples

Dose	Form	Frequency
DOSE 2.5 mg	tablet	once only
DOSE 5 mg	oro-dispersible tablet	once only
other...		

This example is incorrect because the template prescriptions are displayed in a table with column headings (MSP-1110)

---

paracetamol | oral

DOSE 500 mg	four times a day
DOSE 1 g	oral solution – four times a day
other...	

In this correct example, attributes for form and frequency are displayed in the same column since only one of the template prescriptions has a form (MSP-1120)

---

paracetamol | oral

DOSE 500 mg		four times a day
DOSE 1 g	oral solution	four times a day
other...		

This example is not recommended because form ('oral solution') is displayed in a separate column and the first template prescription does not have a form (MSP-1120)

DOSE 2.5 mg	tablet	once only
DOSE 5 mg	oro-dispersible tablet	once only
other...		

In this correct example, the template prescriptions are presented in a list without column headings and dose is displayed at the beginning of the column (MSP-1110, MSP-1130)

DOSE **2.5 mg** – tablet – once only DOSE **5 mg** – oro-dispersible tablet – once only other... ✔	In this correct example of a list of template prescriptions displayed in a constrained space, the template prescriptions are displayed in the style of a medication line and the number of columns has been kept to a minimum (MSP-1140, MSP-1120)
morphine modified-release DOSE **10 mg** MST CONTINUS *12-hourly preparati* DOSE **10 mg** MXL *24-hourly preparati* DOSE **10 mg** ZORMORPH *12-hourly preparati* other... ✘	This example is incorrect because a horizontal scroll bar has been used in a list of template prescriptions (MSP-1150)

Rationale

Design Analysis:

Template prescriptions include different attributes depending on the type of medication (determined by selections made in the preceding cascading lists). For example, the template prescriptions for a fluid may contain volume and rate whilst the template prescriptions for a modified-release product may include a brand name.

The following three designs with varying levels of structure were compared:

- A table with many columns, each displaying one attribute of the template prescription
- A table in which there are fewer columns and some columns contain more than one attribute
- A list (in a single column) in which each line item was displayed as a medication line, thus combining all the attributes for the template prescription into one line

Template prescriptions are displayed in a list rather than a table (MSP-1110) in order to maximise the use of space. *Medications Management – Medications List* **{R1}** contains a more detailed analysis of the pros and cons of using a table with many columns versus using a more flexible layout in which attributes that could otherwise be displayed in separate columns are combined into a single column (MSP-1120). Horizontal scrolling in a list of template prescriptions introduces the risk that information is missed because it is off screen (to the right) and the presence of the scroll bar is not noticed (MSP-1150).

By using medication line style to group attributes into a single column and reduce the number of columns the following is achieved:

- Each template prescription can have a set of values for different attributes without creating blank cells. (Blank cells may be interpreted as a system error and thus need to be populated with null values so that the user knows they are intentionally blank)
- The list can be displayed in a smaller space (because there are no columns containing a value for only one item in the list and because each line can wrap)
- Template prescriptions can be displayed in a format similar to that of a medication line (MSP-1140)

Column headings for columns that contain more than one attribute are unlikely to be useful since they will need to have labels that describe the composite set of attributes rather than labels identifying specific attributes. For example, usage examples in *Medications Management – Medications List* **{R1}** show a column containing attributes such as drug name, dose, form and frequency that is labelled 'Drug Details'.

When a dose is displayed in a list of template prescriptions, it is preceded by a dose label. The other attributes in a template prescription should not need labels since the values of those attributes will be enough to identify them. The display of column headings would create a barrier between the list and the input control from which it was activated (and to which it will 'collapse'). The need to avoid this is considered to outweigh the benefits that the column headings and their labels can bring (MSP-1110).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – By using the medication line format to display template prescriptions the display is both more compact and more flexible (it can wrap) so less space is needed to display them
- Consistency and standards – Each template prescription begins with the dose (or equivalent) and it is recommended that template prescriptions are displayed following the same format as a medication line

User Research:

Study ID 46 (see APPENDIX E) found that the use of a table with many columns was preferred. The preference appears to come from the need to compare attributes between template prescriptions and to pick out specific information (such as dose) more easily. The examples used for testing showed template prescriptions in five columns and each template prescription included a minimum of four attributes and a maximum of six. The need to compare across template prescriptions may have been a reflection of the large number of columns and attributes in the template prescriptions used for testing.

The display of dose first (MSP-1140) helps to mitigate the concern that it may be difficult to compare important information between template prescriptions. Guidance allows the use of a limited number of columns so that attributes, such as dose, can be placed at the beginning of the text in a column and thus easily compared across template prescriptions.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
A template prescription is selected from a list with a horizontal scroll bar and one of the attributes being defined was missed because it was off screen	A horizontal scroll bar should not be used for lists of template prescriptions (MSP-1150)
A template prescription is selected based on reading the contents of a single column (for example, the dose column)	Template prescriptions are presented without column headings (MSP-1110) The number of columns is kept to a minimum (MSP-1130) Template prescriptions are displayed in the style of a medication line (MSP-1140) The number of attributes in a template prescription is kept to a minimum (see section 7.3.4)
A prescription is not wholly reviewed because the information is displayed in different formats, split across many different controls	Guidance recommends that the number of different types of controls are minimised, which reduces the different display formats (see section 8.1) Selection lists are used to combine values (such as those in a template prescription) and display them a format similar to that displayed in a medication line (MSP-1140) Guidance recommends combining controls into a single control (see section 9.3.1)
One or more attributes of a template prescription are mis-read because it wrapped onto a new line	Template prescriptions can be displayed at the beginning of a new line after selections have been made from cascading lists (see section 7.3.2) Attributes can be combined into a single column to reduce the number of columns (and thus the width of the template prescriptions) and medication line style can be used when space is limited (MSP-1120 and MSP-1140) Dose is always displayed at the beginning of a template prescriptions and is thus always consistently placed (MSP-1130) The number of attributes defined by a template prescription should be kept to a minimum (see section 7.3.4)

7.3.4   Contents of a Template Prescription

ID	Guideline	Conformance	Evidence Rating
MSP-1160	Display only template prescriptions relevant to the drug and selections from cascading lists	Mandatory	Medium
MSP-1170	Minimise (where possible, avoid) the number of template prescriptions that have only one attribute that is different from other template prescriptions in the same list	Mandatory	High
MSP-1180	Where possible include dose (or equivalent) and frequency in template prescriptions	Recommended	High
MSP-1190	Include strength in template prescriptions when it is required for this drug	Recommended	High
MSP-1200	Include brand in template prescriptions when it is required for this drug	Recommended	High
MSP-1210	When a template prescription includes supplementary information, display this information in grey italics	Recommended	Low
MSP-1220	Keep the number of attributes defined by a template prescription to a minimum	Recommended	Medium
MSP-1230	Include an option to proceed directly to the prescription form without selecting a template prescription	Mandatory	Medium
MSP-1240	Display the option for proceeding directly to the prescription form at the end of the list and separate it from the template prescriptions with a horizontal line	Mandatory	Medium

Usage Examples

zolmitriptan	oral

DOSE **2.5 mg**	tablet	once only
DOSE **5 mg**	oro-dispersible tablet	once only
other...		

✔

In this correct example, the template prescriptions shown are for the drug and route selected in the previous lists and the template prescriptions contain dose and frequency (MSP-1160, MSP-1180)

salbutamol	inhaled – metered dose inhaler

DOSE **2 puffs** – 100 micrograms per puff – four times a day – as required

DOSE **1 or 2 puffs** – four times a day – as required

other...

✖

This example is incorrect because this medication requires a strength and the last template prescription does not include a strength (MSP-1190)

diltiazem	oral – modified-release

DOSE **60 mg**	three times a day
other...	

✖

This example is incorrect because this medication requires a brand name and the first template prescription does not include a brand name (MSP-1200)

amitriptyline | oral

	DOSE **10 mg**	tablet	at night	*for irritable bowel syndrome*
	DOSE **25 mg**	tablet	at night	*for pain*
	DOSE **50 mg**	tablet	at night	*for depression*
other...				

In this correct example, the list of template prescriptions includes supplementary information that is displayed in grey italics and has an option for accessing the detailed prescription form that is displayed in a section separated by a horizontal line (MSP-1210, MSP-1230, MSP-1240)

Note

The supplementary information in this example helps to differentiate between template prescriptions that would otherwise only differ in dose (MSP-1170)

zolmitriptan | oral

| | DOSE **2.5 mg** | tablet | once only |
| | DOSE **5 mg** | oro-dispersible tablet | once only |

This example is incorrect because the list of template prescriptions does not include an option for accessing the detailed prescription form (MSP-1230)

Rationale

Design Analysis:

Template prescriptions are a means of completing several required fields (such as dose, frequency, strength and brand name) with a single selection and prioritising the selection of predefined (potentially more common and more appropriate) combinations of those required fields (MSP-1180, MSP-1190, MSP-1200). They can help to mitigate errors by presenting short lists of predefined sets of values (and thus valid combinations) that are commonly prescribed.

In some circumstances, it may be appropriate to prescribe some drugs (such as warfarin) without a specific dose value or equivalent. This is reflected in the conformance for guidance point MSP-1180 despite the high evidence rating.

Mis-selection errors in lists of template prescriptions can be reduced by ensuring that each template is sufficiently different from the other templates in the list. For example, a list containing four template prescriptions, each of which only has one digit difference in a strength or dose, creates a higher risk of mis-selection and should thus be avoided or at least minimised (MSP-1170).

A set of template prescriptions that contain many required values would create a complex list that would be more difficult to review and from which it would be harder to make an accurate selection. A list of template prescriptions should therefore remain simple if it is to be effective (MSP-1220).

The inclusion of dose in template prescriptions (MSP-1180) helps to mitigate the risk that an inappropriate dose is mistakenly entered. The drug name and route (or selections that can determine the type of medication) allow the system to determine appropriate template prescriptions to display and thus mitigate the risk that a dose is selected in error that was intended for a prescription of that drug by another route.

Desk Research:

An example of a prescribing error involving selection of an inappropriate dose is reported in *Prescribing errors in hospital inpatients: their incidence and clinical significance* **{R33}**: 'An elderly patient was prescribed 10 ml IV diazepam (equivalent to 50 mg) to be given when required, instead of the intended 10 mg.' This kind of error can be mitigated by the provision of a set of template prescriptions that include common dose values (MSP-1160).

The provision of template prescriptions may depend on a framework of medications types that can use a drug name and route (or form or similar attribute) to determine what other information is needed to safely describe that medication. In the UK, a framework for using the dm+d in the NHS is defined in *dm+d Implementation Guide (Secondary Care)* **{R4}**.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – Template prescriptions contain values for required fields in such a way that several required fields can be completed with a single selection

- Error prevention – The provision of template prescriptions for commonly prescribed sets of values may help to reduce mis-selection errors and mistaken combinations

- User controls and freedom – As with cascading lists, the user is not forced to select a template prescription and may choose to access a detailed prescription form instead of selecting a template prescription (MSP-1230)

User Research:

Study ID 46 (see APPENDIX E) included findings that relate to the display of modified-release and non-modified-release options in cascading lists and in template prescriptions. The findings included a suggestion to consider clarification of release times when displayed modified-release preparations. The use of supplementary text (MSP-1210) provides a means of achieving this.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
A template prescription is selected from a list of very similar template prescriptions	Template prescriptions that have only one attribute that is different from other template prescriptions in the same list should be minimised and where possible, avoided (MSP-1170)
A template prescription is selected based on reading the contents of a single column (for example, the dose column)	Template prescriptions are presented without column headings (see section 7.3.3)
	The number of columns is kept to a minimum (see section 7.3.3)
	Template prescriptions are displayed in the style of a medication line (see section 7.3.3)
	The number of attributes in a template prescription is kept to a minimum (MSP-1220)
An input control for a dose is displayed adjacent to an input control for a strength and causes the dose value to be interpreted as the strength or vice versa	Dose and strength can be entered by selecting a template prescription (MSP-1180, MSP-1190) or by selecting values for individual fields that are presented in sequence (see section 7.3.6). Thus they only appear adjacent after they have already been completed
	In sentence layout (when dose and strength are most likely to appear adjacent), guidance recommends that labels are incorporated into fields, so the dose label immediately precedes the dose value (see section 7.3.7)
	Guidance recommends that labels are used for all fields whose contents could be interpreted as belonging to a different control (see section 7.3.7)
	The dose field is always labelled (see section 9.3.6)
One or more attributes of a template prescription are mis-read because it wrapped onto a new line	Template prescriptions can be displayed at the beginning of a new line after selections have been made from cascading lists (see section 7.3.2)
	Attributes can be combined into a single column to reduce the number of columns (and thus the width of the template prescriptions) and medication line style can be used when space is limited (see section 7.3.3)
	Dose is always displayed at the beginning of a template prescriptions and is thus always consistently placed (see section 7.3.3)
	The number of attributes defined by a template prescription should be kept to a minimum (see section MSP-1220)

7.3.5 Maintaining Access to Template Prescriptions

ID	Guideline	Conformance	Evidence Rating
MSP-1250	After a template prescription has been selected, display editable pre-filled input controls for each of the data values defined by the template prescription	Mandatory	High
MSP-1260	After a template prescription has been selected (and one or more fields are displayed as a result) provide a control that allows the list of template prescriptions to be reopened	Mandatory	Medium
MSP-1270	After a template prescription has been selected, allow the selection of an alternative template prescription	Mandatory	Medium
MSP-1280	When the control for re-opening template prescriptions has focus or is activated, draw attention to the fields that are defined by the template prescriptions	Recommended	Medium
MSP-1290	When the template prescription control is selected, provide visual cues to draw attention to the fields that are defined by the template	Recommended	Medium
MSP-1300	When there are no template prescriptions to display and a known set of safe values are available (for example, for dose and frequency), present selection lists for those fields sequentially (step by step)	Recommended	Medium

Usage Examples

In this sequence of correct examples (MSP-1250):
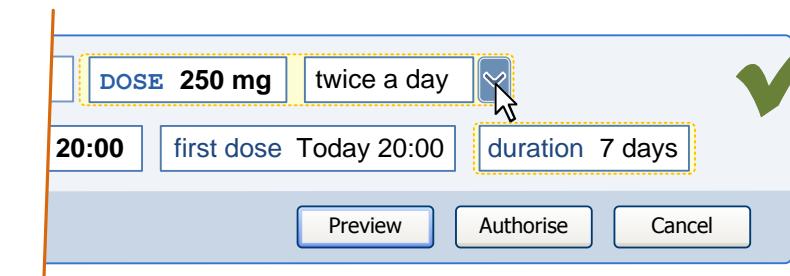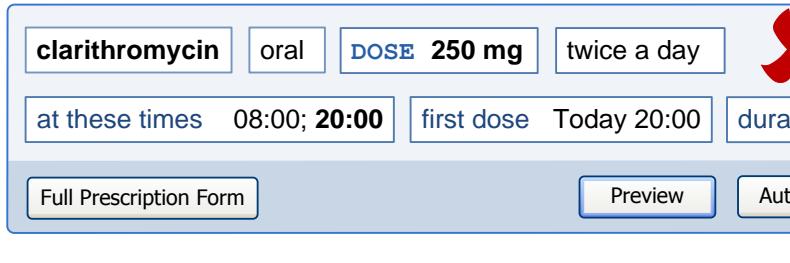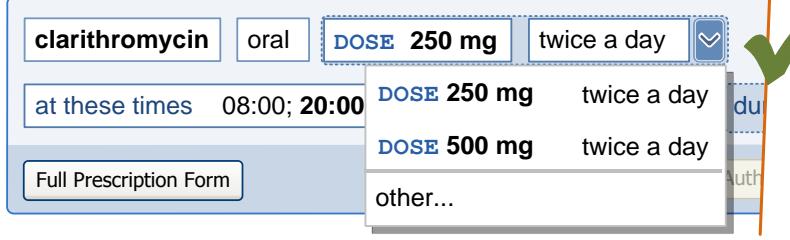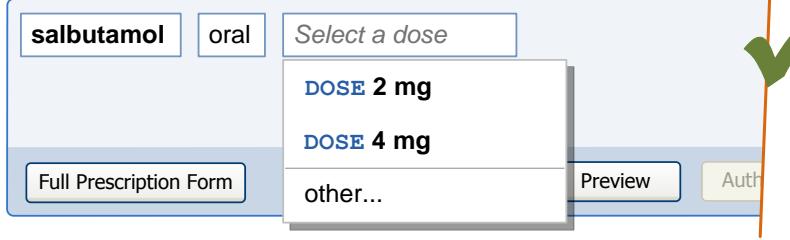
1. A list of template prescriptions is presented

2. A template prescription has been selected and the values it defined are displayed in individual, editable input controls.

3. The control for reopening the list of template prescriptions is selected and the list displayed.

Note

Selections in all fields can be altered, even when they were first populated by selecting from a cascading list (see section 7.3.2) or a list of template prescriptions (MSP-1250).

DOSE 250 mg	twice a day ⌄	In this correct example, the focus is on the control for reopening the list of template prescriptions and formatting has been used to draw attention to the fields that are defined by the template prescriptions (MSP-1260, MSP-1280)
20:00	first dose Today 20:00 duration 7 days	
	Preview Authorise Cancel	

DOSE 250 mg twice a day ⌄

20:00 first dose Today 20:00 duration 7 days

Preview Authorise Cancel

In this correct example, the focus is on the control for reopening the list of template prescriptions and formatting has been used to draw attention to the fields that are defined by the template prescriptions (MSP-1260, MSP-1280)

---

clarithromycin ⌄ oral ⌄ **DOSE** 250 mg ⌄ twice a…

Template Prescriptions ⌄ at these times 08:00; **20:00** ⌄

Full Prescription Form

In this correct example (in which the fields are styled as drop-down lists), a control is provided for reopening the list of template prescriptions (MSP-1260)

---

clarithromycin oral **DOSE** 250 mg twice a day ✗

at these times 08:00; **20:00** first dose Today 20:00 durati…

Full Prescription Form Preview Auth…

This example is incorrect because there is no control for reopening the list of template prescriptions (MSP-1260)

---

clarithromycin oral **DOSE** 250 mg twice a day ⌄

DOSE 250 mg	twice a day
DOSE 500 mg	twice a day
other...	

at these times 08:00; **20:0** …du…

Full Prescription Form Auth…

In this correct example, the list of template prescriptions has been reopened, the control is associated with the fields that are defined by the templates and formatting has been used to draw attention to the fields that are defined by the templates (MSP-1270, MSP-1290)

---

salbutamol oral *Select a dose*

DOSE 2 mg

DOSE 4 mg

other...

Full Prescription Form Preview Auth…

In this correct example, in which:

- there are no template prescriptions
- a list of commonly defined values for each attribute (such as dose) has been predefined
- the commonly prescribed values are dynamically filtered to display only values that are valid given values already defined in other attributes

Selection lists for fields are displayed sequentially (MSP-1300)

Rationale

Design Analysis:

When a template prescription is selected, more than one field is displayed and populated. If a mis-selection is made, the user needs to be able to re-present the list and make a new selection (MSP-1260, MSP-1270). Since the control for redisplaying a list of template prescriptions cannot be associated with a single field (because it affects more than one field), communication of the purpose of the control relies on:

- The time at which the control appears (after a template prescription has been selected)
- Its behaviour when the user interacts with it

The guidance thus recommends the use of formatting and visual cues to help the user to understand how to interact with the control, set expectations for what the control does and ensure that it is discoverable (MSP-1280, MSP-1290). It is anticipated that any unfamiliarity with this style of control may be overcome through initial usage or basic training.

When template prescriptions cannot be provided, the presentation of fields (and their selection lists) in sequence helps to reduce the options available in each list to those that are valid given the values that have been selected (or entered) so far (MSP-1300). See section 7.3.6 for further guidance on presenting fields step by step.

Desk Research:

Template prescriptions or order sentences are particularly useful at mitigating errors such as factor 10 errors in doses or selection of an incorrect frequency (such as four times a day instead of twice a day). In *Prescribing errors in hospital inpatients: their incidence and clinical significance* **{R33}**, errors in dose amounts and dose units were identified that may have been mitigated by the provision of template prescriptions. Template prescriptions can be effective when they present a predetermined set of common values, thus preventing the need for individual selection of attribute values (such as dose and frequency). They also help mitigate factor 10 errors in doses by supporting a standardisation of dosing.

In *Causes of prescribing errors in hospital inpatients: a prospective study* **{R36}**, an example of a slip **{R37}** is provided in which the prescriber changes values in fields (that have already been populated) and authorises the prescription with an unintended but valid combination of values. Template prescriptions allow sets of values to be selected so that a number of fields (such as dose and frequency) can be filled in at once. Filled in fields can then be changed individually. Providing a control that allows the list of template prescriptions to be re-opened may encourage prescribers to select an alternative template prescription, instead of editing individual fields, thus avoiding the kinds of errors reported by this study.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- User control and freedom – Ensuring that the user maintains control over selections and can 'go back' to select a alternative
- Flexibility and efficiency of use – The use of a template prescription as an accelerator

User Research:

Study ID 67 (see APPENDIX D) includes the recommendation that brand name should not be displayed in the working area of a prescription form unless it is mandatory. A brand name will generally be selected in a search results list or a template prescription, so when a brand name is mandatory (or has been explicitly selected) it will be known and displayed alongside the generic name in the 'read only' part of a prescription form. Thus a brand name is only likely to be changed by reopening a list of template prescriptions (MSP-1260) or by clearing the current drug and starting again (see section 8).

7.3.6 Presenting Fields Step by Step

Prescribing begins with the selection of a drug to prescribe and continues with further selections (from cascading lists and template prescriptions) to define the required attributes of the prescription. Once sufficient information has been defined to determine the type of medication being prescribed (and thus determine which other attributes will be needed), a more detailed prescription form can be displayed.

Figure 18 illustrates the process by which a system identifies which fields should appear in a prescription form:

1

dilt

Commonly prescribed matches

diltiazem

Standard matches

diloxanide

diltiazem – DILCARDIA

diltiazem – DILZEM SR

diltiazem – DILZEM XL

Preview   Auth

2

diltiazem

oral

oral – modified-release

rectal

intravenous infusion

other...

Full Prescription   Preview   Auth

3

diltiazem   oral – modified-release

DILZEM SR   **DOSE 60 mg**   three times a day

CALCICARD CR   **DOSE 90 mg**   three times a day

other...

Auth

4

diltiazem   oral – modified-release   **DOSE 60 mg**   twice a da

DILZEM SR   ⌄   at these times   08:00; 14:00; **20:00**   first dos

Full Prescription Form   Preview   Autho

Figure 18: User Interface Example for Identifying Required Fields

The sequence of events shown in Figure 18 is as follows

1. A drug name is selected

2. A list of other attributes relevant to that drug (including a route) are displayed in a cascading list

3. Using the drug name and selection in the cascading list, the system can determine the type of medication (such as 'oral — modified-release') and use this to display available template prescriptions (if there are any)

4. When enough attributes have been defined by selecting a template prescription (or by completing fields such as dose and frequency step by step), the remaining required fields can be presented. The required fields are determined based on the type of medication. For example, an 'oral — modified-release' medication may have the following required fields:

    a. Drug name

    b. Brand name

    c. Route

    d. Dose

    e. Frequency

    f. Administration times

    g. Time of first dose

    h. Duration

Table 8 shows a notional example of the different sets of required fields that might be identified for four types of medication. The four types are determined by the combination of drug name and selections made in cascading lists.

Field	Drug A	Drug B	Drug C	Drug D
Generic Drug Name	**Required**	**Required**	**Required**	**Required**
Brand name	*Optional*	**Required**	*Optional*	*Optional*
Route	**Required**	**Required**	**Required**	**Required**
Strength	*Optional*	*Optional*	**Required**	**Required**
Dose	**Required**	**Required**	**Required**	**Required**
Method	*N/A*	*N/A*	*N/A*	**Required**
Frequency	**Required**	**Required**	**Required**	**Required**
Administration Times	**Required**	**Required**	**Required**	*N/A*
Time of First Dose	**Required**	**Required**	**Required**	*N/A*
Start Date and Time	*N/A*	*N/A*	*N/A*	**Required**
Duration	**Required**	**Required**	**Required**	*Optional*

Table 8: Examples of Required Fields for Four Notional Types of Medication

The majority of prescriptions have only a few required fields and thus, in most cases, a prescription can be completed in a small number of steps. A more detailed prescription is only necessary when additional (optional) information or a less common set of attributes needs to be defined.

In most cases, a template prescription can be selected and the set of required fields can then be displayed. However, in the absence of template prescriptions, a step-by-step process can be used to encourage the selection of important attributes (such as dose) from predefined, limited lists.

> **Important**
>
> This section contains guidance for which there may be alternative solutions. Accordingly, the conformance ratings in this section apply only where the guidance is adopted.
>
> The Rationale section contains a summary of the known risks which are addressed in this section and which must be addressed by any alternative solution. For more information, see the Alternative Design Solutions note in section 1.

ID	Guideline	Conformance	Evidence Rating
MSP-1310	Require the selection of at least drug name and route (or attributes from which the type of medication can be derived) before presenting input controls for any other values	Mandatory	Medium
MSP-1320	After selections have been made in all cascading lists, if there are no template prescriptions, display any required fields that will not be pre-filled in sequence such that a field is displayed when the previous one has been completed	Mandatory	Medium
MSP-1330	If a selection from a cascading list (such as a frequency of 'as required') requires a further field to be completed, display that field before the remaining required fields	Recommended	Low
MSP-1340	Provide a control (such as a button) for switching to a detailed view from which input controls for all valid fields for this prescription can be accessed	Mandatory	Medium
MSP-1350	Disable the control for displaying all valid input controls until at least a drug name and route (or attributes from which the type of medication can be derived) have been selected	Recommended	Medium
MSP-1360	Provide a control that allows the switch to a more detailed prescription form to be undone, thus returning to the previous view containing only the required fields	Mandatory	Medium
MSP-1370	Restrict the number of input controls to the minimum required to enter information needed to complete the prescription	Recommended	Medium
MSP-1380	When presenting fields step by step, support pre-filling of one or more of the fields that are already displayed when a selection is made in a related field	Recommended	Medium
MSP-1390	When presenting fields step by step, allow the contents of all fields to be reselected such that a pre-filled value, previous choice or text entry can be changed (even if the associated selection list has only one option)	Recommended	Medium
MSP-1400	Do not display optional fields, or controls for accessing optional fields (apart from the button for accessing a more detailed prescription form)	Recommended	Medium
MSP-1410	Ensure that no data is lost whilst switching from one form to another	Mandatory	Medium
MSP-1420	Minimise the number of controls that are needed for navigation	Recommended	Medium
MSP-1430	Ensure that no data is lost whilst switching from one form to another	Recommended	Medium
MSP-1440	Minimise the number of controls that are needed to navigate between forms	Recommended	Medium

Usage Examples

1

clarithromycin

- oral
- oral – modified-release
- intravenous – infusion
- other...

Full Prescription Form   Preview

In this sequence of correct examples (MSP-1320):

1. A cascading list is displayed after a drug name has been selected
2. A template prescription is selected from the list
3. Input controls for the remaining required fields are displayed.

| 1 | 2 | 3 |

2

oral

DOSE **250 mg**   twice a day

DOSE **500 mg**   twice a day

other...

                    Authorise

3

clarithromycin | oral | DOSE **250 mg** | twice a day

at these times   08:00; **20:00**   first dose   Today 20:00   durat

Full Prescription Form   Preview   Auth

inhaled | 100 micrograms per puff | DOSE **1 to 2 puffs**

ay as required   *Give when...*

Breathless

PEFR is below 200

other...

In this correct example, a list ('Give when...') has been presented because an 'as required' frequency has been selected (MSP-1330)
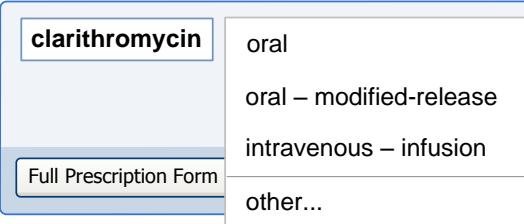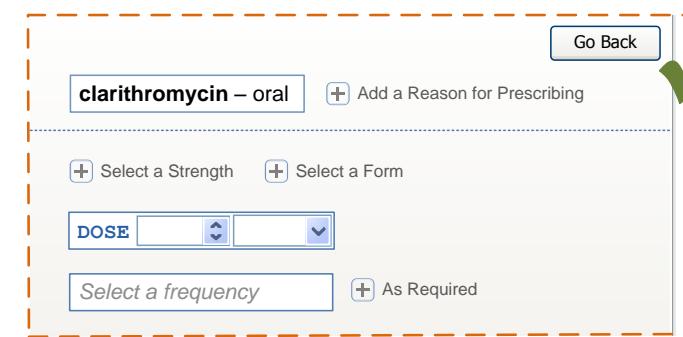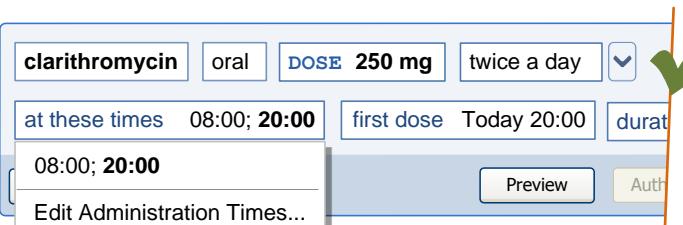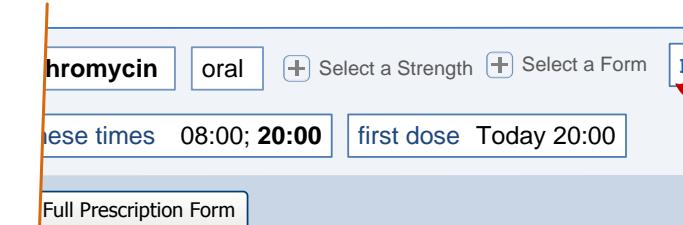
clarithromycin | oral | DOSE **250 mg** | twice a day

at these times   08:00; **20:00**   first dose   Today 20:00   dur

Full Prescription Form   Preview   Auth

In this correct example, a 'Full Prescription Form' button is provided for opening a view from which input controls for all valid fields (required and optional) can be accessed (MSP-1340)

clarithromycin oral oral – modified-release intravenous – infusion other... Full Prescription Form Preview	In this correct example, the control for opening a more detailed prescription ('Full Prescription Form') is disabled because the route has not yet been selected (MSP-1350)
clarithromycin oral oral – modified-release intravenous – infusion other... Full Prescription Form Preview	This example is incorrect because the button for displaying all valid input controls ('Full Prescription Form') is enabled before a route has been selected (MSP-1350)
Go Back clarithromycin – oral + Add a Reason for Prescribing + Select a Strength + Select a Form DOSE [ ] [ ] Select a frequency + As Required	In this correct example, in which all valid input controls are displayed a button ('Go Back') is provided for undoing the display of all valid fields, thus returning to a view of only the required fields (MSP-1360)
clarithromycin Select a route DOSE Enter a dose at these times Select first dose Select dur Full Prescription Form	This example is incorrect because a route has not yet been selected and there are input controls for other values (MSP-1310)
clarithromycin oral DOSE 250 mg twice a day at these times 08:00; 20:00 first dose Today 20:00 durat 08:00; 20:00 Edit Administration Times... Preview Auth	In this correct example, the administration times can be edited (even though there is only one option that can be selected in the list) (MSP-1390)
hromycin oral + Select a Strength + Select a Form D ese times 08:00; 20:00 first dose Today 20:00 Full Prescription Form	This example is not recommended because it includes 'Select a Strength' and 'Select a Form', which are controls for accessing optional fields (MSP-1400)

Rationale

Design Analysis:

The contents of the prescription form are constrained (by keeping the input controls to a minimum (MSP-1370, MSP-1320) in order to promote more efficient prescribing. Limited choices in selection lists and sets of predefined values are used to speed up the process within parameters that are more likely to be safe. This step-by-step or 'progressive disclosure' approach is similar to a wizard, except that only a few selections (and, in most cases, only drug name and route) need to be made before other fields are also presented and before there is an option to switch to a more detailed prescription form.

Guidance for prescription forms strikes a balance between:

- Giving the user control (by providing access to controls that allow all fields to be modified)
- Speeding up the process of prescribing (by presenting only a few fields)
- Keeping selection lists short
- Tailoring selection lists according to the previous selections
- Pre-filling fields where appropriate

See also section 9.3.5 for general guidance on pre-filling input controls and section 9.3.6 for guidance on the pre-filling of specific input controls.

Since it is an aspiration of this guidance that the majority of prescriptions (an estimated 80%) can be completed by defining only a few attributes (see section 1.3), there is no need to present a prescription form with many input controls for all prescriptions. Presenting a prescription form that is designed to elicit the minimum set of information necessary (MSP-1320) achieves the following:

- Reduces the 'cognitive load' on the user by presenting short lists of choices that are refined based on a previous choice
- Speeds up the process of prescribing for the majority of prescriptions by removing the need to scan the prescription form to find the input controls that are needed
- Reduces the presentation of controls that are displayed to a minimum thus focusing attention more effectively on the important information on screen
- Reduces opportunity for errors by presenting limited choices for attributes that must be completed and by presenting them one at a time
- Ensures a degree of security when providing access to less frequent and potentially dangerous choices

Access to all other valid input controls must also be available so that users remain in control of the information they want to specify for their prescription (MSP-1340, MSP-1350, MSP-1360). A prescriber who normally prescribes using only the required input controls may still need occasional access to controls for medications that he or she prescribes less frequently.

In anecdotal evidence from a feedback session with clinicians in which wireframes were reviewed, a doctor preferred prescription forms that only showed required fields because it appeared to be more efficient to use. A nurse preferred the full screen and more detailed prescription form because it removed the distractions of optional fields and other views that can be seen simultaneously.

The guidance is written such that it can be extended to support moving between detailed and more concise views of the prescription, where appropriate (such as those presented after a template prescription has been selected or during a step-by-step process) (MSP-1340, MSP-1350, MSP-1360). For example, a more detailed prescription form could be accessed to specify an optional attribute before returning to the original prescription form to preview and authorise. Whilst the principles of ensuring that no data is lost when switching between forms (MSP-1430) and minimising the number of controls needed for navigation (MSP-1440) are both well supported by usability literature, the details of this approach would require further design exploration, analysis and user testing.

Presenting the minimum (and thus, probably, the only required) fields by default (MSP-1370):

- Discourages the unnecessary completion and viewing of optional fields and in turn speeds up the prescribing process
- Removes the risk that optional fields are completed unnecessarily, thus removing the need for later clarification of the reasons for the unnecessarily completed optional fields
- Removes the need to mark which fields are required and which are optional since the intention is that they will all be completed (see also the rationale in section 8.1 for the placement of field labels)

The presentation of the minimum set of fields depends on first selecting drug name and route (at least) before the type of medication can be determined and therefore the remaining required fields presented (MSP-1310). This approach is dependent on a medications types framework such as that defined in *dm+d Implementation Guide (Secondary Care)* **{R4}**.

After a minimal set of fields has been completed, the presentation of other fields then completes the minimum total set of fields before a prescription can be authorised. Even though some of these fields may be pre-filled, all fields should still be editable so that the user is in control. Although some fields are only presented when other selections are made (MSP-1330), there is no reason to prevent the user from going back a couple of steps to change a selection he or she made previously. Thus it should be possible to interact with all fields to change their values.

Desk Research:

The paper *The Impact of Computerized Physician Order Entry on Medication Error Prevention* **{R38}** reports the findings of a study of medications errors before and after implementation of an electronic prescribing system. The study (which excluded 'missed dose' errors from its analysis) reported a significant reduction (80%) in medication errors. Three quarters of this reduction was achieved with a relatively simple system that structured the entry of prescriptions (the paper refers to them as 'orders') and included rudimentary 'order checking'. The default prescription form reduces the possibility of errors by providing a highly structured approach to entering prescriptions and reducing the possibilities for error by limiting the options available based on values that must be entered in a particular order, thus providing a more pro-active approach to 'order checking'.

An earlier study, *Effect of Computerised Physician Order Entry and a Team Intervention on Prevention of Serious Medication Errors* **{R39}** reports that implementing even a modest electronic prescribing system can result in important error reduction if the system includes a dose selection menu, simple drug-allergy and drug-drug checking and the requirement that clinicians indicate the route and frequency of drug doses. The prescription form first presents doses as part of a template prescription or as a selection menu when there are no template prescriptions. (A more detailed prescription form can then also present doses within a selection menu but may in some cases support the entry of a dose amount in figures, see section 9.3.1.)

The provision of a default prescription form that only presents fields that are relevant to the selections made so far, depends on the availability of a framework of medications types that can use a drug name and route (or form or similar attribute) to determine what other information is needed to safely describe that medication. In the UK, a framework for using the dm+d in the NHS is defined in *dm+d Implementation Guide (Secondary Care)* **{R4}**.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- User control and freedom – The provision of a control that allows the user to switch to a more detailed prescription form as soon as possible (MSP-1340) allows the user to decide whether to continue with the default prescription form or to switch to a detailed approach to prescribing. MSP-1360 ensures that the user can undo the action of switching from default to more detailed prescription forms without losing any information entered or selected so far

- Flexibility and efficiency of use – By presenting a step-by-step prescription form first (MSP-1320), efficiency is improved for most prescriptions whilst also providing the flexibility needed to prescribed more detailed prescriptions

- Aesthetic and minimalist design – In the default prescription form, input controls are kept to a minimum, are presented one at a time for critical information and are presented such that information that is rarely needed is hidden, thus increasing the relative visibility of important information

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ The system presents a prescription form complete with default values and the prescriber is unaware of other prescription regimens	■ MSP-1320 ensures that explicit selections are made for the most important parts of a prescription (and see section 6 for selections in cascading lists) ■ Template prescriptions (see section 7) are presented as a list so that the prescriber can see commonly prescribed regimens
■ Individual administration times have to be defined by the prescriber and result in non-standard times	■ Where appropriate, pre-fill one or more fields when a selection is made in a related field (MSP-1380) ■ Pre-filling administration times when the frequency is defined (see section 9.3.5) ■ Providing a selection list of (common) administration schedules (see section 9.3.6) ■ Restricting the definition of individual administration event times to a more detailed view (see section 9.3.6)
■ A prescription is authorised with a value that was not the intended value because it had been automatically updated when a value was defined in another field	■ The contents of all fields can be changed such that a pre-filled value can be changed (MSP-1390) ■ Guidance requires the use of formatting to draw attention to a field whose contents have changed automatically (see section 9.3.5)

▪ An input control for a dose is displayed adjacent to an input control for a strength and causes the dose value to be interpreted as the strength or vice versa	▪ Dose and strength can be entered by selecting a template prescription (see section 7.3.4) or by selecting values for individual fields that are presented in sequence (MSP-1320). Thus they only appear adjacent after they have already been completed
	▪ In sentence layout (when dose and strength are most likely to appear adjacent), guidance recommends that labels are incorporated into fields, so the dose label immediately precedes the dose value (see section 7.3.7)
	▪ Guidance recommends that labels are used for all fields whose contents could be interpreted as belonging to a different control (see section 7.3.7)
	▪ The dose field is always labelled (see section 9.3.6)
▪ A prescriber selects a template prescription in order to avoid using the more detailed prescription form because it is too complicated	▪ When there are no template prescriptions, the required fields can be presented and completed one by one (MSP-1320)

7.3.7   Using Sentence Layout

Sentence layout is the display of input fields as if they were words in a sentence. Display rules (such as those for width and wrapping) that might apply to words in a sentence are applied to the dynamic display of input fields. This means that input fields can grow in width as values are entered into them and wrap onto a new line as necessary. Figure 19 illustrates wrapping in sentence layout, showing the wrapping of an input control such that it is placed at the beginning of a new line and followed by the next input control:

Figure 19: Wrapping in Sentence Layout

Figure 20 shows a sequence of steps in which values are typed into two dynamic width input controls. In steps 3 and 6 the input controls grow in width to accommodate the values that have been typed into them.
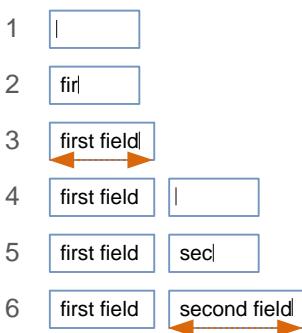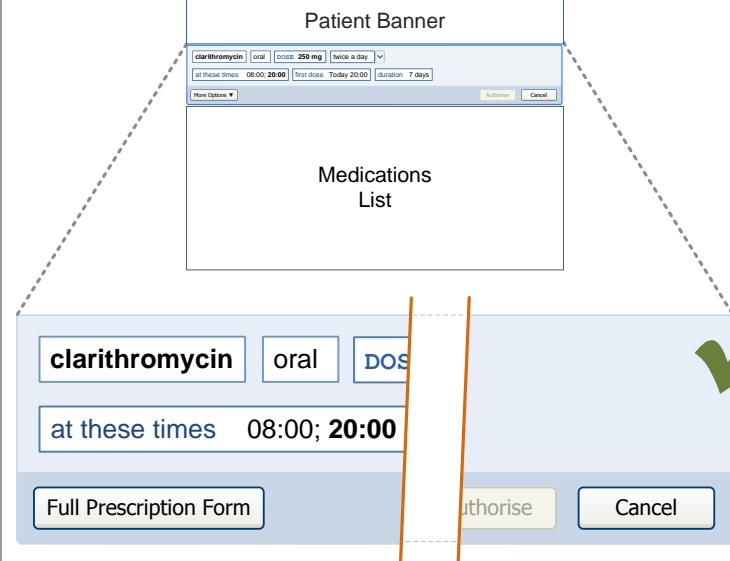
Figure 20: Dynamic Width Input Controls
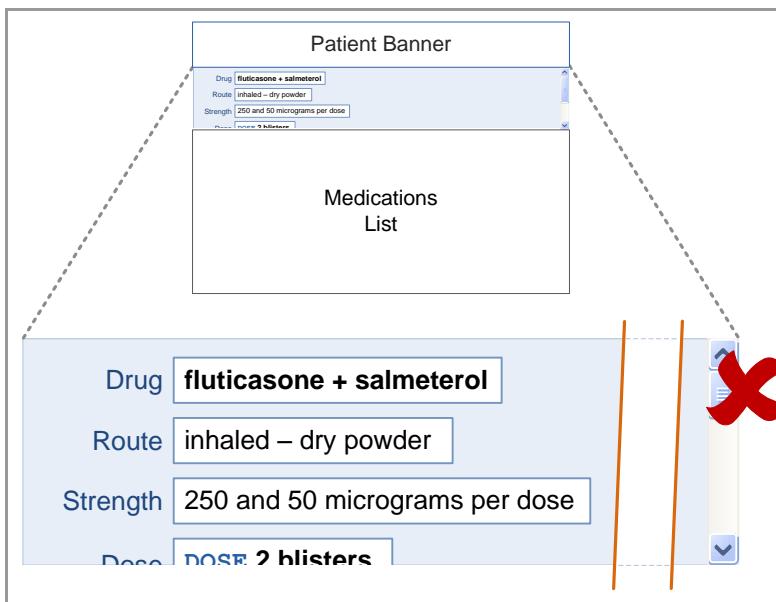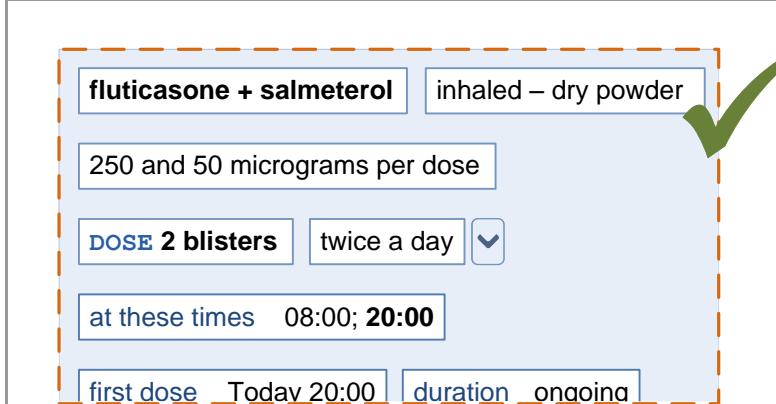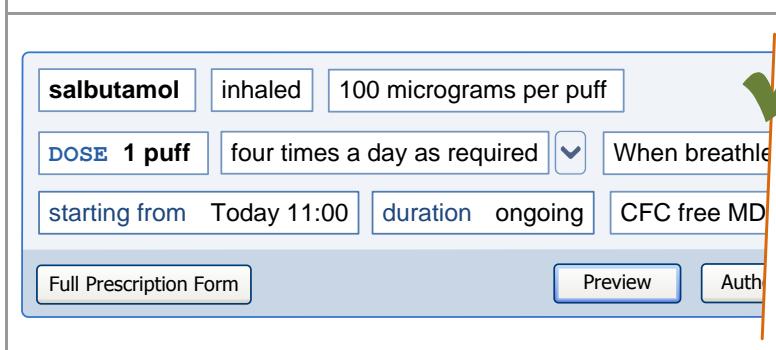
Important
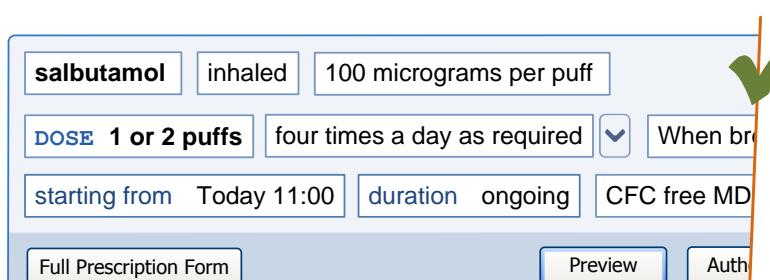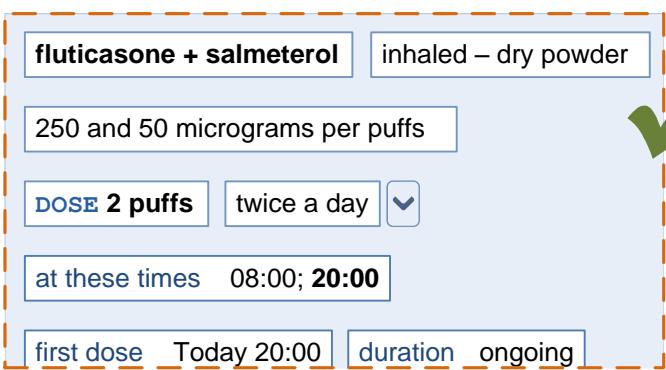
This section contains guidance for which there may be alternative solutions. Accordingly, the conformance ratings in this section apply only where the guidance is adopted.

The Rationale section contains a summary of the known risks which are addressed in this section and which must be addressed by any alternative solution. For more information, see the Alternative Design Solutions note in section 1.

ID	Guideline	Conformance	Evidence Rating
MSP-1450	Use sentence layout when fields are displayed in an area with much greater width than height (a thin horizontal strip)	Mandatory	Medium
MSP-1460	Use sentence layout for cascading lists and whenever selection lists are presented step by step	Recommended	Low
MSP-1470	When using sentence layout, for fields that have labels, incorporate labels into the fields	Recommended	Low
MSP-1480	When using sentence layout, wrap fields onto a new line as necessary	Mandatory	Medium
MSP-1490	When grouping fields in sentence layout, start a new line after each group	Recommended	Low
MSP-1500	When using sentence layout, allow fields to grow in width to fit the text entered or value selected from a list	Mandatory	Medium
MSP-1510	When using sentence layout, allow fields to shrink in width when a value is changed	Recommended	Medium
MSP-1520	Provide labels for controls whose contents could be interpreted as belonging to a different control	Recommended	High

Usage Examples

In this correct example, the fields are displayed in an area with much greater width than height and sentence layout has been used (MSP-1450)

This example is incorrect because fields are displayed in an area with much greater width than height and sentence layout has not been used (MSP-1450)

Drug **fluticasone + salmeterol**

Route inhaled – dry powder

Strength 250 and 50 micrograms per dose

Dose **DOSE 2 blisters**

In this correct example, a series of controls are presented like words in a sentence, with labels incorporated into the fields and wrapped onto a new line as necessary (MSP-1460, MSP-1470).

fluticasone + salmeterol   inhaled – dry powder

250 and 50 micrograms per dose

DOSE 2 blisters   twice a day

at these times   08:00; **20:00**

first dose   Today 20:00   duration   ongoing

In this correct example where dose and frequency are grouped, dose appears on a new line (MSP-1490)

salbutamol   inhaled   100 micrograms per puff

DOSE 1 puff   four times a day as required   When breathle

starting from   Today 11:00   duration   ongoing   CFC free MD

Full Prescription Form   Preview   Auth

In this sequence of correct examples:

1. A prescription is shown that has a regular frequency (as opposed to a once only or as required)

2. The frequency is changed, the field increases in width to accommodate the new value (MSP-1500) and the duration field wraps onto a new line (MSP-1480)

In this correct example, the dose was changed from '1 puff' (see the previous usage example) to '1 or 2 puffs' and the width of the field has grown in width to match the new content (MSP-1510)

In this correct example, the dose field contains the label 'DOSE' and the time and date of first dose contains the label 'first dose' (MSP-1520)

This example is not recommended because (MSP-1520):

- The dose field does not contain a label and could be confused with strength
- The date and time of first dose does not contain a label and could be confused with another event such as time of prescribing or end date

Rationale

Design Analysis:

Sentence layout is designed to enhance legibility of the data and minimise distractions. Sentence layout maximises the similarity between the way that the medication is displayed in a prescription form and the way that it is displayed in other views, such as a list of medications or a Drug Administration View. The use of sentence layout mirrors the principles used for *Medications Management – Medication Line* **{R3}** guidance on displaying a medication line.

Sentence layout is most appropriate for use with cascading lists and step-by-step selection lists because the fields are revealed dynamically (one by one and in groups based on a selection). Hence, the space in which they are displayed is small initially and can grow as necessary (MSP-1460, MSP-1500, MSP-1510). This allows more room on the screen for the display of other information either within the prescribing area or alongside it. When the available space is a horizontal rectangle that is much wider than it is high, sentence layout maximises use of the space and avoids the need for a scroll bar. A layout using columns may require more space (height), may need a scroll bar and, compared to sentence layout, is likely to be able to display fewer fields at any one time. When the available space is a vertical rectangle that is much higher than it is wide, sentence layout is still effective since the fields can wrap onto a new line. In such a case, a layout using columns is also effective since there is sufficient vertical space for many fields to be placed in a column without the need for a scroll bar (MSP-1450).

When using sentence layout, displaying labels before fields interrupts the reading flow. For most fields, a label will be unnecessary. However, some fields (such as a dose, strength or dates) need to be differentiated from other fields that may have similar content (MSP-1520). When fields with labels are displayed, placing them within the field ensures that the full 'sentence' is constructed with similar objects rather than a mixture of fields (often shown as a rectangle with a dark border and white background) and labels (MSP-1470).

Grouping in sentence layout (MSP-1490) ensures that related fields are kept together even when fields have to wrap onto a new line. The purpose of the grouping is not to communicate what those groups are but to maintain the related fields together.

Even when sentence layout is used, fields must still be displayed in a consistent order (MSP-1530).

Desk Research:

In *Label Placement in Forms* **{R40}**, Matteo Penzo proposes a set of guidelines for building Web forms. One of these guidelines recommends using the default value for a drop-down list box instead of a separate label. This approach is recommended for sentence layout to remove the need for separate labels and thus the need to associate labels to corresponding fields.

The use of a prompt inside a drop-down list or combo box is recommended by the *Windows User Experience Interaction Guidelines* **{R26}** when:

- Screen space is at such a premium that using a label or instruction is undesirable, such as on a toolbar
- The prompt is primarily for identifying the purpose of the list in a compact way. It must not be crucial information that users need to see while using the combo box

The use of a prompt inside the fields also follows the principle of minimising clutter by reducing the number of separate elements displayed (since labels do not need to be displayed separately). This follows the principle of increasing the data to ink ratio referred to by Tufte in *The Visual Display of Quantitative Information* **{R43}**.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Aesthetic and minimalist design – By identifying controls using text in boxes, relative emphasis is placed on the information within the controls instead of the controls themselves. By placing labels within the controls instead of providing separate labels, unnecessary clutter is reduced

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risk which is partially mitigated by the guidance:

Potential Hazards:

- An input control for a dose is displayed adjacent to an input control for a strength and causes the dose value to be interpreted as the strength or vice versa

Mitigations:

- **This risk is not wholly mitigated by guidance**
- Dose and strength can be entered by selecting a template prescription (see section 7.3.4) or by selecting values for individual fields that are presented in sequence (see section 7.3.6). Thus they only appear adjacent after they have already been completed
- In sentence layout (when dose and strength are most likely to appear adjacent), guidance recommends that labels are incorporated into fields, so the dose label immediately precedes the dose value (MSP-1470)
- Guidance recommends that labels are used for all fields whose contents could be interpreted as belonging to a different control (MSP-1520)
- The dose field is always labelled (see section 9.3.6)

8 GUIDANCE DETAILS FOR PRESCRIPTION FORMS

8.1 Introduction

It is assumed (see section 1.3) that the majority of prescriptions will be completed by selecting a template prescription and entering values for any remaining required fields. However, in some cases, additional specific fields or more detailed prescriptions may be needed and forms with a larger number of fields would be required to support these.

Figure 21 shows the full user interface prescribing process in which the step covered in this section is shown with a grey background:
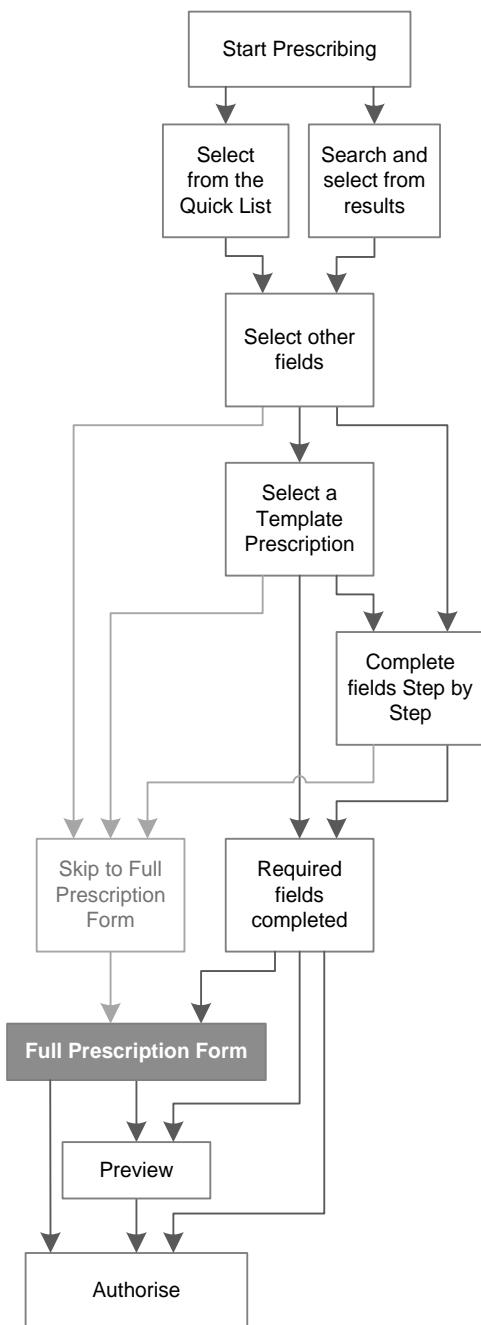
Figure 21: The Prescribing Process – Full Prescription Form

Figure 22 is an extract from Figure 21 to illustrate the user interface prescribing steps covered in this section showing the full prescription form and links to and from other steps:
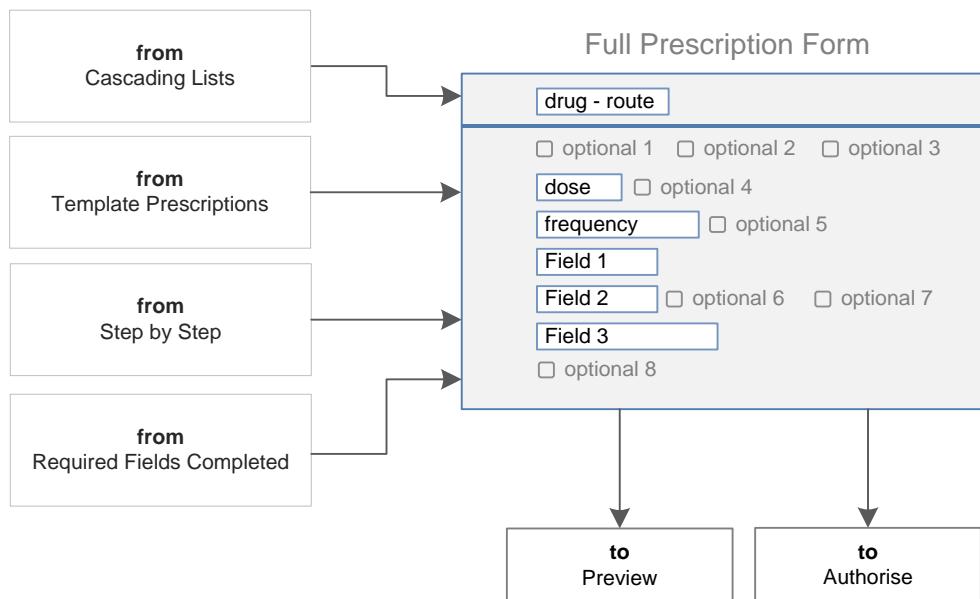
Figure 22: User Interface Prescribing Steps – The Prescription Form

8.2   Principles

All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:
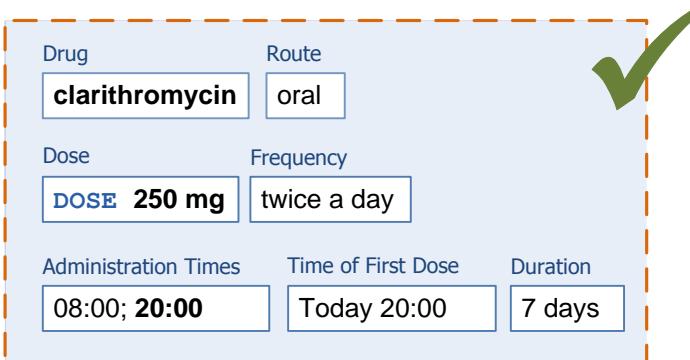
- Encourage simplicity of design by promoting user interface approaches that help to avoid overly complex displays and interactions that require many controls:

  - The number of input controls for a detailed prescription form is kept to a minimum

  - The need to navigate between sections of a detailed prescription form is kept to a minimum by displaying a view containing required fields and input controls for common optional fields by default

- Ensure that the prescribing process can be supported in multiple layouts and is flexible enough to be presented in different screen dimensions:

  - Guidance supports (and usage examples illustrate) multiple approaches to layout, including using columns to show labels and input controls and using sentence layout for input controls

- Maximise scalability such that the prescribing process can be modified to accommodate additional information, steps or shortcuts:

  - Guidance supports alternative means providing access to individual optional fields, groups of optional fields and views with larger sets of fields

  - The process by which the prescriber arrives at a prescription form can incorporate additional steps

  - The prescription form can include controls that add further steps to be completed before the prescription can be authorised

- Manage users expectations and improve their efficiency by providing a clear framework with consistent logic for the placement of user interface elements and the interactions that they support:

  - Efficiency is improved by presenting input controls for the fields that must be completed and ensuring quick access to those that are most likely to be needed

  - Input controls (and controls for accessing some optional controls) are placed in a consistent order

- Minimise the potential for important information to be hidden from view:

  - Placement of the drug name and design of the form ensures that the drug name cannot be scrolled out of view

8.3   Guidelines

8.3.1   Presentation and Layout of Prescription forms

This section provides guidance for layout of input controls. Although most relevant for a more detailed prescription form, the guidance in this section applies to all stages of a prescription form, from cascading lists, template prescriptions and step-by-step required fields. See section 9 for guidance specifically for input controls.

ID	Guideline	Conformance	Evidence Rating
MSP-1530	Display fields (and controls for accessing individual optional fields) in a consistent order for all prescriptions	Mandatory	Medium
MSP-1540	Minimise the number of different types of input controls displayed in any one view	Recommended	Medium
MSP-1550	Do not allow the drug name to be scrolled out of view. Keep the drug name visible at the top of the prescription form, even when the form has a scroll bar	Mandatory	High
MSP-1560	When displaying a prescription form with fields arranged in a column, display field labels right-aligned and on the left with the fields left-aligned and on the right	Recommended	Medium
MSP-1570	When placing field labels above input controls, display the labels left-aligned and in a smaller font than the text displayed in the control	Recommended	Medium
Usage Examples			

In this correct example the types of input controls have been minimised (MSP-1540)

See sections 9.3.1, 9.3.5 and 9.3.6 for more on input controls

This example is not recommended because it uses an unnecessary number of different types of controls (including text entry boxes, drop-down lists, spin controls, radio buttons, date entry and check boxes) (MSP-1540)
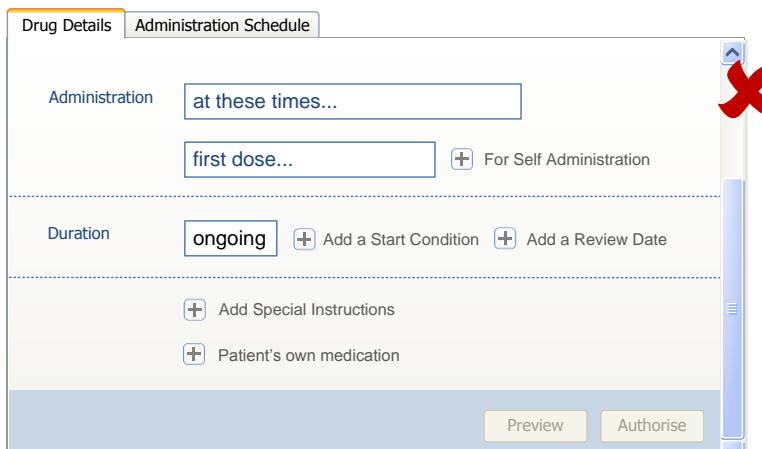
This example of a detailed prescription form is incorrect because the drug name has been scrolled out of view (MSP-1550)

In this correct example, the fields are arranged in a column, the labels are right aligned and the fields are left aligned (MSP-1560)

This example also illustrates the use of more than one type of input control where necessary (where dictated by system constraints) whilst still using the minimum possible number of input controls (MSP-1540)

This example with fields arranged in a column is not recommended because the labels are left aligned (MSP-1560)

In this correct example, the labels above the controls are left aligned and in a smaller font than the text in the control (MSP-1570)

This example of labels placed above controls is not recommended because the labels are in the same font size as the text in the control (MSP-1570)

Rationale

Design Analysis:

When designing forms for capturing information from users, fields can be placed in the following ways:

- Absolute placement, in which fields are placed in the same order and the same place on the screen
- Relative placement, in which fields are placed in the same order relative to one another, but not necessarily the same place on the screen
- Dynamic placement, in which the fields are placed in different orders depending on the type of medication
- Dynamic groups, in which the fields are placed consistently in groups and ordered consistently within those groups but the groups may be displayed in different orders depending on the type of medication

For example, in dynamic placement, the view could be divided such that required fields are placed in one area and optional fields are placed in another. Since different medications will have different sets of required and optional fields, any field that can be either required or optional might appear in one section or the other.

The task of ensuring that fields are easily found involves achieving a balance between consistent placement and dynamic placement. Consistent placement may involve more clutter, since some consistently placed fields are less likely to be used. Dynamic placement moves less frequently used fields (such as those that are optional) to a separate area, presenting a simple, short form with fewest possible fields.

If all medications needed exactly the same set of fields, then the consistent, absolute placement of fields would be uncontroversial and would ensure the building of a clear mental model of where to expect fields to be. When the set of fields that are needed changes, depending on the type of medication being prescribed (we are assuming this to be determined largely by drug name and route), then consistent placement may result in a large set of fields being presented out of which only a few need to be used. Furthermore, the few that are used may be distributed unevenly amongst other fields and controls, with some potentially being out of view (if the page is long enough to need a scroll bar).

In the alternatives that were assessed, the best balance was achieved when all fields were placed in a consistent order (relative placement). This tips the balance in favour of knowing where to look but increases the visual complexity of the form since the optional fields are displayed amongst the required fields (MSP-1530). For more guidance on the presentation of required and optional fields, see section 8.3.4.

A successful layout will achieve the following:

- Make it easier to read the important information by reducing the relative emphasis of other elements on the screen
- Minimise the need for a preview by displaying the medication in a format sufficiently similar to other views (such as a medications list)
- Provide the most important information 'at a glance', thus also making it easier to recognise the type of medication

Since a prescription form may need to be greater in height than the available vertical space, it may be necessary to display a scroll bar. When a scroll bar is displayed, the drug name should remain in view to reduce opportunity for prescribers to mentally switch to thinking about a different drug half way through a prescription (for example, after an interruption) and to define later values thinking that they are prescribing a different drug (MSP-1550).

Desk Research:

The paper, *Label Placement in Forms*[18] examined eye-tracking to assess the relative cognitive load of Web forms with different label placement and alignment and different input controls. In this paper, Matteo Penzo confirmed findings from a previous study that drop-down controls are the most eye-catching of (Web) form elements. In this study, he finds that they are more eye-catching than both text-input controls and buttons. Penzo attributes this to the success of the form element in conveying its meaning and how the user must interact with it. Since each different input control conveys meaning and how the user should interact with it differently, the introduction of different types of controls increases the 'competition' for attention and understanding. This does not happen if all input controls convey their meaning in the same way and exhibit the same interactions. This finding is relevant to MSP-1540 since it refers to the general principle of reducing the visual noise introduced by controls.

The paper, *Should I use a drop-down?*[19], focuses on the use of drop-down controls in Web forms. Miller and Jarrett suggest a four-step process for choosing form elements. The third is 'Third, look at the impact of your choice on the form as a whole. Choose a sensible order for the options, keep the options short and avoid too many different input methods.' This is reflected in MSP-1540.

MSP-1560 and MSP-1570 refer to the placement of labels in relation to forms when the fields have been arranged in a column. In *Label Placement in Forms – What's Best* **{R42}**, Caroline Jarrett concludes that appropriate placement of field labels depends on the users, task and specific design. Both Jarrett (in *Label Placement in Forms – What's Best* **{R42}**) and Penzo (in *Label Placement in Forms* **{R40}**) point out that the placement of a label depends on whether the labels are needed to:

- **Understand the whole form**. In which case, they should be placed so that they can be scanned independently of the fields

- **Work out what to fill in and what to leave blank**. This is relevant when only some of the fields are required and the user wants to provide the minimum information

- **Understand what information is needed**. This is relevant when the user is not familiar with the form as a whole or not familiar with the information needed in one or more specific fields

These tasks reflect the focus of Jarrett and Penzo's papers on the design of Web forms and are less relevant to the task of prescribing using a more sophisticated interface than a simple Web form since:

- Users will already be familiar with the prescription form (and many will use it regularly)

- There is no need to determine which fields should be filled in since required fields are displayed and the display of optional fields is significantly discouraged

- When watermark text is used as a prompt within the fields, there is no need to read a separate label to determine what the field is for

- The pattern of the prescription form is likely to be familiar

- The options presented in selection lists when a field is active also tells the user what the input control is for

Whilst usability references for the design of Web forms can inform the design of application forms as well, there are some differences that are important in this context. One of the most significant differences is that, in general, studies on Web forms indicate they are designed for users who will encounter that form rarely and probably only once. This impacts findings that relate to orientation when viewing a form for the first time and the need to scan all labels in order to build up a picture of what the form covers and what must be filled in. These usage examples are far less relevant to the design of a form that is expected to be used regularly by trained users.

The visual design principle 'data to ink ratio', coined by Edward Tufte in *The Visual Display of Quantitative Information* **{R43}**, is informed by his analysis of many examples of visual design in artefacts that are widely considered to be exemplary at efficient and effective communication. His principle holds that the quantity of ink (in a printing metaphor) needed for the display of information should exceed that which is used to display supporting visual structures and embellishments.

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Consistency and standards – Input controls for fields (both required and optional) are displayed in a consistent (relative) order (MSP-1530)

- Aesthetic and minimalist design – The number of different input controls is limited, thus also limiting the number of different interactions required to input information (MSP-1540)

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[18] Penzo, M – Label Placement in Forms **{R40}**:
http://www.uxmatters.com/mt/archives/2006/07/label-placement-in-forms.php

[19] Miller S, Jarrett C – Should I use a drop-down? Four steps for choosing form elements on the Web **{R41}**:
http://www.formsthatwork.com/files/Articles/dropdown.pdf

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:

- A prescription is not wholly reviewed because the information is displayed in different formats, split across many different controls

- Optional information is missed from a prescription because the prescriber could not find the control for accessing optional fields or other areas of a detailed prescription form

Mitigations:

- MSP-1540 recommends that the number of different types of controls are minimised, which reduces the different formats used to display it

- Selection lists are used so that the combined list items can be displayed in a format similar to that of a medication line (see section 7.3.3)

- Guidance in section 9.3.1 recommends combining controls into a single control

- Controls for accessing optional fields are displayed in a consistent order (MSP-1530)

- Controls for optional fields are displayed alongside required fields (see section 8.3.2)

- Controls should be provided for all areas of a detailed prescription form such that there is no area that can only be accessed by selecting an item from a selection list (see section 8.3.2)

- Controls for accessing optional fields are placed where the optional field appears when it is displayed (see section 8.3.4)
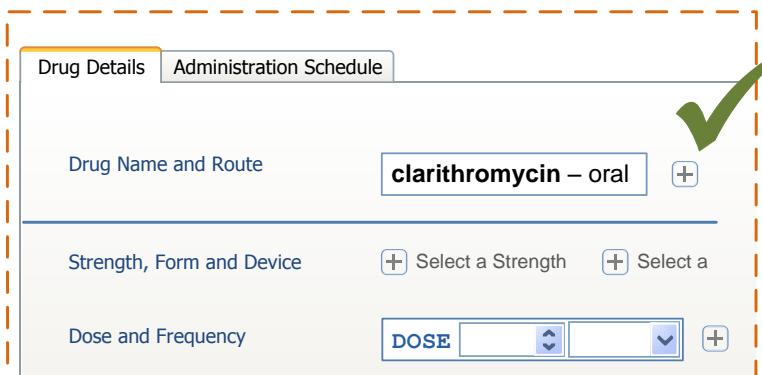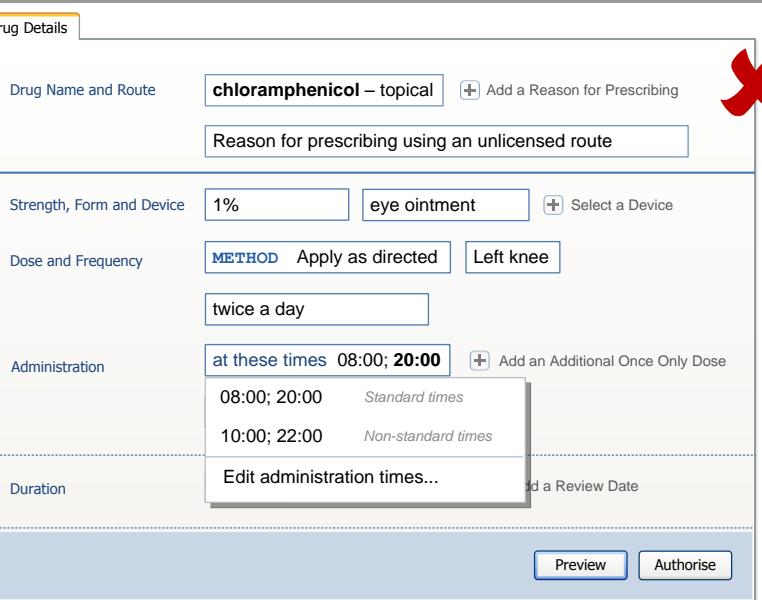
8.3.2 Presenting a Detailed Prescription Form

Some prescriptions may be defined using template prescriptions or completing the required fields step by step. When prescribers need to be more specific or to enter more (and optional) information, they need access to a more detailed prescription form. This section contains guidance for presenting such a prescription form.

ID	Guideline	Conformance	Evidence Rating
MSP-1580	In a detailed prescription form, require the selection of drug name and route (or drug name and attributes that allow the type of medication to be determined) before fields are displayed in the rest of the detailed prescription form	Mandatory	Medium
MSP-1590	Present the required fields by default when a detailed prescription form is opened	Mandatory	Medium
MSP-1600	Provide access to a detailed prescription form that presents the most important attributes by default and from which all fields can be accessed	Mandatory	High
MSP-1610	Provide controls such as tabs or buttons for navigating between areas of the detailed prescription form	Mandatory	Medium
MSP-1620	Provide controls for accessing all areas of the detailed prescription such that there is no area that can only be accessed by selecting an item (such as edit administration times) from a selection list.	Mandatory	High
MSP-1630	When displaying the input controls in a detailed prescription form, include an appropriate set of controls for accessing optional fields	Recommended	Medium
MSP-1640	When displaying a detailed prescription form, combine the drug name and route (or drug name and attributes that allow the type of medication to be determined) into a single control	Recommended	Low
MSP-1650	When the combined drug name and route field is selected, provide an option to change the drug name and route	Recommended	Low

MSP-1660	Do not rely on disabling fields (or controls for accessing optional fields) to impose an order.	Mandatory	Medium
MSP-1670	After selections from cascading lists have been completed, do not automatically open a selection list for a control in the a detailed prescription form unless a change to a field has triggered the need to confirm or re-enter values in related fields	Mandatory	Medium

Usage Examples

In this correct example, tabs are provided for accessing other sets of fields. The drug name and route have been combined into a single field (MSP-1610, MSP-1640)

This example is incorrect because a list item provides access to an area in which individual administration times can be edited but there is no other control (such as a tab or button) for accessing this area directly (MSP-1620)

Drug Details

Drug Name and Route   **chloramphenicol**

auricular

ocular

other...

Authorise

In this correct example, a route must be selected before other fields are displayed (MSP-1580)

Drug Details   Administration Schedule

Drug Name and Route   **clarithromycin**

oral

oral – modified-release

intravenous – infusion

other...

escribing

Strength, Form and Device   ⊕ Select a Strength   a Device

Dose and Frequency   **DOSE**

Select a frequency   ⊕ As Required

Administration   at these times...

first dose...   ⊕ For Self Administration

Duration   ongoing   ⊕ Add a Start Condition   ⊕ Add a Review Date
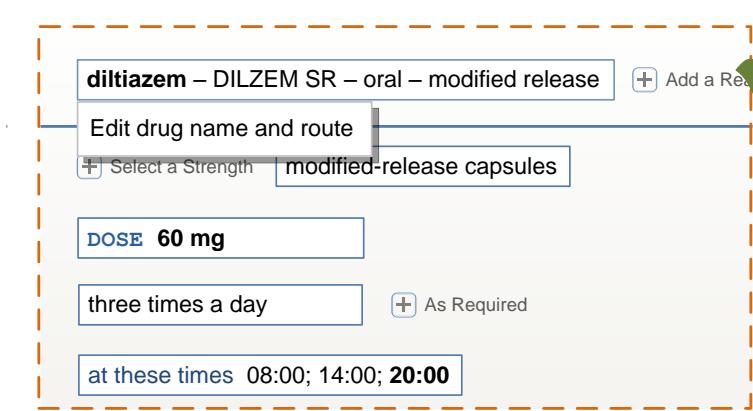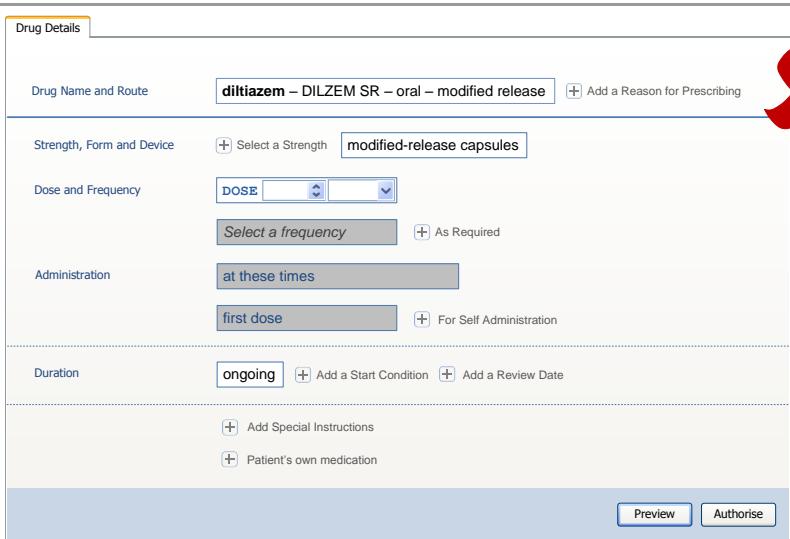
⊕ Add Special Instructions

⊕ Patient's own medication

Preview   Authorise

This example is incorrect because fields are displayed before a drug name and route have been selected (MSP-1580)

This example is incorrect because disabled fields are displayed before a drug name and route have been selected (MSP-1580)

In this correct example, required fields and controls for accessing an appropriate set of optional fields have been displayed after the selection of drug, route and template prescription (MSP-1580, MSP-1630)

This example is not recommended because the drug name and route are displayed in separate fields (MSP-1640)

In this correct example, the combined field for drug name and route has been selected and an option to edit the drug name and route is displayed (MSP-1650)

This example is incorrect because fields are disabled so that the order in which they can be completed is set (MSP-1660)

Rationale

See the rationale in section 8.1 for more information relating to the presentation of prescription forms.

Design Analysis:

Guidance recommends that detailed prescription forms include the most important information, including required fields and potentially some optional fields that have been 'promoted'. This approach aims to maximise efficiency for most prescriptions by minimising the navigation that is likely to be needed for accessing fields (MSP-1600, MSP-1590). Some of the areas of a prescription form can be accessed by selecting an option from a selection list but it must also be possible to get to these areas by other means (such as selecting a tab). This is so these options are immediately visible (MSP-1610) without having to open a selection list. For example, a detailed administration schedule (in which individual administration times can be added and edited) could be accessed by selecting 'Edit administration times' from the selection list that shows the administration times as text. The same detailed administration view should also be accessible by a tab or a button. By providing access to these additional areas from within selection lists (MSP-1620), users are not required to build an accurate model of where to look for options that relate to values they are selecting.

The presentation of required fields depends on first selecting drug name and route (at least) before the type of medication can be determined and therefore the remaining required fields presented (MSP-1580). Since the combination of drug name and route determines the other fields in the form, they cannot be changed without potentially removing some fields that may have already been completed. The drug name and route are thus combined since selecting and changing them signifies a return to the previous step and may result in the display of a new set of fields (MSP-1640).

The display of required fields by default in a prescription form improves efficiency and helps prevent errors by removing the distractions of optional fields (MSP-1590). Access to optional fields and the controls that are used to access those optional fields can be placed alongside related fields to reduce or remove the need for the user to search for them (MSP-1630).

Unlike the step by step, cascading list or template prescription parts of the prescribing process, a detailed prescription does not impose an order on the entry of information in fields. A detailed prescription form is more likely to be used when a less common prescription is being defined. Some of the fields are inter-related so the optimal way of completing a prescription may be different from one prescription to another. Imposing an order would remove this flexibility and thus also remove the opportunity for a more efficient way of completing the prescription (MSP-1660, MSP-1670).

Desk Research:

The guidance for a detailed prescription form follows the user interface principles of 'chunking' and prioritising (see the rationale in section 9.3.3).

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – A detailed prescription presents as little information as possible to focus attention on what needs to be completed and removes distractions
- User control and freedom – Although input controls for only the required fields are displayed by default, the prescriber has access to optional attributes and additional fields. The prescriber may also choose to complete the input controls in a different order to the one in which they are presented

User Research:

Study ID 67 (see APPENDIX D) includes the recommendation that brand name should not be displayed in the working area of a prescription form unless it is mandatory. A brand name will generally be selected in a search results list or a template prescription so when a brand name is mandatory (or has been explicitly selected) it will be known and displayed alongside the generic name in a prescription form. Thus, a brand name is only likely to be changed by reopening a list of template prescriptions (see section 7.3.5) or by clearing the current drug and starting again (MSP-1650).
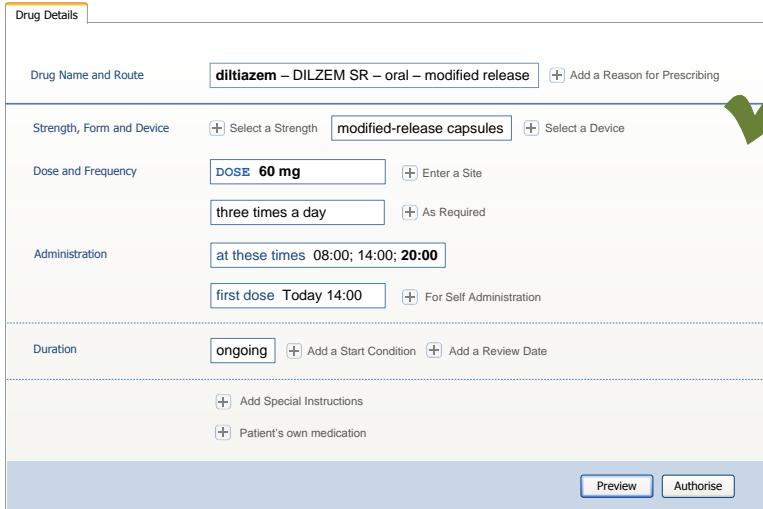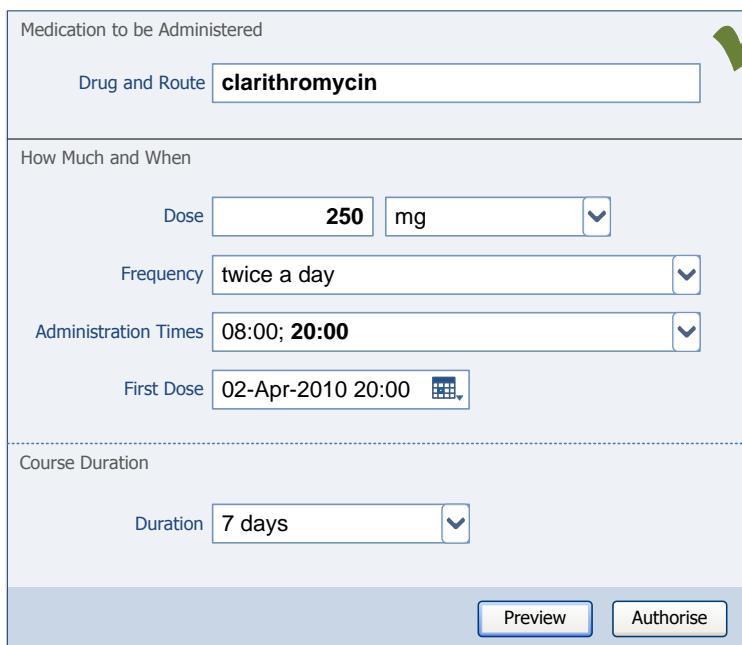
Study ID 68 (see APPENDIX C) identified the need to limit optional fields that are presented by default (so that they are less likely to be filled in unnecessarily) and to allow easy access to an appropriate set of optional fields.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
▪ The name of the drug being prescribed is not noticed at the top of the form and is not the intended drug	▪ The options presented after a drug is selected are filtered to be relevant to that drug (see section 6.3.1) ▪ The drug name remains at the top of the form when switching to a detailed prescription and is visible throughout, even when the prescription is long enough to need a scroll bar (see section 8.3.3)
▪ The prescriber cannot tell which fields are required and which are optional	▪ In principle, the prescription form only shows required fields (MSP-1590) ▪ Optional fields are accessed by clicking on a different style of control (see section 8.3.4)
▪ Optional information is missed from a prescription because the prescriber could not find the control for accessing optional fields or other areas of the detailed prescription	▪ Controls for accessing optional fields are displayed in a consistent order (see section 8.3.1) ▪ Controls should be provided for all areas of a detailed prescription form such that there is no area that can only be accessed by selecting an item from a selection list (MSP-1620) ▪ Controls for optional fields are displayed alongside required fields (MSP-1630) ▪ Controls for accessing optional fields are placed where the optional field appears when it is displayed (see section 8.3.4)

8.3.3   Structuring a Detailed Prescription

ID	Guideline	Conformance	Evidence Rating
MSP-1680	Display the drug name and route (or drug name and attributes that allow the type of medication to be determined) in a section at the top of the detailed prescription view	Mandatory	Medium
MSP-1690	Display the first field in each section on a new line	Mandatory	Medium
MSP-1700	When section labels are provided, display them at the top of the section	Recommended	Low
MSP-1710	Label at least each input control, group of input controls or section	Mandatory	Medium

Usage Examples

In this correct example:

- Drug name and route are displayed in a section at the top (MSP-1680)
- Each group of input controls is labelled (MSP-1710)

This example uses section labels which are left-aligned. Individual field labels have been incorporated into the fields.

In this correct example, labels are provided for all input controls in addition to labels for sections, which have been placed at the top of each section (MSP-1700, MSP-1710)

This example uses left-aligned section labels and right-aligned individual field labels.

This example is incorrect because some input controls do not have individual labels or group labels and are in sections that do not have labels (MSP-1710)

Rationale

Design Analysis:

If we assume that a prescriber usually has a 'whole' prescription in mind, then a system could prompt for any part of that prescription first and then go on to complete the prescription by completing fields in any order. However, it is likely that different clinicians will have different structures for the prescription in mind, so the order of fields and the structure provided by grouping is unlikely to successfully match a clinician's mental model. The primary aim of the grouping is to provide a structure that, over time, becomes familiar and achieves 'recognition over recall'.

Guidance for placing certain fields on a new line (MSP-1690), labelling sections (MSP-1700) and labelling controls (MSP-1710) is designed to provide a flexible and consistent set of mechanisms by which a structure is implied in the prescription form.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error prevention – Maintaining the drug name on screen helps mitigate errors that might be caused by interruption or distraction

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	**Mitigations:**
■ The name of the drug being prescribed is not noticed at the top of the form and is not the intended drug	■ The options presented after a drug is selected are filtered to be relevant to that drug (see section 6.3.1) ■ The drug name remains at the top of the form when switching to a detailed prescription and is visible throughout even when the prescription is long enough to need a scroll bar (MSP-1680)
■ Optional information is missed from a prescription because the prescriber could not find the control for accessing optional fields or other areas of the detailed prescription	■ Controls for accessing optional fields are displayed in a consistent order (see section 8.3.1) ■ All areas of a detailed prescription should be accessible through a separate control as well as a list item in a selection list (see section 8.3.2) ■ Controls for accessing optional fields are placed where the optional field appears when it is displayed (see section 8.3.4)

8.3.4   Displaying Required and Optional Fields

This section includes guidance for how to display required and optional fields and to communicate which fields must be completed before a prescription can be authorised.

When a detailed prescription form is presented, the required fields are displayed by default. Also displayed are controls for accessing optional fields and, when those controls are selected, the optional fields appear alongside the required fields. This approach is based on the assumption (see section 1.3) that the majority of prescriptions will be completed using template prescriptions and that most of the time only a few optional fields may be needed. However, in some cases, additional specific fields or more detailed prescriptions may be needed and forms with a larger number of fields would be required to support these.

This section refers to three types of control:

1. Controls for accessing individual (or very small groups) of optional fields. These controls are defined by guidance in this section

2. Controls for accessing small sets of fields (see Figure 23)

3. Controls (such as tabs or buttons) for accessing large sets of fields (see Figure 24 and Figure 25).
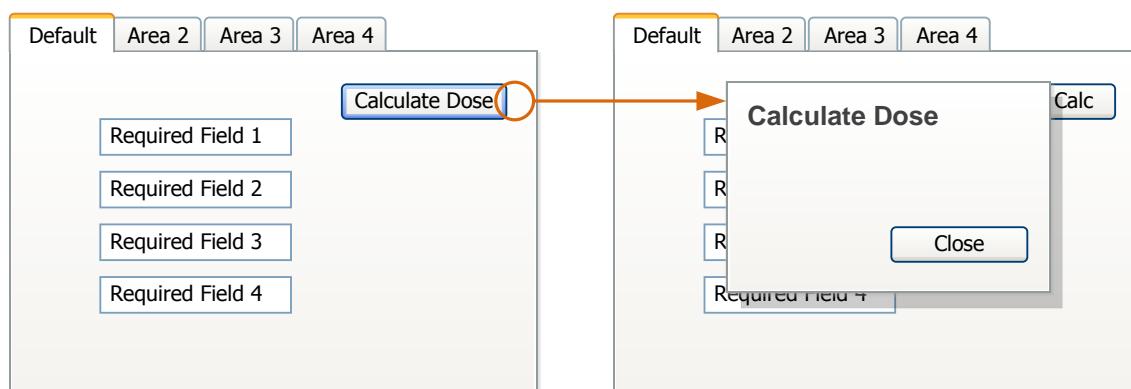
Figure 23: Accessing Small Sets of Fields
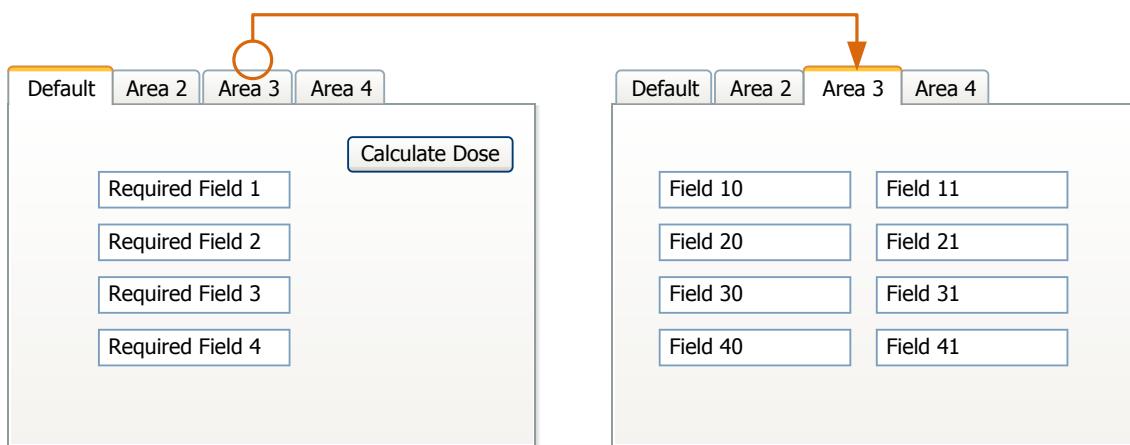
Figure 24: Using a Tab to Access a Large Set of Fields
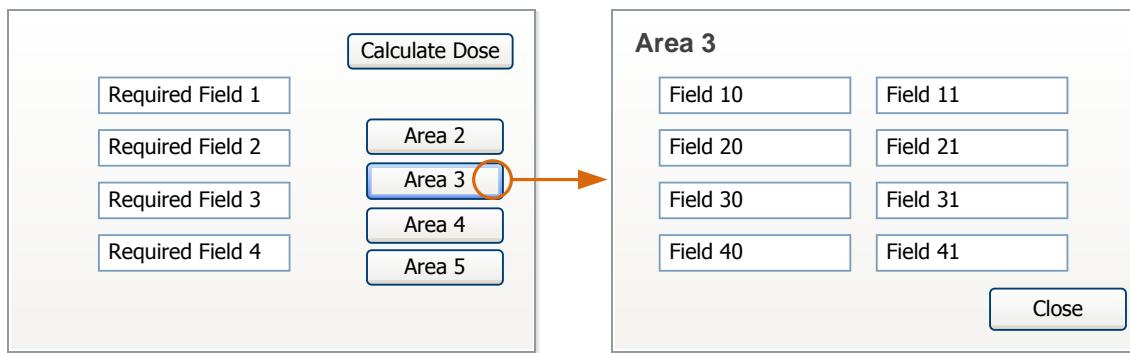
Figure 25: Using a Button to Access a Large Set of Fields

ID	Guideline	Conformance	Evidence Rating
MSP-1720	Only when it is important to encourage the completion of an optional field, promote it by displaying an input control for it	Recommended	Medium
MSP-1730	When an optional input control is promoted, support the entry or selection of a null value and require it to be completed	Recommended	Medium
MSP-1740	Display in-field prompts for fields that have to be completed by the user and would otherwise be blank. (A field does not have to have an in-field prompt if it contains a label)	Mandatory	Medium
MSP-1750	Use a phrase that begins with a verb for in-field prompts in fields that have to be completed by the user	Recommended	Medium
MSP-1760	Provide access to individual optional fields by placing a control in the place where the field will appear when the control is selected	Mandatory	High
MSP-1770	If the value selected for an optional field causes it to increase in width, allow it to wrap onto a new line if necessary	Recommended	Low
MSP-1780	When necessary, display more than one optional field on activation of a control for displaying an optional field	Recommended	Low
MSP-1790	Use formatting to reduce the relative emphasis on optional controls	Recommended	Medium
MSP-1800	Allow values entered in optional fields to be removed such that the optional field or control is returned to the state it was in when the prescription form was opened	Recommended	Medium
MSP-1810	Use other formatting to mark required fields (or their labels) in a detailed prescription form where necessary to ensure consistency with other areas of the application	Recommended	Medium
Usage Examples			

In this correct example, an input control is displayed for the optional field 'Reason for Prescribing' (MSP-1720)

diltiazem – DILZEM SR – oral – modified release

Select or enter a reason for prescribing

angina

mild hypertension

moderate hypertension

None (leave blank)

other...

In this correct example, in which an input control is displayed for the optional field 'Reason for Prescribing', a null value 'None (leave blank)' is provided (MSP-1720, MSP-1730)

diltiazem – DILZEM SR – oral – modified release

Select or enter a reason for prescribing

Select from a list...

None (leave blank)

Enter a reason for prescribing

Select a frequency   + As Required

In this correct example, in which an input control is displayed for the optional field 'Reason for Prescribing', a null value 'None (leave blank)' is provided (MSP-1720, MSP-1730)

This is an alternative to the previous example

+ Select a Strength   modified-release capsules

DOSE 60 mg

Select a frequency   + As Required

at these times

first dose   + For Self Administration

In this correct example, an in-field prompt is displayed in the field that will have to be completed by the user, the prompt begins with a verb and visual formatting has been used to reduce the relative emphasis on optional controls (MSP-1740, MSP-1790)

This example is incorrect because the frequency field must be completed by the user and does not have an in-field prompt (MSP-1740)

This example is incorrect because the prompts do not begin with a verb (MSP-1750)

In this correct example, the controls for accessing individual optional fields (in grey text preceded by a '+') are placed where the field will appear when the control is selected (MSP-1760)

1

Drug Details

Drug and Route	**diltiazem** – DILZEM SR – oral – modified release	Add a Reason for Prescribing
Strength, Form and Device	modified-release capsules	Select a Strength
Dose and Frequency	DOSE **60 mg**	
	Select a frequency	As Required
		For Self Administration
Administration	at these times	
	first dose	
Duration	ongoing	Add a Start Condition
		Add a Review Date
		Add Special Instructions
		Patient's own medication

Preview   Authorise

2

Drug Details

Drug and Route	**diltiazem** – DILZEM SR – oral – modified release	

angina
mild hypertension
moderate hypertension
other...

Strength, Form and Device	...ease capsules	
Dose and Frequency		
	Select a frequency	As Required
		For Self Administration
Administration	at these times	
	first dose	
Duration	ongoing	Add a Start Condition
		Add a Review Date
		Add Special Instructions
		Patient's own medication

Preview   Authorise

In this sequence of incorrect examples (MSP-1760):

1. A prescription form is displayed in which the controls for accessing individual optional fields are displayed on the right.

2. When the 'Add a Reason for Prescribing' control is selected, the corresponding field appears on a new line below the drug name.

In this correct example, a drop-down list for the optional attribute 'as required' provides a means of removing that attribute (MSP-1800)

In this correct example, required fields are marked using asterisks to maintain consistency with other areas of the application (MSP-1810)

In this correct example, required fields are marked using asterisks and bold labels to maintain consistency with other areas of the application (MSP-1810)

Rationale

Design Analysis:

Presenting only required fields by default discourages the unnecessary completion and viewing of optional fields (MSP-1720). It also removes the need for a mechanism by which required and optional fields can be identified. (See the rationale in section 8.1 for a more detailed description of the relationship between form layout and the presentation of required and optional fields). By not displaying optional fields by default, they are less likely to be completed unnecessarily. Unnecessarily completed optional fields can take up valuable time later in the process when the reasons for their completion may need to be followed up.

The prescribing area is being used to communicate to the prescriber what the minimum set of information required for a prescription is. This is most effective when controls for any other (not required) information are kept to a minimum to reduce distractions (MSP-1760).

When an input field that is normally considered to be optional is important enough that it should be completed, it can be treated like a required field. If the optional field must remain optional because the prescriber may not want to select any of the values available in the selection list, then a 'null' value in the selection list allows the input control to be treated as a required field whilst effectively remaining optional (MSP-1720, MSP-1730)

By placing controls for accessing optional fields amongst the required fields, the following is achieved:

- Optional fields can be placed consistently for all types of medication
- Optional fields can be grouped with related required fields
- No navigation is needed to access optional fields that are not immediately present
- It is possible to become familiar with the pattern of required fields (and controls for optional fields)
- Controls clearly labelled for accessing options to refine or extend the standard choices
- Interpretation of labels for optional controls benefit from the context in which they are placed

The set of required fields that are displayed when a prescription is first opened may include some fields that have labels within the input control, some fields that already contain values and other fields that have been pre-filled. Prompts within those empty fields (MSP-1740) help to keep the prescribers attention on the fields and the values within them and to minimise the need to review section labels and field labels (that are outside of the input controls). Starting in-field prompts with verbs (MSP-1750) clearly indicates that those fields need to be completed.

When a control for an optional field is selected, an input control for that field must be available. The display of that input field in the same place as the control that was used to access it minimises disruption to the fields already presented in the prescription form whilst remaining consistent with sentence layout (see section 7.3.7) and preserving the emphasis on required fields (MSP-1760, MSP-1770, MSP-1780, MSP-1790, MSP-1800).

In some applications, conventions may already exist for marking which fields in a form are required and must be completed for the form to be submitted. Although these conventions are not necessary in the prescribing form, they can still be displayed for consistency with the rest of the application (MSP-1810).

Desk Research:

Accepted methods for marking required fields are informed largely by studies of Web forms that contain required and optional fields that are mixed together (for example, *Label Placement in Forms* **{R40}**, *Should I use a drop-down?* **{R41}** and *Label Placement in Forms – What's Best?* **{R42}**). It is harder for users of such forms to tell when they have skipped a required field because the visual cue (usually a red star or asterisk) is small and is usually placed nearer the label than the field. This approach is effective when the field label must be carefully read before the user can know what to enter into the corresponding field. The detailed prescription form follows a different model so that it avoids these problems.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- User control and freedom – Guidance ensures that the user remains in control of values entered in optional fields by requiring that values entered in optional fields can be amended or cleared

User Research:

All 14 participants in Study ID 69 (see APPENDIX B) preferred to avoid a prescription form in which the layout of fields is absolutely identical for all drugs. Fields in this design of a prescription form were enabled or disabled depending on the drug being prescribed.

The primary reasons they gave for their preference were:

- They did not know where they had to enter information
- They incorrectly tried to enter values in the wrong field
- The process was, or appeared to be, longer
- The disabled fields were a distraction

Guidance for cascading lists (section 6) and template prescriptions (section 7), dynamic layout of prescription forms (section 8.1) and required fields versus optional fields (MSP-1720, MSP-1790) are designed to focus attention on the fields that are relevant, thus avoiding the distraction caused by fields that do not need to (or cannot) be filled

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
When optional attributes are specified unnecessarily, the need for clarification may delay treatment	The unnecessary completion of optional fields is discouraged by not displaying them by default (see section 8) and requiring an additional selection before they are displayed (MSP-1760)
	The definition of drug name and route before a detailed prescription form can be displayed (see section 8) ensures only the appropriate (required) input fields are displayed
Important information is not included in the prescription because only required fields were presented	Controls for accessing optional fields (MSP-1760) must be consistently placed and presented (see section 8.1)
Presentation of both required and optional input controls slows the process of prescribing	Optional fields are not displayed by default (see section 8.1)
Prescriber can't work out why the prescription can't be authorised	Prompts are displayed in required input controls until they are populated with a value (MSP-1740)
The prescriber cannot tell which fields are required and which are optional	In principle, the prescription form only shows required fields (see section 8)
	Optional fields are accessed by clicking on a different style of control (MSP-1760)
Optional information is missed from a prescription because the prescriber could not find the control for accessing optional fields or other areas of the detailed prescription	Controls for accessing optional fields are displayed in a consistent order (see section 8.3.1)
	Controls should be provided for all areas of a detailed prescription form such that there is no area that can only be accessed by selecting an item from a selection list (MSP-1620)
	Controls for optional fields are displayed alongside required fields (MSP-1630)
	Controls for accessing optional fields are placed where the optional field appears when it is displayed (see section 8.3.4)

9   Guidance Details for Input Controls

9.1   Introduction

This section contains guidance for the display of input controls and guidance for particular types of controls such as selection lists.

Figure 26 shows the full user interface prescribing process in which the steps covered in this section are shown with a grey background:
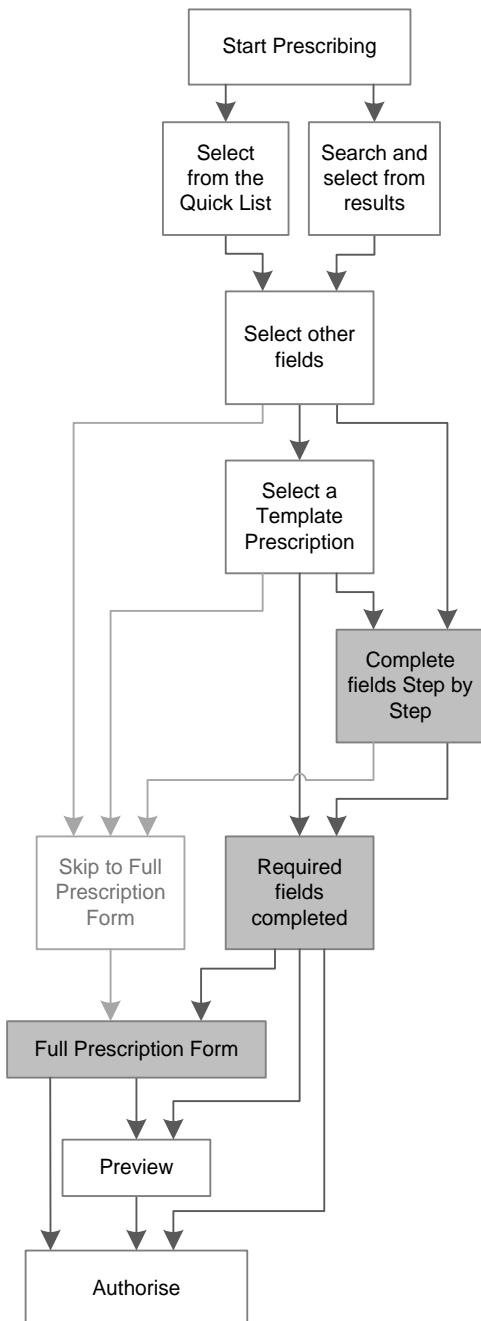
Figure 26: The Prescribing Process – Input Controls

Figure 27 is an extract from Figure 5 to illustrate the user interface prescribing steps that are covered in this section showing the step-by-step alternative to template prescriptions and the remaining steps for completing a prescription:
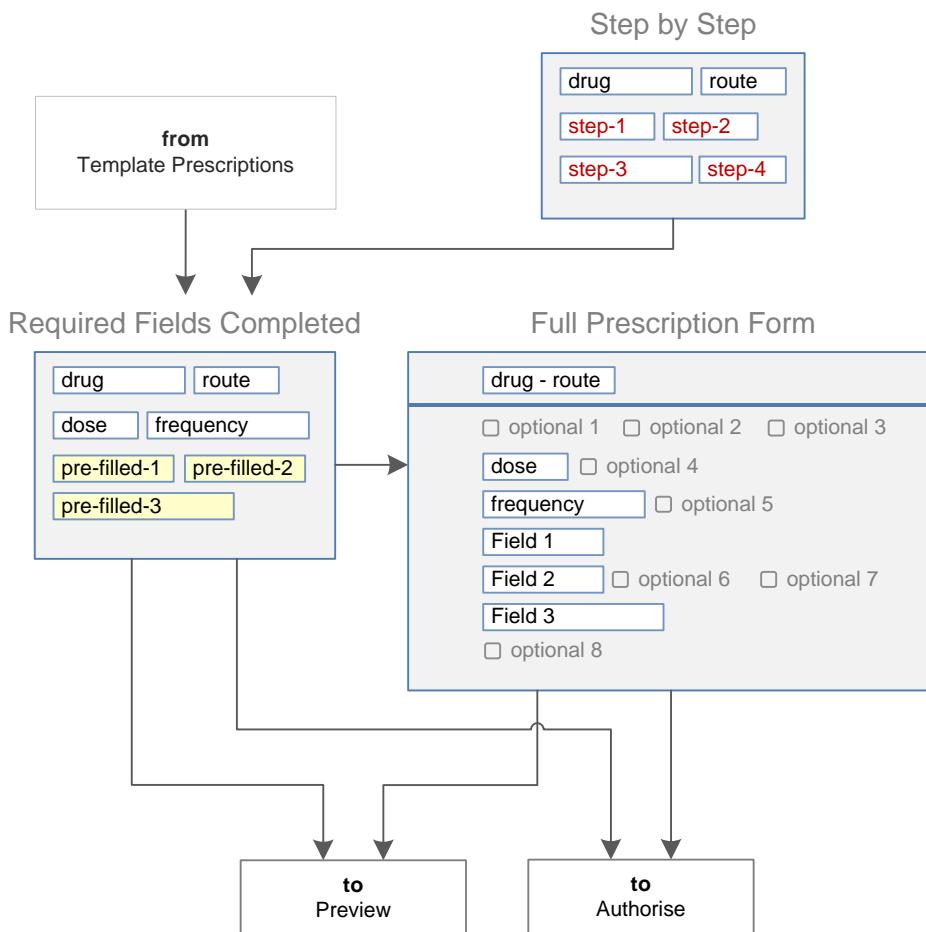
Figure 27: User Interface Prescribing Steps – The Prescription Form

The contents of a prescription form depend on the type of medication being prescribed and this determines which attributes are required and thus which input controls will be displayed. The prescription form is thus dynamic.

There are three aspects of a prescription form that can be considered to be 'dynamic':

- The display of a set of input controls. The controls displayed will depend on the type of medication being prescribed (see section 9.3.1)

- Input controls that may appear when a value is defined in another input control (see section 9.3.1)

- Input controls that may be pre-filled depending on selections elsewhere in the form (see section 9.3.5)

- Input controls whose dimensions may change as the form or field is completed (see section 7.3.7)

Figure 28 and Figure 29 show detailed prescription forms for two different types of medication that have different sets of required fields.

The oral — modified-release medication in Figure 28 requires a brand name and a dose:

Drug Details

Drug Name and Route	**diltiazem** – DILZEM SR – oral – modified release ⊞ Add a Reason for Prescribing

Strength, Form and Device   ⊞ Select a Strength   modified-release capsules

Dose and Frequency   DOSE **60 mg**

twice a day   ⊞ As Required

Administration   at these times 08:00; **20:00**

first dose Today 20:00   ⊞ For Self Administration

Duration   ongoing   ⊞ Add a Start Condition   ⊞ Add a Review Date

⊞ Add Special Instructions

⊞ Patient's own medication

Preview   Authorise

Figure 28: Detailed Prescription Showing a Set of Fields for an Oral — Modified-Release Medication

The topical medication in Figure 29 does not require a brand name but does require a method, a strength and site:

Drug Details

Drug Name and Route   **hydrocortisone** – cutaneous   ⊞ Add a Reason for Prescribing

Strength, Form and Device   1%   cream

Dose and Frequency   METHOD Apply as directed   Left knee

once a day

Administration   at night

start Today   ⊞ For Self Administration

Duration   ongoing   ⊞ Add a Start Condition   ⊞ Add a Review Date

⊞ Add Special Instructions

⊞ Patient's own medication

Preview   Authorise

Figure 29: Detailed Prescription Showing a Set of Fields for a Topical Medication (Unlicensed Route)

9.2　Principles

All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries:

    - Since options available in selection lists are dependent on values in other input fields, the opportunity for inappropriate selections or invalid combinations is reduced

- Encourage simplicity of design by promoting user interface approaches that help to avoid overly complex displays and interactions that require many controls:

    - Prescribing forms are initially presented with as few controls as possible and it is up to the prescriber to progressively reveal the less frequently used options and controls associated with them

- Maximise flexibility and scalability of both the way that the prescribing process is supported by the user interface and the dimensions of the spaces in which prescribing takes place:

    - The prescribing process is flexible so that it can support a short path through the process and many potential different longer paths

    - Additional screens can be incorporated into a detailed prescription form so that many sets of input controls can be included in a prescription if necessary

- Manage users expectations and improve their efficiency by providing a clear framework with consistent logic for the placement of user interface elements and the interactions that they support:

    - In the absence of template prescriptions, the parts that might make up a template prescription are simply revealed step by step

    - Input fields in a prescription form are placed using the same logic that is used to place drug search results, cascading lists and template prescriptions

    - As far as possible, all input controls use the interaction model that is familiar from selection list interaction model similar to that of drop-down lists, combo boxes, menus with submenus (see *Windows User Experience Interaction Guidelines* **{R26}**) or column views (see *Apple Human Interface Guidelines* **{R44}**)

- Minimise the potential for important information to be hidden from view:

    - Prescription forms begin by presenting input controls for the minimum required information and progressively reveal further input controls on demand

- Adhere to a user interface strategy that gives the impression of making progress within a single space (which has all the necessary information immediately or readily available) and avoids the impression of needing to move between many different spaces:

    - The prescription allows most prescriptions to be completed within a small space whilst providing access to a more detailed view at any point after the type of medication has been established
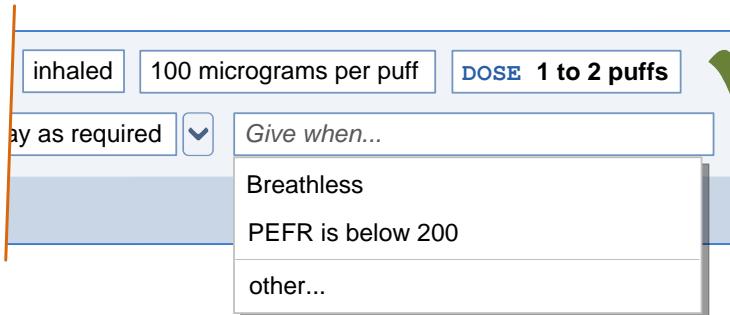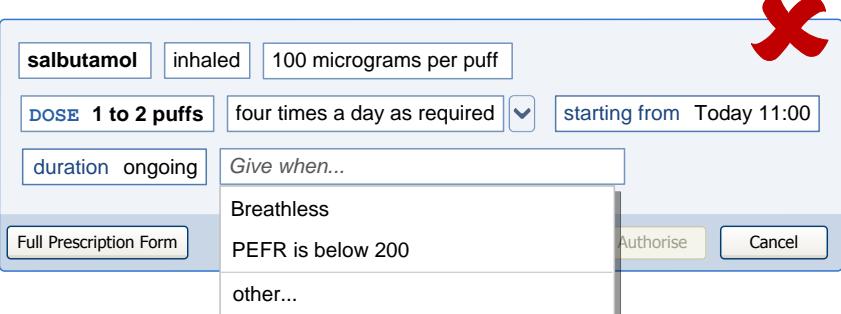
■ Navigation to additional spaces is only necessary for more complex prescriptions, detailed editing of administration schedules or for unusual attributes or combinations of attributes

9.3 Guidelines

Important

The usage examples in this section include examples of sets of fields, some of which are shown as required and some as optional. These examples are illustrative only and are not intended to provide guidance on which fields should be available for specific types of medication nor which fields should be required or optional.

9.3.1 Using Dynamic Controls

ID	Guideline	Conformance	Evidence Rating
MSP-1820	Allow some input controls to be defined that are only displayed when certain values are selected in another input control	Mandatory	Medium
MSP-1830	When determining the order in which to display input controls, prioritise the placement of fields whose values determine which other fields may be displayed in the form	Recommended	Low
MSP-1840	When determining the order in which to display input controls, prioritise the grouping together of controls whose values affect the options available in other controls	Recommended	Medium
MSP-1850	When an input causes new input control(s) to appear, allow other input controls to move so that the new one can be placed correctly and consistently	Recommended	Low
MSP-1860	When an input causes new input control(s) to appear, place the new input controls next (at least in sequence if not in layout) to the control that caused it to appear	Recommended	Low
Usage Examples			

In this correct example, the attribute 'Give when...' is only displayed when a frequency including 'as required' has been selected (MSP-1820, MSP-1830)

This example is not recommended because the field 'Give when...' does not appear next (in sequence) to the field that caused it to appear (frequency, containing 'as required'). (MSP-1860)

In this sequence of correct examples (MSP-1850, MSP-1860):

1. The field 'Give when...' only appears when an 'as required' frequency is selected and has already been completed by the prescriber

2. When a regular frequency is selected, the field containing 'Give when breathless' is removed

Rationale

Design Analysis:

By presenting some fields only when a specific value has been selected in a previous list (MSP-1820), the prescription form can proactively display dynamic fields that would otherwise not be displayed. For example, when a frequency of 'as required' is selected, a field can be presented for the selection (or entry) of a description for the conditions in which to give the medication.

If dynamic input controls are not used, the prescription form has to display all fields for all types of medications at all times and those fields then have to be enabled or disabled as values are entered in other fields. This approach is not effective at prioritising fields and is likely to result in the required fields being spread over a larger area.

Sentence layout depends on dynamic width controls in order to reduce the space between each prescription element so that it can be read as a sentence.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Flexibility and efficiency of use – By dynamically presenting fields based on information in other fields, the number of fields displayed can be kept to a minimum whilst still providing access to various additional fields that are displayed only when they are needed

- Aesthetic and minimalist design – The dynamic presentation of fields allows some fields to be displayed only when they are needed, thus keeping the remainder of fields to a minimum

User Research:

Study ID 68 (see APPENDIX C) identified some scenarios in which a prescription with an 'as required' frequency would need one or more additional fields to be displayed. Guidance allows the additional fields to be presented when such a frequency is selected depending on (at least) the drug and route. This study also identified the need to clearly label the time from which the 'as required' medication can be administered and to differentiate this from the label used for a first dose for regular medications.

9.3.2   Presenting Selection Lists in Prescription forms

Selection lists can be used to speed up the entry of prescription information by presenting predefined sets of choices in a list that might otherwise have to be presented as a series of separate input controls. For example, when entering a dose, a selection list could contain a predefined list of dose values and units. Alternatively, it could present a free-text box for the dose amount and a selection list for the dose units. If the predefined sets of doses are appropriate, the former approach is faster and potentially safer than the latter approach of typing in the amount in digits and then selecting a unit (such as milligrams or grams).

This section includes illustrations (such as those in Table 9) that show dose units (such as 'mg' and 'g') in lists that are not ordered alphabetically. The display of dose values in alphanumeric order can result in selection lists with options such as those in Figure 30. This illustration shows a high value dose (such as 1 g) listed next to a much lower value dose (such as 15 mg) and highlights the patient safety risks associated with lists ordered in this way. The research necessary to provide guidance for this area is not within the scope of this work so there is no guidance in this document for mitigating this risk.

DOSE 120 mg

DOSE 125 mg

DOSE 15 mg

DOSE 1 g

DOSE 240 mg

DOSE 250 mg

DOSE 30 mg

DOSE 500 mg

DOSE 60 mg

Figure 30: Example of a List of Dose Values in Alphanumeric Order

Table 9 illustrates a set of alternative input control styles for entering a dose. The table shows a progression from a simple set of separate input boxes through to a more sophisticated selection list with predefined values and a list item that includes a nested text entry box.

Style	Visual Summary	Description
1	**DOSE** 500 mg	**Two text entry boxes** This approach, combined with form validation to check the combination of the dose value and the dose unit, may be preferred when the selection of appropriate dose units is high risk. Form validation and confirmation from the user may be safer in this context than a pre-populated selection list. This approach is not recommended in the absence of sophisticated form validation dependent on a knowledgebase that performs extensive checks on the values entered.
2	**DOSE** 500 mg ▾ mg g	**A text entry box combined with a selection list** A text entry box for a dose may be necessary when it is not appropriate or safe to display predefined dose values in a list. The dose entered will need to be validated by the system and/or confirmed by the user.
3	**DOSE** 500 ⇕ mg	**A spin control and a predefined dose unit** This approach may be appropriate for drugs with a narrow range of valid doses.
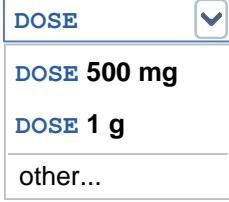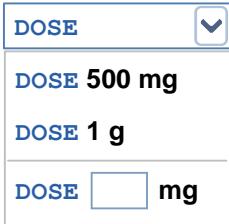
Style	Visual Summary	Description
4	**DOSE** ▼ **DOSE** **500 mg** **DOSE** **1 g** other...	**A selection list containing predefined sets of values** When it is possible to define the dose values that are commonly used and are appropriate for this drug, a pre-populated list can be effectively used to improve efficiency and require additional effort to define unusual dose values. Risks are reduced when it is possible to combine this approach with validation that checks the combination of prescription values and that those values are appropriate for the patient.
5	**DOSE** ▼ **DOSE** **500 mg** **DOSE** **1 g** **DOSE** [ ] **mg**	**A selection list containing predefined sets of values including a list item that combines a text entry box with a predefined value.** This approach combines style 2 with style 4 but with predefined dose units. It thus encourages selection rather than text entry whilst allowing both so that any dose value can be entered.

Table 9: Alternative Input Controls for Entering a Dose

Whilst each of these styles may be appropriate in specific circumstances, guidance promotes the use of controls such as styles 4 and 5. It is recommended to use these styles wherever possible to improve efficiency by allowing more than one value to be defined with a single selection and to help limit choices to predefined values and valid combinations. Styles 1, 2 and 3 need to be combined with form validation to check that values entered in the dose and dose unit fields are valid for the drug and for the values entered for other attributes.

The use of controls such as styles 4 and 5 depends on the availability of predefined dose values. In most cases, a dose value is expected to be selected as part of a template prescription and has thus been predefined along with the other attributes in the template prescription. If a selection list containing predefined doses is displayed independently of other attributes (as part of a step by step process, see section 7.3.6), it can be pre-filled based on the drug name and attributes selected in cascading lists. However, if a dose selection list is displayed after values have been entered for attributes such as strength and frequency, it may no longer be valid to display those values. See section 9.3.4 for guidance on inter-related fields and see the rationale in that section for the associated hazards.

ID	Guideline	Conformance	Evidence Rating
MSP-1870	Allow the ESC key to be used to close a selection list	Mandatory	High
MSP-1880	Combine controls (such as check boxes and text entry boxes) into a single list control where this achieves a usability benefit	Recommended	Medium
MSP-1890	Do not empty other fields when a selection list is reopened	Mandatory	Medium
MSP-1900	Where possible, encourage the selection of an item from a selection list before allowing free text to be entered	Recommended	Medium
MSP-1910	When there is supplementary information to display for an entry in a selection list, display the information in grey italics	Recommended	Low

Usage Examples

eye ointment

⊕ Select a Device

METHOD *Enter a method of administration*   *Enter a site*

Select a frequency   ⊕ As Required

in the morning

at bedtime

twice a day

three times a day

four times a day

every ☐ hours

other...

⊕ For Self Administration

Condition   ⊕ Add a Review Date

In this correct example, the frequency input control combines standard list items and one list item that incorporates a text entry box (MSP-1880)

Select a frequency

every hour

every 2 hours

every 3 hours

every 4 hours

every 6 hours

every 8 hours

every 12 hours

once a day

twice a day

three times a day

four times a day

This example is not recommended because the long list is less usable (MSP-1880)

METHOD *Enter a method of administration*

Frequency

○ 3 ⇕ times a day ▾   ⊞ As required

○ every 2 ⇕ hours ▾

at these times...

first dose...   ⊞ For Self Administration

This example is not recommended because several input controls have had to be used for a frequency input (MSP-1880)

In this sequence of correct examples (MSP-1890):

1. All the required fields for a prescription have been completed

2. A selection list is reopened and values remain displayed in the other fields

| 1 | 2 |

1

clarithromycin | oral | DOSE **250 mg** | twice a day | ▾

at these times   08:00; **20:00** | first dose   Today 20:00 | durat

Full Prescription Form   Preview   Auth

2

clarithromycin

at these times   0

Full Prescription Form

oral

oral – modified-release

intravenous – infusion

other...

ice a day | ▾

day 20:00 | durat

Preview   Auth

In this sequence of correct examples (MSP-1900):

1. A selection list is displayed

2. When 'other' is selected, free-text can be entered

1

salbutamol – inhaled   ⊞ Add a Reason for Prescribing

⊞ Select a Strength   nebuliser liquid   ⊞ Select a Device

DOSE **2.5** mg   ⊞ Enter a Site

four times a day   as required   *Give when...*

Breathless

PEFR is below 200

other...

starting from Today 11:04

ongoing   ⊞ Add a Start Condition

2

salbutamol – inhaled   ⊞ Add a Reason for Prescribing

⊞ Select a Strength   nebuliser liquid   ⊞ Select a Device

DOSE **2.5** mg   ⊞ Enter a Site

four times a day   as required   *Give when...*

Breathless

PEFR is below 200

starting from Today 11:04

Enter a description of when this medication should be given

ongoing   ⊞ Add a Start Condition

1

salbutamol – inhaled   ⊕ Add a Reason for Prescribing

⊕ Select a Strength | nebuliser liquid | ⊕   Select a Device

DOSE | 2.5 ⇕ | | mg ⌄ | ⊕ Enter a Site

| four times a day | | as required | | *Give when...* |

| starting from Today 11:04 |

Breathless

PEFR is below 200

other...

| ongoing | ⊕ Add a Start Condition

2

salbutamol – inhaled   ⊕ Add a Reason for Prescribing

⊕ Select a Strength | nebuliser liquid | ⊕   Select a Device

DOSE | 2.5 ⇕ | | mg ⌄ | ⊕ Enter a Site

| four times a day | | as required | | *Give when...* |

| starting from Today 11:04 |

Enter a description of when this medication should be given

| ongoing | ⊕ Add a Start Condition

In this sequence of correct examples (MSP-1900):

1. A selection list is displayed
2. When 'other' is selected, free-text can be entered

This is an alternative to the previous example.

| inhaled | | 100 micrograms per puff | **DOSE** | 1 to 2 puffs |

...ay as required | ⌄ | | When to give this as required medication |

Enter a description of when this medication should be given

This example is not recommended because free-text must be entered and there is no opportunity to make a selection from a list (MSP-1900)

Frequency   **METHOD** Apply as directed   Left knee

| twice a day |

| at these times 08:00; **20:00** | ⊕ Add an Additional Or...

08:00; 20:00   *Standard times*

10:00; 22:00   *Non-standard times*

Edit administration times...   ...d a Review Date

In this correct example, supplementary information is included in the list and has been displayed in grey italics (MSP-1910)

Rationale

Design Analysis:

Input controls for some attributes are more complex than others. Date and time guidance (including *Design Guide Entry – Time Display* **{R13}**, *Design Guide Entry – Date Display* **{R14}** and *Design Guide Entry – Date and Time Input* **{R15})** exemplifies where separate sets of guidance are provided to ensure that these attributes are handled consistently. Within a prescription, the definition of a field such as 'frequency' or 'dose' is relatively straightforward if a preconfigured list of regularly used frequencies or doses can be presented.

The input of a frequency could be facilitated by providing more than one input control. For example, to enter any possible frequency, the system would need to support the entry of a quantity and the selection of a unit to be able to display '5 days'. If presented as a selection list, it would have to display a long list of all valid combination of values. Very long lists of values, especially where items in the list are very similar, increase the risk of mis-selection and should be avoided as far as possible. It is thus more effective to combine list items and text input (such as '5' for '5 days') and provide them for selection from within the same control (MSP-1880).

One of the advantages of building the prescription using selection lists and fields presented one by one is that the selections remain visible and can be continually reviewed along with the other information being added to the prescription. This increases opportunities to notice a mistake. To confirm a mistake, prescribers may want to reopen a selection list so that they can see their selection within the list from which it was selected and still have visibility of the other attributes in the prescription (MSP-1890).

Whilst free-text fields are useful for providing flexibility in highly structured prescription forms, there is a risk that they are used inappropriately and may result in discrepancies between the information entered in structured fields and the free-text comments. This kind of error is reported in *Prescription Errors and Outcomes Related to Inconsistent Information Transmitted Through Computerized Order Entry* **{R45}**. For example, a free-text field labelled 'Special Instructions' could be used to enter important information about administrations that should have been entered in a separate field for which there is a selection list of predefined values. Since selection lists are populated with predefined options, they can also be used to link to information elsewhere in the system and may be needed for reporting and auditing. Although the provision of any free-text field is best avoided, since it may be used inappropriately, it will still need to be provided in some instances. By providing access to a free-text field only after a selection has been made in a list (MSP-1900), the selection of a list item is encouraged over the entry of free-text. This is because selecting from a list is easier and because proactively presenting the selection list does not limit the user to a selection that may not be wholly appropriate. Not limiting the user to predefined selections is particularly important if there is a risk that the user may interpret the pre-populated values as recommendations (and this will depend on the specific example and its context).

Desk Research:

The paper *Prescription Errors and Outcomes Related to Inconsistent Information Transmitted Through Computerized Order Entry* **{R45}** studied the incidence of inconsistencies in prescriptions created using a single electronic prescribing system in tertiary care. The findings suggest that free-text fields can be used inappropriately to supplement or even modify values entered (or selected) elsewhere in the prescription and that their inappropriate use may be higher for more complex prescriptions.

The *ePrescribing Functional Specification* **{R12}** includes requirements (GEN.AD.003 and GEN.AD.011) that refer to the need to allow for different schedules for administration to be determined according to ward, specialty or drug. This requirement can be met by using supplementary text (MSP-1910).

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Aesthetic and minimalist design – By combining controls (such as dose or frequency) the total number of controls that needs to be displayed is reduced

- Error prevention – A reduction in the number of selections that has to be made reduces the number of times a user is exposed to the risk of mis-selection

- Flexibility and efficiency of use – Combining controls allows the user to define a number of values by making a single selection from a pre-populated set of values presented as a list

User Research:

Guidance for the display of supplementary text in selection lists (MSP-1910), meets a requirement identified in Study ID 67 (see APPENDIX D) to indicate administration schedules that do not correspond with ward round times.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated by the design and one that is not mitigated by guidance

Potential Hazards:

- A selection list in the prescribing area may obscure important information in a list of current medications

- Important information about a prescription is not carried forward into other medications views because it was entered into a free-text field instead of a structured field

- A prescription is not wholly reviewed because the information is displayed in different formats, split across many different controls

- Individual administration times have to be defined by the prescriber and result in non-standard times

- A large dose value is mis-selected because it is displayed adjacent to the intended small dose value in a selection list ordered alphanumerically

Mitigations:

- Selection lists can collapse once a selection has been made if necessary to preserve visibility of other information (see section 6.3.2)

- MSP-1900 recommends that ,wherever possible, drop-down lists are presented before free-text can be entered

- Guidance recommends that the number of different types of controls are minimised, which reduces the different formats used to display it (see section 8.1)

- Selection lists are used to combine values (such as those in a template prescription) and display them a format similar to that displayed in a medication line (see section 7.3.3)

- MSP-1880 recommends combining controls into a single control

- MSP-1910 recommends the use of grey italic text for supplementary information and this could be used to indicate when an administration schedule is non-standard

- **This risk is not mitigated by guidance**

9.3.3 Using Selection Lists to Prioritise

When a selection list is used to enter values for a prescription, more common values can be placed at the top of the list so that they are easier to find. This process of placing such values at the top of the list is referred as 'prioritisation' and this section provides guidance for prioritising selection lists that may be presented in any part of the prescribing process.

ID	Guideline	Conformance	Evidence Rating
MSP-1920	Prioritise the items displayed in a selection list by separating them into sections	Recommended	Medium
MSP-1930	Limit the options available in the first section of a selection list (and in automatically presented cascading lists) to relevant values	Recommended	Medium
MSP-1940	When there are further choices than are displayed by default in a prioritised list, provide access to further options with an additional section of the list	Recommended	Low
MSP-1950	When a more detailed view is available for defining the values in a prioritised list (such as one for editing individual administration times), include a single list item for accessing that view at the end of the selection list	Recommended	Medium

Usage Examples

1

chloramphenicol	auricular
	ocular
	other...

✓

| 1 | 2 | 3 |

2

chloramphenicol	auricular
	ocular
	cutaneous
	other...
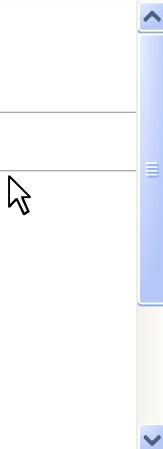
3

chloramphenicol	auricular
	ocular
	cutaneous
	auricular
	body cavity use
	cutaneous
	dental
	endosinusial

In this sequence of correct examples (in which the prescriber can access an extended list of routes) (MSP-1920, MSP-1930, MSP-1940):

1. A list of routes is presented

2. 'Other' is selected and a further (unlicensed) route is revealed

3. 'Other' is selected again and an extended list of routes is revealed

Note

In practice, the word 'other' may be replaced by a label that more accurately describes the contents of the list that will be revealed when that option is selected.

This example is incorrect because the long list could have been separated into sections and a first section could have been provided that contains appropriate commonly selected routes (MSP-1920, MSP-1930)

chloramphenicol	auricular
	body cavity use
	cutaneous
	dental
	endosinusial
	endotracheopulmonary
	epidural
	gingival
	intraarterial
	intraarticular
	intravenous – infusion
	intravenous – injection
	ocular
	oral

Full Prescription Form

In this correct example, a list of sets of administration times is supplemented with an option that opens a more detailed view in which individual administration times can be edited (MSP-1950)

| clarithromycin | oral | DOSE 250 mg | twice a day |

at these times   08:00; **20:00**   first dose   Today 20:00   durat

08:00; **20:00**   *Standard times*
06:00; **22:00**   *Non-standard times*
Edit Administration Times...

Preview   Auth

Rationale

Design Analysis:

The guidance in this section is primarily aimed at mitigating the risks of mis-selection. Prioritising selection lists by dividing the list into sections (MSP-1920) helps to:

- Mitigate the mis-selection risks that are attributed to the difficulties associated with navigating and selecting from long lists

- Reduce the cognitive load associated with making a choice because there are fewer choices within each section (MSP-1930)

- Make the most common options readily available and ensure that the less common options take a little more effort to get to (MSP-1940)

In some cases, it may not be advisable for an item to be available in a selection list because it should be defined in the context of other information or because patient safety concerns require that it is much more difficult to access. For example, it may be acceptable to select from a list of predefined sets of administration times but not to edit individual administration times so that they are different on consecutive days without viewing the whole schedule. In this case, to maintain the simplicity of the prescription whilst providing access to these less frequently used and sometimes more complex options, a list item (such as 'Other...' or 'Edit administration times'), can be provided that opens a new dialog or redirects users to an area of the prescription form in which they can specify more information (MSP-1950).

Desk Research:

The use of sections in a selection list and the hiding of options that can be considered to be more 'advanced' help to break the information into chunks. The use of 'chunking' and the principle of reducing load on short-term and working memory are described in Shneiderman's *Strategies for effective human-computer interaction* **{R18}**.

MSP-1940 allows the prioritisation of routes that are normally prescribed whilst still allowing routes not normally associated with the drug to be selected. This meets a requirement (GEN.OS.050) in the *ePrescribing Functional Specification* **{R12}** to support prescribing drugs using routes that are not normally associated with them. The prioritisation of routes can also be used as part of a mechanism that meets the requirement (GEN.OS.062). The requirement is to be able to prioritise specific routes of administration for patients that have reduced or unusual requirements but to still provide access to other routes (with reminders or alerts).

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

■ Flexibility and efficiency of use – Selection lists can be prioritised so that the most likely (or most appropriate) values appear towards the top, thus reducing the need for the complete list to be reviewed

■ User control and freedom – Even though lists are prioritised, other options are available by making selections from the list that reveal further choices

User Research:

Findings from Study ID 67 (see APPENDIX D) suggest that the ability to change the dose units (for example, from milligrams to grams) introduces the risk that an incorrect unit (and therefore an incorrect dose) can be easily selected. Selection lists can be used to limit the choices based on other values selected (MSP-1930) such that the dose units could be set to milligrams if appropriate and either 'locked', so that it cannot be changed, or displayed as the only value in the prioritised section of a selection list. An option such as 'other' can be provided to display an input control for changing the dose units.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ An antibiotic is prescribed without an end date	■ Appropriate pre-filling of fields based on the drug name and route (see section 9.3.5) ■ Prioritising options in selection lists (MSP-1920)
■ A list item is mis-selected	■ Prioritising of selection lists to promote the most likely (or most appropriate) selection targets to the top of the list (MSP-1920) ■ Restricting options available in selection lists so that some selections are more difficult to access than others (MSP-1930)

9.3.4 Presenting Selection Lists for Inter-Related Fields
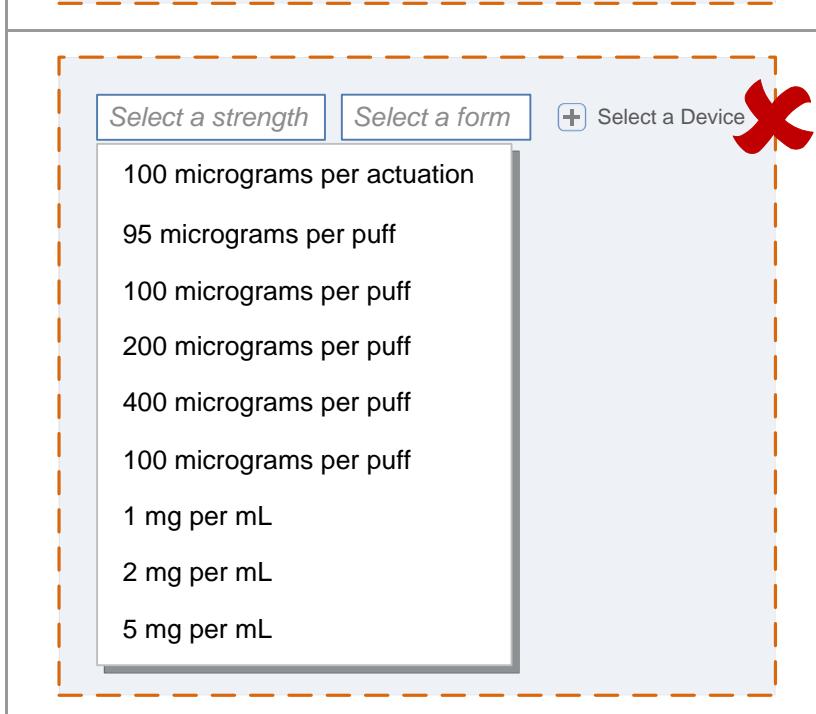
This section includes guidance for the placement of fields with dynamic selection lists that may contain different list items depending on selections made in other fields. It also includes guidance for the behaviour of fields when a value is selected in a related field or a value is selected that affects other fields.

Entering a value into a field may also cause a related field to be pre-filled. See section 9.3.5 for guidance on pre-filling.

ID	Guideline	Conformance	Evidence Rating
MSP-1960	Where relevant, use supplementary text in a drop-down list of options if the selection will affect other options in the form	Recommended	Low
MSP-1970	Where data is available, update the contents of a selection list based on selections made in related fields	Mandatory	High
MSP-1980	When displaying list items that are not valid in relation to values selected in other fields, list them in a separate section in the selection list	Recommended	Low
MSP-1990	When a list item is selected that is not valid in relation to values selected in other fields (and data is available to support this) clear the other fields	Mandatory	High

MSP-2000	As far as possible, present input controls for fields that are inter-dependent close to one another	Recommended	Medium
MSP-2010	In a system that cannot validate entered values (because decision support checking is not available), when a selection list is reopened and a different value selected, clear entries in all input controls that are interdependent	Recommended	Medium

Usage Examples

Select a strength Select a form ⊕ Select a Device ✔ *For breath actuated inhalers* 100 micrograms per actuation *For dry powder inhalers* 95 micrograms per puff 100 micrograms per puff 200 micrograms per puff 400 micrograms per puff *For metered dose inhalers* 100 micrograms per puff *For nebulisers* 1 mg per mL 2 mg per mL 5 mg per mL	In this correct example of a list of strengths, a selection will limit or change the options available for form. Both grouping and supplementary text for each group have been used to indicate that a selection will affect other options in the form (MSP-1960)
Select a strength Select a form ⊕ Select a Device ✖ 100 micrograms per actuation 95 micrograms per puff 100 micrograms per puff 200 micrograms per puff 400 micrograms per puff 100 micrograms per puff 1 mg per mL 2 mg per mL 5 mg per mL	This example is not recommended because the selection list has not been divided into sections and supplemented with text. When an item in this selection list for strength is selected, it will affect the choices available in the form selection list (MSP-1960)

In this sequence of correct examples (MSP-1970, MSP-1980, MSP-1990, MSP-2000):

1. Strength has been selected and form is required

2. The selection list for form displays choices that are relevant for the selected strength. Choices for other strengths are listed in a separate section (in this case accessible through 'Other...')

3. When 'Other' is clicked, the choices that relate to other strengths are displayed

4. If a form is selected from the 'For other strengths' section, the strength is cleared and must be re-entered

This example is incorrect because the contents of this selection list have not been updated to match the selected strength (MSP-1970)

It is also not recommended because the list has not been separated into sections such that the choices that are not valid for the selected strength are displayed in a separate section (MSP-1980)

Rationale

Design Analysis:

When the contents of some fields are dependent on the value entered or selected in others, providing a set of input controls that can be completed in any order presents some patient safety challenges.

The patient safety risks are well illustrated by an example of the relationship between dose, strength and form. Taking salbutamol as an example, if a strength of '100 micrograms per dose' is selected and then a form of 'aerosol' is selected, the dose can only be defined as a number of puffs. If the form is then changed from aerosol to dry powder, the strength must be cleared because it is no longer valid for that form. When the form control is activated, the list may contain 'dry powder', even though it is not valid, but it should be displayed in a separate section and labelled so that the user knows that selecting it will result in the strength being cleared. In a design alternative in which the form selection list would only display 'aerosol', because that is the only form that is valid for the selected strength, the user is forced to change the strength in order to change the form.

The placement of inter-related controls close to one another helps to communicate the relationship between them and ensure that, when changes in one field impacts another, they cause minimum disruption to the dynamic form and provide strong feedback for the results of a selection.

The presentation of 'invalid' options in a separate section provides some flexibility for 'unusual' combinations to be selected that would normally be disallowed. If a combination of values is very rarely used, but must be accommodated, a system that is unable to check values entered may instead require extra confirmation or reselection of one or more related values.

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Visibility of system status – The feedback for a selection of an entry in an inter-related field is stronger if the fields that it effects are visibly grouped

- Error prevention – The demotion of options that will affect values in other fields draws attention to the fact that selecting them results in an invalid combination of values in the prescription

- Flexibility and efficiency of use – The presentation of values that might otherwise be suppressed allows flexibility in the system design that could be used to accommodate specialist use

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	**Mitigations:**
■ Strength is changed after a dose has already been defined and the resulting combination is not relevant for the patient	■ When strength is selected or changed after dose, the dose must be reconfirmed (MSP-1970)
■ Inappropriate combinations are selected	■ When a list item is selected that is not valid in relation to values selected in other fields, clear the other fields (MSP-1970, MSP-1990)

9.3.5   Pre-Filling Input Controls

This section contains guidance for presenting field that already contain a value and pre-filling fields when values are defined in other fields.

Pre-filling input controls is most likely when fields are inter-related such that a value in one causes the other to be pre-filled. See section 9.3.4 for guidance on inter-related fields.

ID	Guideline	Conformance	Evidence Rating
MSP-2020	Support pre-filling of fields (or sets of fields) when they are first displayed and ensure that the pre-filled values are based on at least the drug name and route (or attributes from which the type of medication can be derived).	Mandatory	High
MSP-2030	Allow the contents of all fields to be reselected such that a pre-filled value, previous choice or text entry can be changed (even if the associated selection list has only one option)	Recommended	Medium

MSP-2040	When a value is selected in a field, pre-fill appropriate fields that have defaults (or only one possible value) based on the selected value (for example, pre-fill administration times when a frequency is selected)	Recommended	Low
MSP-2050	Use formatting (such as highlighting) to draw attention to a field whose contents have changed automatically rather than directly by the user	Mandatory	High
MSP-2060	Pre-fill administration times and time of first dose (or equivalent for once only and as required medications) when frequency has been selected	Recommended	Low

Usage Examples

1

Select a Strength   modified-release capsules   Select a De

DOSE   60 mg   Enter a Site

Select a frequency   As Required

at these times

first dose   For Self Administration

2

Select a Strength   modified-release capsules   Select a De

DOSE   60 mg   Enter a Site

three times a day   As Required

at these times   08:00; **14:00**; 20:00

first dose   Today 14:00   For Self Administration

In this sequence of correct examples:

1. A frequency has not yet been entered

2. When the frequency has been entered, the administration times and first dose fields are pre-filled automatically (MSP-2060)

The automatically filled values are based on the drug and route as well as the frequency (MSP-2020)

The pre-filled fields are highlighted to emphasise that they have been completed automatically (MSP-2050)

1

Select a Strength | modified-release capsules | Select a De

DOSE **60 mg**   ⊞ Enter a Site

Select a frequency   ⊞ As Required

at these times

first dose   ⊞ For Self Administration

2

Select a Strength | modified-release capsules | Select a De

DOSE **60 mg**   ⊞ Enter a Site

three times a day   ⊞ As Required

at these times 08:00; **14:00**; 20:00

first dose Today 14:00   ⊞ For Self Administration

In this sequence of incorrect examples:

1. A frequency has not yet been entered

2. When the frequency has been entered, the administration times and first dose fields are pre-filled automatically.

This sequence of examples is incorrect because the administration times and time of first dose have been filled automatically and formatting has not been used to draw attention to them. (MSP-2050)

Rationale

Design Analysis:

Alternative designs were assessed in which one design presented a list of template prescriptions that can be selected to fill in a number of fields and the other displayed fields already pre-filled when the prescription form was opened. The display of template prescriptions requires the prescriber to make an explicit and active choice whereas pre-filled values can be passively accepted. Guidance must balance the need to improve efficiency with the need for the prescriber to make an active choice. The following approach to pre-filling is thus reflected in the guidance:

- Drug name and other attributes that define the type of medication must be explicitly selected. Pre-filling happens when there is only one possible value
- Template prescriptions allow other important attributes (such as dose and frequency) to be explicitly selected
- In the absence of template prescriptions, important attributes (such as dose and frequency) are presented one by one and an explicit choice must be made. Pre-filling happens when there is only one possible value
- When a prescription form is opened, remaining fields are only pre-filled if appropriate and can all be modified by the prescriber (MSP-2020)
- Fields can be pre-filled when a specific value is selected in another field. For example, administration times could be pre-filled once a frequency has been selected (MSP-2040, MSP-2060))

See also section 7.3.6 for guidance on pre-filling when presenting fields step by step and section 9.3.6 for guidance on the pre-filling of specific input controls.

Desk Research:

The pre-filling of fields such as administration times (MSP-2020), reflects the GEN.OS.052 requirement in the *ePrescribing Functional Specification* **{R12}** to provide the ability to define that specific medications should be routinely scheduled for administration at certain times of day and to allow the system to default to these values.

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

■ Flexibility and efficiency of use – Efficiency is improved by pre-filling appropriate fields (such as administration times

User Research:

Two designs were assessed in Study ID 46 (see APPENDIX E), one of which used pre-filling and the other used template prescriptions. The study recommended the use of active selection (template prescriptions) rather than passive pre-filling.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A default value is defined that is inappropriate for the selected drug and or other values in the prescription	■ Pre-filled values must be appropriate for the drug and route at least and preferably also reflect other values defined in the prescription (MSP-2020)
■ A prescription is authorised with a value that was not the intended value because it had been automatically updated when a value was defined in another field	■ Guidance requires the use of formatting to draw attention to a field whose contents have changed automatically (MSP-2050) ■ The contents of all fields can be changed such that a pre-filled value can be changed (see section 7.3.6)
■ An antibiotic is prescribed without an end date	■ Appropriate pre-filling of fields based on the drug name and route (MSP-2020).
■ Individual administration times have to be defined by the prescriber and result in non-standard times	■ Pre-filling administration times when the frequency is defined (MSP-2060) ■ Providing a selection list of (common) administration schedules (see section 9.3.6) ■ Restricting the definition of individual administration event times to a more detailed view (see section 9.3.6) ■ Where appropriate, pre-fill one or more fields when a selection is made in a related field (see section 7.3.6).

9.3.6　Presenting Input Controls

This section includes guidance relating to the display of specific input controls such as those for dose and administration times.

ID	Guideline	Conformance	Evidence Rating
MSP-2070	When a dose field (or equivalent) is displayed, also display a label for the dose (either within or outside of the input control)	Mandatory	High
MSP-2080	If possible, do not allow the selection of a unit of measurement for a dose that would result in an invalid value when combined with the number entered for the dose amount	Recommended	High
MSP-2090	When a strength field is displayed, also display a label for the strength field or a group label including the word 'strength'	Mandatory	Medium
MSP-2100	Do not present strength and dose input controls next to each other (side by side) in a detailed prescription form	Mandatory	Medium

MSP-2110	When displaying a list of administration times, display the dose for the first scheduled administration in bold	Mandatory	Medium
MSP-2120	Do not display a horizontal (text-only) list of administration times for schedules containing more than six administration events in 24 hours	Recommended	Low
MSP-2130	Provide a selection list containing predefined sets of administration times	Recommended	Medium
MSP-2140	Do not display input controls for entering or editing individual administration times within the view that shows all the required fields for a prescription	Mandatory	Medium
MSP-2150	For all prescriptions, require a date and time to be defined (or pre-filled) for: ▪ The first dose (for regular medications) ▪ The starting date and time (for as required medications) ▪ The only dose (for once only medications)	Recommended	Medium
MSP-2160	Use unique labels for the following fields: ▪ The first dose (for regular medications) ▪ The starting date and time (for as required medications) ▪ The only dose (for once only medications) **Note** This guidance point does not constitute a recommendation for the specific text of those labels	Recommended	Medium
MSP-2170	Do not provide a check box for fields with two opposite states when one of those states causes a related field to be presented. (For example, do not provide a check box to set 'as required' to on or off if a setting of 'on' requires another field to be presented to qualify the conditions for administration)	Recommended	Low

Usage Examples

This example is incorrect because a dose field is displayed without a label (MSP-2070)

Drug Details

Drug Name and Route	**chloramphenicol** – cutaneous
	Reason for prescribing using an unlicer
Strength and Form	1% eye ointment
Dose and Frequency	**METHOD** Apply as directed Left kn
	twice a day
Administration	at these times 08:00; **20:00** ⊞ Ad
	first dose Today 20:00
Duration	ongoing ⊞ Add a Start Condition

In this correct example, a label is provided for the strength, form and device fields (MSP-2090)

Drug and Route	**chloramphenicol** – cutaneous
	Reason for prescribing using an unlicensced route
Strength	1 %
Form	eye ointment ⊞ Select a Device
Method	Apply as directed
Site	Left knee
Frequency	twice a day ⊞ As Required
Administration Times	08:00; **20:00**
First Dose	Today 20:00 ⊞ For Self Administration
Duration	ongoing ⊞ Add a Start Condition
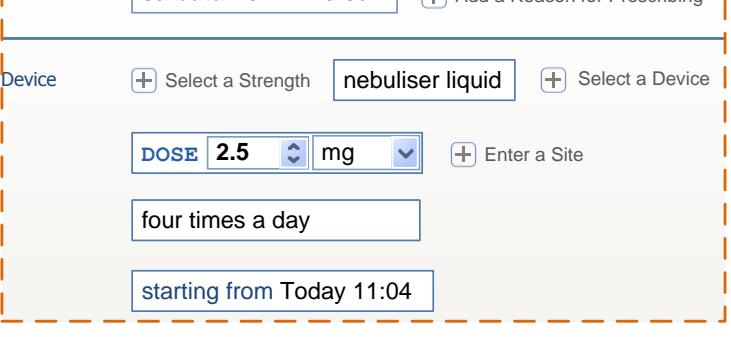
Preview   Authorise

In this correct example, a label is provided for the strength field (MSP-2090)

Drug Details

Drug Name and Route	**chloramphenicol** – cutaneous
	Reason for prescribing using an unlicen

Dose and Frequency	1%	eye ointment
	METHOD Apply as directed	Left kn
	twice a day	
Administration	at these times 08:00; **20:00**	⊕ Add
	first dose Today 20:00	
Duration	ongoing ⊕ Add a Start Condition	

This example is incorrect because a strength field is displayed without a label for the field or for the group (MSP-2090)

---

100 micrograms per puff ⊕ Select a Form ⊕ Select a Device
DOSE 1 to 2 puffs ⊕ Enter a Site
four times a day ⊕ As Required
at these times 08:00; 14:00; **20:00**
first dose Today 14:00 ⊕ For Self Administration

This example is correct because the strength and dose fields are not next to one another (side by side) (MSP-2100)

⊕ Select a Form ⊕ Select a Device ⊕ Enter a Site
100 micrograms per puff **DOSE** 1 to 2 puffs
four times a day ⊕ As Required
at these times 08:00; 14:00; **20:00**
first dose Today 14:00 ⊕ For Self Administration

This example is incorrect because the strength and dose fields are next to one another (side by side) (MSP-2100)

In this correct example, the scheduled administration time at which the first dose is due to be given is displayed in bold. (MSP-2110)

This example is not recommended because horizontal lists of administration times should not be displayed for schedules containing more than six administration events in 24 hours (MSP-2120)

In this correct example, a selection list is provided that contains sets of administration times that are valid for the prescription attributes defined so far (MSP-2130)

This example is incorrect because administration times should not be displayed in controls that allow them to be edited individually (MSP-2140)

In this sequence of correct examples:

1. A selection list is used to remove the attribute 'as required'.

2. When 'as required' is removed, the related field containing 'Give when breathless' is also removed and its contents are lost (MSP-2170)

This example is not recommended because a checkbox has been used for a control ('as required') that causes another input control to appear. If the checkbox is selected, the related field containing 'Give when breathless' is removed and its contents are lost (MSP-2170)

Rationale

Design Analysis:

See also the rationale in section 7.3.7 for guidance on the provision of labels for fields whose contents may be interpreted as belonging to a different control.

The use of text boxes that present selection lists when activated is an effective means of minimising the number of controls and focusing more attention on the information and less on the controls. Guidance recommends not using a check box for attributes that are linked to the appearance of new controls such that ticking the check box causes a new field to appear. (MSP-2170)

For example, 'as required' (PRN) medications may need an additional field for selecting or entering a description of when to give the medication. If the 'as required' attribute is displayed as a check box, then ticking it causes the dynamic field (description of when to give the medication) to appear. If a selection or entry is made in that field, and the tick is removed from the check box, then either the information entered in the field is lost or alerting the user is necessary to draw attention to the field's removal. Since removing the tick inadvertently is simple, but re-entering the lost information lost takes time, a better control can help to avoid this loss of information.

It is considered acceptable to display up to six administration times as a horizontal list because:

- They are likely to be pre-filled when a frequency is selected
- The individual times are expected to conform to ward round times that are preconfigured
- The list of administration times can be supplemented with text such as 'standard times'
- The specific administration times are supplemented by the frequency and time of first dose (or equivalent)
- More frequent administration times are better handled in a more detailed view in which a more detailed administration schedule can be displayed (MSP-2120)

When a set of administration times is pre-filled, or selected from a drop-down list, the display of the times in a horizontal line (such as 08:00, 20:00) is designed to supplement the frequency and to support recognition of a familiar set of administration times. The readability issues with displaying administration times in a horizontal list are thus mitigated by the display of the frequency and the time and date of the first scheduled administration. The display of administration times in a horizontal list (a sentence) for more than six administration times is unlikely to be useful in supporting quick recognition of a familiar set of administration times and an alternative control or a more detailed administration view may be more effective.

See also section 9.3.5 for general guidance on pre-filling input controls and section 7.3.6 for guidance on pre-filling when presenting fields step by step.

For rationale relating to the display of labels, see the following:

- Section 7.3.7 for labels in sentence layout
- Section 8.3.1 for guidance on label alignment
- Section 8.3.3 for when to display labels

Desk Research:

The *ePrescribing Functional Specification* **{R12}** requirement GEN.OS.043 indicates that an 'as required' medication has an indicative frequency (or maximum dose or frequency) and requires qualification of the circumstances in which it is to be given (MSP-2170).

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Aesthetic and minimalist design – Minimising the visual noise introduced by input controls (fields) and maximising the relative emphasis on the information within them
- User control and freedom – By providing selection lists to change values in a field that may cause other fields to be removed or cleared, the user is less likely to choose an action that results in loss of data

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks, some of which are mitigated and some partially mitigated by the guidance:

Potential Hazards:	Mitigations:
▪ An inappropriate administration schedule is defined as a result of an individual administration time being edited inappropriately	▪ Providing a selection list of (common) administration schedules (MSP-2130) ▪ Not recommended to allow individual administration times to be edited only in the context of a view that displays a detailed administration schedule (MSP-2140)
▪ A medication is started later than intended because the prescriber does not notice that the first scheduled dose is too far into the future	▪ The first scheduled dose is displayed in bold within the list of administration times (MSP-2110) ▪ When there is more than one dose, the first dose date and time is displayed in a separate field (in addition to the administration times) (MSP-2150)
▪ The label 'start date' is incorrectly interpreted causing an inappropriate administration schedule	▪ Guidance recommends that the label for this field is different for regular, as required and once only medications to clarify the meaning of the date and time (MSP-2160)
▪ Individual administration times have to be defined by the prescriber and result in non-standard times	▪ Pre-filling administration times when the frequency is defined (see section 9.3.5) ▪ Providing a selection list of (common) administration schedules (MSP-2130) ▪ Restricting the definition of individual administration event times to a more detailed view (MSP-2140) ▪ Where appropriate, pre-fill one or more fields when a selection is made in a related field (see section 7.3.6)
▪ An inappropriate value is defined as a default	▪ **This risk is not mitigated by the guidance**. The definition of appropriate default values is a local system configuration issue and is thus outside of the scope of this design guidance
▪ An input control for a dose is displayed adjacent to an input control for a strength and causes the dose value to be interpreted as the strength or vice versa	▪ Dose and strength can be entered by selecting a template prescription (see section 7.3.4) or by selecting values for individual fields that are presented in sequence (see section 7.3.6). Thus they only appear adjacent after they have already been completed ▪ In sentence layout (when dose and strength are most likely to appear adjacent), guidance recommends that labels are incorporated into fields, so the dose label immediately precedes the dose value (see section 7.3.7) ▪ Guidance recommends that labels are used for all fields whose contents could be interpreted as belonging to a different control (see section 7.3.7) ▪ The dose field is always labelled (MSP-2070) ▪ Strength and dose fields must not be placed adjacent in detailed prescription forms (MSP-2100) and strength fields must be accompanied by a label that uses the word 'strength' for the individual field or the group containing the strength field (MSP-2090)

10   GUIDANCE DETAILS FOR PREVIEW AND AUTHORISE

10.1   Introduction

Once a prescriber has completed entering prescription details, a preview of the prescription in a more familiar format (such as that displayed in a Current Medications View) allows the prescriber to review his or her entry before authorising. This section provides some guidance relating to previews and the placement of controls for authorising prescriptions.

Figure 31 shows the full user interface prescribing process in which the steps covered in this section are shown with a grey background:
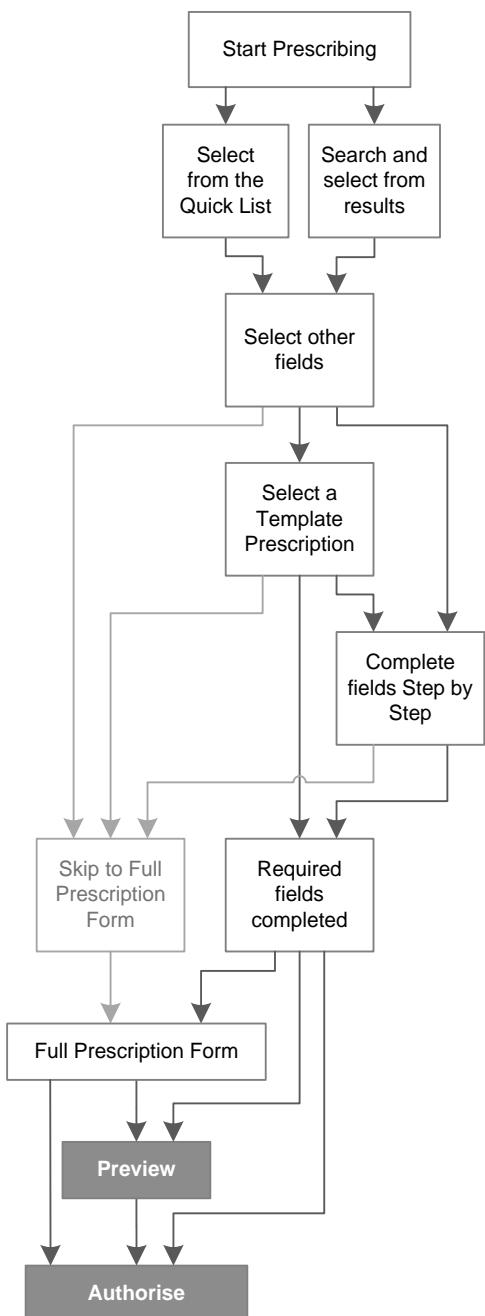
Figure 31: The Prescribing Process – Preview and Authorise

Figure 32 is an extract from Figure 31 to illustrate the user interface prescribing steps covered in this section showing the preview and authorise steps and the links to and from them:
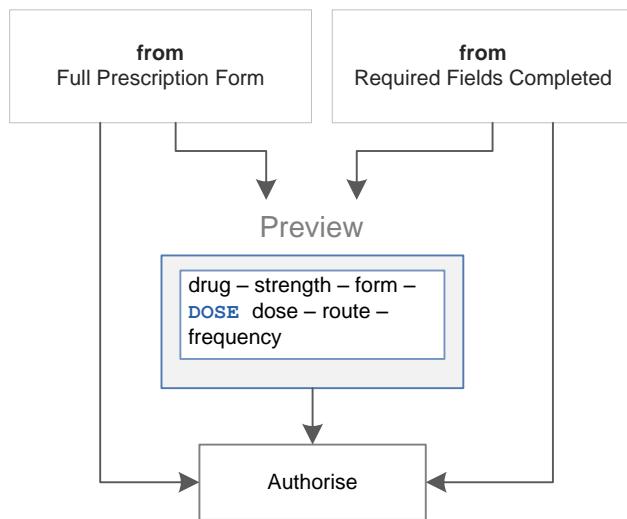
Figure 32: User Interface Prescribing Steps—Preview and Authorise

10.2 Principles
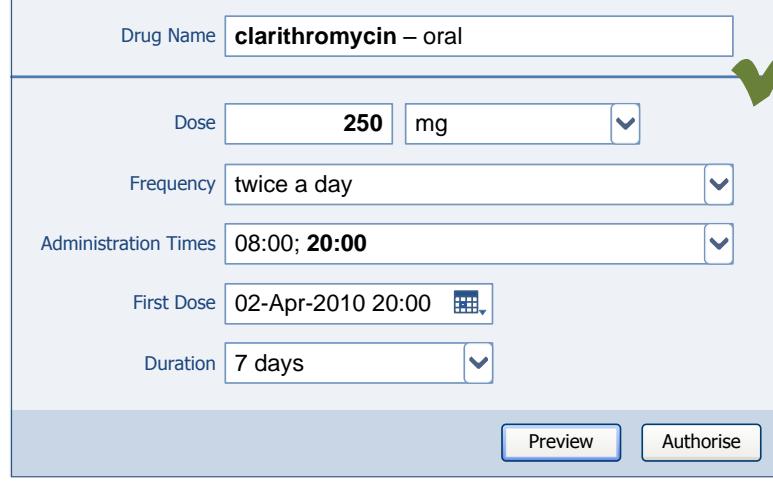
All guidance is informed by all of the principles for search and prescribe listed in section 2.1. The following are particularly relevant to this section:

- Mitigate the risks of mis-selection and misinterpretation:

  - Appropriate setting of focus can help avoid mis-selection of a control such as 'Authorise'.

- Maximise safety in the absence of decision support systems by designing for the reduction of errors from invalid or inappropriate selections or entries:

  - The preview is always available so that prescribers have access to the full prescription in a format that is both more condensed and familiar from other medications views

- Maximise scalability such that the prescribing process can be modified to accommodate additional information, steps or shortcuts:

  - The preview can be extended in a system that can save completed prescriptions before authorisation such that they can then be reviewed and authorised as a group

- Minimise the potential for important information to be hidden from view:

  - A preview can become a required step when more detailed prescriptions are defined in which the input controls are distributed across more than one screen

10.3   Guidelines

10.3.1   Providing a Preview

This section includes guidance for how to provide and display a preview of all information defined within a prescription, before final authorisation of the prescription.

ID	Guideline	Conformance	Evidence Rating
MSP-2180	Provide a control for displaying a preview	Mandatory	High
MSP-2190	Include all values defined as part of the prescription in a preview	Mandatory	High
MSP-2200	Adhere to guidance in *Medications Management – Medication Line* **{R3}** for the display of drug details in a preview	Mandatory	Medium
MSP-2210	Do not introduce a preview as a compulsory step before a detailed prescription form has been opened	Recommended	Medium
MSP-2220	Require a preview to be presented before a prescription can be authorised when the prescription details are distributed over more than one screen such that a navigation control (such as a button or tab) is needed to move between screens	Mandatory	High
MSP-2230	Do not display the medication line within a preview as a long line of text extending for longer than 120 characters without wrapping onto a new line	Recommended	Low
MSP-2240	Where relevant, display some prescription attributes in a preview using a format similar to that used in other medications views (though different to the format used for the input control)	Recommended	Medium
MSP-2250	Provide a control for closing the preview and returning to the prescription form (such that the prescription can be amended)	Mandatory	Medium
MSP-2260	Set default focus to the control that closes the preview	Mandatory	Medium
Usage Examples			

Drug Name	**clarithromycin** – oral	In this correct example, a button is provided for displaying a preview (MSP-2180)
Dose	**250** mg	
Frequency	twice a day	
Administration Times	08:00; **20:00**	
First Dose	02-Apr-2010 20:00	
Duration	7 days	
	Preview Authorise	

In this correct example, the preview displays the prescription information in a format similar to that used in a Medications List View and a control for closing the preview is provided and has focus by default (MSP-2190, MSP-2200, MSP-2250, MSP-2260)

In this correct example, the preview displays administration times in a format similar to that used in a Drug Administration View (MSP-2190, MSP-2200, MSP-2220, MSP-2240)

This illustration of a preview is not recommended because the preview has been displayed as a long line of text that exceeds 120 characters without wrapping onto a new line (MSP-2230)

Rationale

Design Analysis:

When a preview is displayed for every single prescription, the risk that the contents of the preview are ignored is higher than when the preview is only displayed in specific circumstances or on demand. The more information that has been entered into a prescription, the more important it is that a preview is provided so that the information can be reviewed without having to read it from within a series of input controls. The prescription can be displayed in a preview such that it looks the same as it would in another view, such as a Medications List View or a Drug Administration View.

When the design of a prescription form makes it easy to read the information (without getting distracted by input controls, command buttons or visual design), a preview is less critical. However, a preview is very effective at encouraging a review of the prescription details prior to authorisation when information has been entered into a prescription form that spans many tabs or windows (such as pop-up dialogs).

Desk Research:

Guidance in this section is informed by the following Nielsen heuristics **{R17}**:

- Error prevention – When the contents of a prescription cannot be displayed within a single view, a preview can facilitate the review of all prescription values before the prescription is submitted (MSP-2180, MSP-2190)

- User control and freedom – The preview is an optional step (MSP-2210) since, in the simplest prescriptions, all of the prescription details can be effectively reviewed within the input controls

User Research:

Guidance for the presentation of a preview when prescription details are spread across more than one screen (MSP-2220) is informed by the findings of Study ID 67 (see APPENDIX D). The study found that, when considering prescribing processes with greater and fewer steps (longer and shorter prescribing processes), a preview becomes more useful and important when there are more steps (a longer process). User research was unable to determine whether a mandatory preview step is beneficial since some participants currently using such a system reported that the preview step was often ignored.

Study ID 67 also recommends that a preview step has an option that allows the user to return to the prescription form and amend it (MSP-2250).

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:

- A prescription is authorised with unintended values that were not visible from the page from which it was authorised

- A prescription is authorised by activating a control in error

Mitigations:

- Require a preview when the prescription values cannot be seen in a single screen (regardless of whether the view has a scroll bar) (MSP-2220)

- By default, focus is set to the control that closes the preview (MSP-2260)

10.3.2   Presenting Controls for Authorising a Prescription

This section includes guidance for the placement and focus of command buttons used to preview and authorise a prescription.

ID	Guideline	Conformance	Evidence Rating
MSP-2270	Place the preview button before the authorise button and reflect this in the tabbing order	Mandatory	High
MSP-2280	Provide a button for authorising the prescription and label it 'Authorise'	Mandatory	Medium
MSP-2290	Place the Authorise button at the bottom right of the prescription form such that it may be out of view if the form is long enough to need a scroll bar	Mandatory	High
MSP-2300	Do not set the focus to the Authorise button by default	Mandatory	High
MSP-2310	Disable the Authorise button until all required fields have been completed	Mandatory	High
Usage Examples			
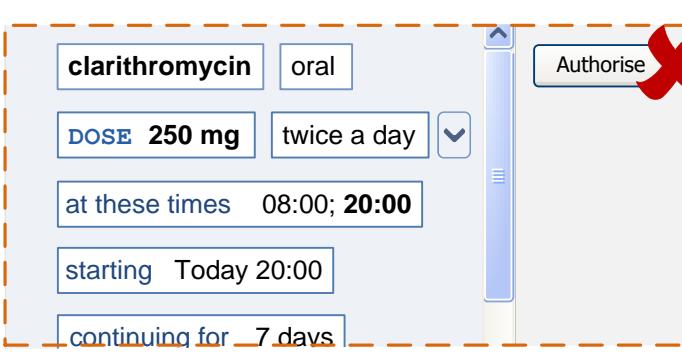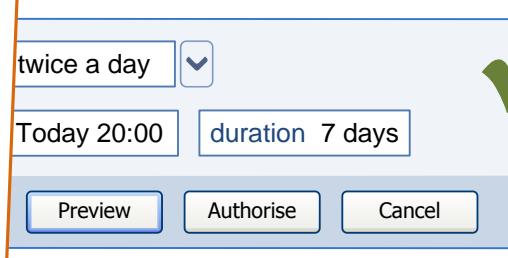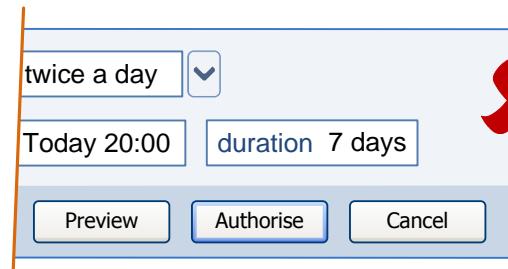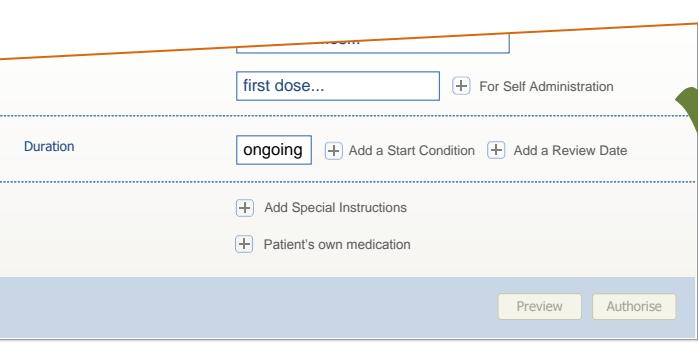
In this correct example, a button for authorising the prescription is placed at the bottom right of the prescription form and is labelled Authorise (MSP-2280, MSP-2290)

The preview button has been placed before the Authorise button (MSP-2270)

	This example is incorrect because the preview button is placed after the Authorise button (MSP-2270)
	This example is incorrect because the Authorise button has not been placed at the bottom right of the prescription form such that it may be out of view if the form is long enough to need a scroll bar (MSP-2290)
	In this correct example, the 'Preview' button has focus by default (MSP-2300)
	This example is incorrect because the Authorise button has focus by default (MSP-2300)
	In this correct example, the Authorise button is placed at the bottom right and has been disabled because some required fields have not yet been completed (MSP-2290, MSP-2310)

Rationale

Design Analysis:

If the Authorise button becomes active as soon as all required fields have been completed, and the button has focus by default, then it is possible to authorise a prescription in error. In some cases, this may also mean that a set of fields that have been displayed and pre-filled are not reviewed before the prescription is authorised. When this is the case, the severity of the inadvertent authorisation may depend on the ease with which the prescription can be checked immediately afterwards and the ease with which it can be amended. Not setting focus on the Authorise button by default (MSP-2270, MSP-2300) can mitigate these risks. If necessary, a check box can be introduced that must be selected before the Authorise button can be activated.

Alternative designs were explored in which the Authorise button was available even when the required fields had not been completed. This approach depends on the use of alerting and error-reporting to draw attention to the required fields that have not been completed. This approach is also only possible in a detailed prescription form in which the fields can be completed in any order. Our analysis indicates that it is better to present a form with only required fields so that all fields need to be completed and none will be missed out. This approach also avoids the irritation and alert fatigue associated with error reporting and alerts that would otherwise be needed.

Desk Research:

The paper, *The Extent and Importance of Unintended Consequences Related to Computerized Provider Order Entry* **{R10}**, reports the findings of a qualitative study in which unintended consequences of computerized provider order entry (CPOE) were monitored and evaluated. New kinds of errors reported by this study included that of 'desensitization to alerts'. Although the problem of alert fatigue needs to be addressed primarily in the context of decision support, even in the absence of decision support the guidance promotes a way of working that can help to reduce unnecessary alerts during prescribing.

The ePrescribing *Guidelines for hazard review of ePrescribing systems* **{R31}** lists the risk that a prescription can be completed with a series of identical keystrokes (guideline 4.8). Guidance reduces this risk by the use of cascading lists and template prescriptions and mitigates the risk by ensuring that focus is not set to the Authorise button by default.

There are two usability principles to consider in defining which command button should have focus by default:

- Setting the default command button to a command that is safest prevents loss of data and is the most secure (see *Windows User Experience Interaction Guidelines* **{R26}**)
- Setting the default to a command button that invokes an action that can be undone (see *ePrescribing Functional Specification* **{R12}**)

Guidance in this section is informed by the following Nielsen heuristic **{R17}**:

- Error Prevention – Tabbing order and placement of the preview and Authorise button helps to ensure that a prescription is not authorised by activating the Authorise button by mistake

User Research:

Recommendations from Study ID 67 (see APPENDIX D) include the use of the term 'Authorise' (MSP-2280) as a label for the button that equates to signing a completed prescription.

Hazard Risk Analysis Summary:

From our Patient Safety Risk Assessment analyses, we identified a number of potential hazards, including the following key risks which are mitigated by the guidance:

Potential Hazards:	Mitigations:
■ A prescription is not wholly reviewed because the authorise button was selected by mistake	■ A Preview button is placed before the Authorise button both in terms of layout and tabbing order and that the Authorise button does not have focus by default (MSP-2270, MSP-2300, MSP-2310)
■ A prescription is not wholly reviewed because some fields were out of view	■ The Authorise button is at the bottom of the form so if there are fields out of view, the form must be scrolled to the bottom in order to authorise (MSP-2290)

11 DOCUMENT INFORMATION

11.1 Terms and Abbreviations

Abbreviation	Definition
ACBS	Advisory Committee on Borderline Substances
BNF	British National Formulary
CATR	Clinical Authority to Release
CDER	Center for Drug Evaluation and Research
Co-Drugs	Combination Drugs
CSG	Clinical Safety Group
CUI	Common User Interface
dm+d	Dictionary of Medicines and Devices
FDA	US Food and Drug Administration
HDU	High Dependency Unit
INR	International Normalized Ratio
ISMP	Institute for Safe Medication Practices
ISV	Independent Software Vendor
IUD	Intrauterine Devices
KLM-GOMS	Keyboard-Level Model — Goals, Objects, Methods and Selection
NHS	National Health Service
NHS CFH	NHS Connecting for Health
NPfIT	National Programme for Information Technology
NPSA	National Patient Safety Agency
OTC	Over the Counter
PGD	Patient Group Direction
POD	Patient's Own Drugs
PRN	'As required' medication
TFN	Trade Family Name
TPN	Total Parenteral Nutrition
TTO	To Take Out
VDT	Visual Display Terminal
VTM	Virtual Therapeutic Moiety
W3C	World-Wide Web Consortium
WHO	World Health Organization

Table 10: Terms and Abbreviations

11.2 Definitions

Term	Definition
Authorise	Equivalent to signing a prescription
The Authority	The organisation implementing the NHS National Programme for IT (currently NHS Connecting for Health).
Brand name	Proprietary drug name for a product (as used by the brand originator)
Conformance	In the guidance tables, indicates the extent to which you should follow the guideline when defining your UI implementation. There are two levels: **Mandatory** – An implementation should follow the guideline **Recommended** – An implementation is advised to follow the guideline
Current best practice	Current best practice is used rather than best practice, as over time best practice guidance may change or be revised due to changes to products, changes in technology, or simply the additional field deployment experience that comes over time.
Evidence Rating	In the guidance tables, summarises the strength of the research defining the guideline and the extent to which it mitigates patient safety hazards. There are three ratings (with example factors used to determine the appropriate rating): ■ **Low:** 　■ Does not mitigate specific patient safety hazards 　■ User research findings unclear and with few participants 　■ Unreferenced usability principles indicate the design is not significantly better than alternatives ■ **Medium:** 　■ Mitigates specific patient safety hazards 　■ User research findings clear but with few participants 　■ References old authoritative guidance (for example, from National Patient Safety Agency (NPSA), Institute for Safe Medication Practices (ISMP) or World Health Organization (WHO)) that is potentially soon to be superseded 　■ Referenced usability principles indicate the design is significantly better than alternatives ■ **High:** 　■ Mitigates specific patient safety hazards 　■ User research findings clear and with a significant number of participants 　■ References recent authoritative guidance (for example, from NPSA, ISMP or WHO) 　■ Referenced usability principles indicate the design is significantly better than alternatives
Generic drug name	The chemical or approved name of a product as opposed to the proprietary name often used by the brand originator
NHS Entity	Within this document, defined as a single NHS organisation or group that is operated within a single technical infrastructure environment by a defined group of IT administrators.
Template prescriptions	Predefined and partially completed prescriptions that allow several attributes to be defined with a single selection from a list

Table 11: Definitions

11.3 Nomenclature

This section shows how to interpret the different styles used in this document to denote various types of information.

11.3.1 Body Text

Text	Style
Code	`Monospace`
Script	
Other markup languages	
Interface dialog names	Bold
Field names	
Controls	
Folder names	Title Case
File names	

Table 12: Body Text Styles

11.3.2 Cross References

Reference	Style
Current document – sections	Section number only
Current document – figures/tables	Caption number only
Other project documents	*Italics* and possibly a footnote
Publicly available documents	*Italics* with a footnote
External Web-based content	*Italics* and a [hyperlinked footnote](#)

Table 13: Cross Reference Styles

11.4 References

Reference	Document	Version
R1.	NHS CUI Programme – Medications Management – Medications List – User Interface Design Guidance	1.0.0.0
R2.	NHS CUI Programme – Medications Management – Drug Administration – User Interface Design Guidance	4.0.0.0
R3.	NHS CUI Programme – Medications Management – Medication Line – User Interface Design Guidance	2.0.0.0
R4.	NHS NPfIT – dm+d Implementation Guide (Secondary Care): http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/refdocs/dmd_guidance.doc	29-May-2009
R5.	NHS – dictionary of medicines + devices: http://www.dmd.nhs.uk/	Release 2.3
R6.	NHS NPSA – The fourth report from the Patient Safety Observatory – PSO/4 – Safety in doses: medication safety incidents in the NHS: http://www.npsa.nhs.uk/nrls/alerts-and-directives/directives-guidance/safety-in-doses/	2007-08

Reference	Document	Version
R7.	Cohen M R (Ed) – Medication Errors – Causes, Prevention, and Risk Management – Jones and Bartlett Publishers	2004
R8.	Kohn L, Corrigan J, Donaldson M – To Err is Human – Building a Safer Health System – Washington, DC: National Academy Press, 2000	2000
R9.	Wachter R M – Understanding Patient Safety – The McGraw-Hill Companies, Inc, 2008	2008
R10.	Ash JS, Sittig DF, Poon EG, Guappone K, Campbell E, Dykstra RH – JAMA – The Extent and Importance of Unintended Consequences Related to Computerized Provider Order Entry –Vol 14, No. 4, p415	July / August 2007
R11.	Koppel R, Metlay JP, Cohen A, Abaluck B, Localio AR, Kimmel SE, Strom BL – Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors – JAMA – Vol 293, No. 10, p1197	09-Mar-2005
R12.	NHS NPfIT – ePrescribing Functional Specification: http://www.connectingforhealth.nhs.uk/newsroom/news-stories/eprescfunctspec	1.0
R13.	NHS CUI Programme – Design Guide Entry – Time Display	4.0.0.0
R14.	NHS CUI Programme – Design Guide Entry – Date Display	4.0.0.0
R15.	NHS CUI Programme – Design Guide Entry – Date and Time Input	3.0.0.0
R16.	British National Formulary: http://www.bnf.org/bnf/	58 (September 2009)
R17.	Nielsen, J – Ten Usability Heuristics: http://www.useit.com/papers/heuristic/heuristic_list.html	1994
R18.	Shneiderman, B and Reading, MA – Designing the user interface: Strategies for effective human-computer interaction – Addison-Wesley Publishing	Third Edition,1998
R19.	British Standards Institute – BS EN ISO 9241-12: 1999 Ergonomic requirements for office work with visual display terminals (VDTs) – Part 12: Presentation of information	1999
R20.	NHS NPfIT – Guidelines for the Design and Presentation of Medication Elements Required in Electronic Prescribing or Medication Ordering Systems – NPfIT-EP-DB-0003.01	2005
R21.	ISMP – ISMP Medication Safety Alert! – It's Time for Standards to Improve Safety with Electronic Communication of Medication Orders – Draft Guidelines for Safe Electronic Communication of Medication Orders: http://www.ismp.org/Newsletters/acutecare/articles/20030220.asp	20-Feb-2003
R22.	NHS CUI Programme – Design Guide Entry – Patient Banner	4.0.0.0
R23.	The Joint Commission – National Patient Safety Goals – NPSG.03.03.01 – Look-alike/sound-alike drugs: http://www.jointcommission.org/AccreditationPrograms/BehavioralHealthCare/Standards/09_FAQs/NPSG/Medication_safety/NPSG.03.03.01/look_alike_sound_alike_drugs.htm	Dec-2009
R24.	NHS CFH – The Use of Tall Man Lettering to Minimise Selection Errors of Medicine Names in Computer Prescribing and Dispensing Systems – Loughborough University Enterprises Ltd: http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/refdocs/tallman.pdf	July 2009
R25.	W3C – Web Content Accessibility Guidelines – W3C Recommendation 5-May-1999: http://www.w3.org/TR/WAI-WEBCONTENT/	1.0
R26.	Microsoft – Windows User Experience Interaction Guidelines – Guidelines, Controls, Command Buttons: http://msdn.microsoft.com/en-us/library/aa511453.aspx#defaults	2009
R27.	Card SK, Moran TP, Newell A – The Keystroke-Level Model for User Performance Time with Interactive Systems – Palo Alto Research Center	1980

Reference	Document	Version
R28.	ISMP – List of Confused Drug Names: http://www.ismp.org/tools/confuseddrugnames.pdf	2009
R29.	The Joint Commission International – WHO Collaborating Centre for Patient Safety Releases – Nine Life-Saving Patient Safety Solutions: http://www.ccforpatientsafety.org/patient-safety-solutions/	
R30.	US FDA Center for Drug Evaluation and Research – Name Differentiation Project: http://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm164587.htm	May 2001
R31.	NHS CFH – Guidelines for hazard review of ePrescribing systems: http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/hazard_framework.pdf	1.0
R32.	Bates DW – Using information technology to reduce rates of medication errors in hospitals – BMJ 2000; 320:788-91	2000
R33.	Dean B, Schachter M, Vincent C, Barber N – Prescribing errors in hospital inpatients: their incidence and clinical significance – Quality Healthcare – 2002:11:340-344	2002
R34.	Cooper A, Reimann R, Cronin, D – About Face 3: The Essentials of Interaction Design – Wiley Publishing Inc – 2007	2007
R35.	Johnson J – GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers – Morgan Kaufmann Publishers – 2000	2000
R36.	Dean B, Schachter M, Vincent C, Barber N – Causes of prescribing errors in hospital inpatients: a prospective study –The Lancet – Vol 359	20-Apr-2002
R37.	Reason J – Human Error –Cambridge	1990
R38.	Bates DW, Teich JM, Lee J, Seger D, Kuperman GJ, Ma'Luff N, Boyle D, Leape L – The Impact of Computerized Physician Order Entry on Medication Error Prevention –JAMIA – 1999;6:313-321	1999
R39.	Bates DW, Leape LL, Cullen DJ, Laird N, Petersen LA, Teich JM, Burdick E, Hickey M, Kleefield S, Shea B, Vander Vliet M, Seger DL – Effect of Computerised Physician Order Entry and a Team Intervention on Prevention of Serious Medication Errors –JAMA – 1998;280:1311-1316	1998
R40.	Penzo M – Label Placement in Forms –UX Matters: http://www.uxmatters.com/mt/archives/2006/07/label-placement-in-forms.php	12-Jul-2006
R41.	Miller S, Jarrett C – Should I use a drop-down? Four steps for choosing form elements on the Web: http://www.formsthatwork.com/files/Articles/dropdown.pdf	2001
R42.	Jarrett C – Label Placement in Forms – What's Best? –British Computer Society Conference on Human-Computer Interaction – Proceedings of the 22nd British CHI Group Annual Conference on HCI 2008: People and Computers XXII: Culture, Creativity, Interaction – Volume 2, pp229-30	Sept-2008
R43.	Tufte E, Cheshire, CT – The Visual Display of Quantitative Information – Graphics Press, 2001	Second Edition 2001
R44.	Apple Inc – Apple Human Interface Guidelines	June 2008
R45.	Singh H, Mani S, Espadas D, Petersen N, Franklin V, Petersen LA – Prescription Errors and Outcomes Related to Inconsistent Information Transmitted Through Computerized Order Entry – Arch Intern Med– Vol 169, No.10, p982-989	25-May-2009

Table 14: References

APPENDIX A   USABILITY PRINCIPLES

The following usability principles have been applied through this guidance document. They are well-recognised principles within the user experience domain.

A.1   Nielsen's Usability Heuristics

See *Usability Engineering* **{R17}** for more information on these principles:

- Visibility of system status

- Match between system and the real world

- User control and freedom

- Consistency and standards

- Error prevention

- Recognition rather than recall

- Flexibility and efficiency of use

- Aesthetic and minimalist design

- Help users recognise, diagnose, and recover from errors

- Help and documentation

A.2   Shneiderman's Eight Golden Rules of Interface Design

See *Designing the User Interface – Strategies for Effective Human-Computer Interaction* **{R18}** for more information on these principles:

- Strive for consistency

- Enable frequent users to use shortcuts

- Offer informative feedback

- Design dialogs to yield closure

- Offer error prevention and simple error handling

- Permit easy reversal of actions

- Support internal locus of control

- Reduce short-term memory load

A.3   ISO 9241: Presentation of Information

See *Ergonomic requirements for office work with visual display terminals (VDTs) – Part 12: Presentation of information* **{R19}** for more information on these principles:

- Clarity (the information content is conveyed quickly and accurately)

- Discriminability (the displayed information can be distinguished accurately)

- Conciseness (users are given only the information necessary to accomplish the task)

- Consistency (the same information is presented in the same way throughout the application, according to the user's expectation)

- Detectability (the user's attention is directed towards information required)

- Legibility (information is easy to read)

- Comprehensibility (meaning is clearly understandable, unambiguous, interpretable and recognisable)

APPENDIX B STUDY ID 69: EXECUTIVE SUMMARY

B.1 Abstract

The UK National Health Service (NHS) Common User Interface (CUI) programme is a partnership between Microsoft® and NHS Connecting for Health (NHS CFH), which is part the NHS National Programme for Information Technology (NPfIT).

As part of CUI, the Clinical Applications and Patient Safety (CAPS) project has the goal of ensuring that software applications used by the NHS enhance patient safety. To achieve this, CAPS provides software developers with user interface design guidelines derived through a user-centric development process that includes explicit patient-safety evaluations.

This summary describes key findings from user research carried out in April 2009 by the CUI CAPS team on course definition in Medications Search and Prescribe. These findings are a subset from a larger internal report prepared for the CUI CAPS Search and Prescribe team.

Purpose:

To gain clinical feedback on design concepts for prescribing medications in electronic systems.

Method:

Interviews: structured interviews with 14 Health Care Professionals (HCPs) eliciting HCP preferences and qualitative feedback on design alternatives.

Key Results:

Based on clinician preference and rationale:

- Form layout and prescribing pane orientation should not (as yet) be mandated by the CUI, as there was no clear preference or concrete safety risks elicited for the contrasting designs shown

- Fields on the full form should be grouped by 'field type' rather than 'mandatory-ness'

- Seeing the medications list while prescribing is favourable but not essential

- A field strategy like 'dynamic mandatory' was supported, as opposed to a display whereby all possible fields are displayed and then the mandatory fields varied based on the drug type

- An authorisation 'safety catch' cannot be mandated without further evidence

B.2 Research Objectives

To gather HCP preferences and qualitative feedback on, and to identify possible patient safety hazards with, CUI course definition designs.

B.3 Research Design

Structured one hour interviews carried out in person. Using three common prescribing tasks participants were taken through:

1. Wireframe design alternatives for each design area

2. An interactive prototype for one of the tasks

Participants were then asked for preferences based on patient safety criteria. Other qualitative feedback was elicited covering:

- Rationale for preference

- Design fit with current and best practice

- Design understandability

- Any potential hazards resulting from the designs

Design alternatives were order-balanced per task (in that, they were presented in differing orders to different participants to try and minimise an order effect), and all designs were shown as a full prescribing sequence, beginning and ending in the Medication List View.

Detailed notes from the interviews were qualitatively analysed using thematic coding.

B.4   Results

B.4.1   Participant Description

14 participants were interviewed in 12 sessions. Each had either volunteered through the NHS CFH Event Management System (EMS) signup or had been recruited by an HCP who had volunteered. 7 out of 14 respondents had previously taken part in CUI clinical engagement for other work areas. Table 5 shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Site	Prescriber?	Used ePrescribing?
402	Doctor		FY1	Teaching Hospital A	Yes	eTTAs
403	Doctor		FY1	Teaching Hospital A	Yes	eTTAs
	Doctor		FY1		Yes	eTTAs
404	Doctor	Surgery	ST1	Teaching Hospital B	Yes	eTTAs
405	Doctor	Endocrine and General Medicine	FY1	Teaching Hospital C	Yes	PICS
406	Doctor	Endocrine	FY2	Teaching Hospital C	Yes	PICS
407	Doctor	Acute Medicine	FY1	Teaching Hospital C	Yes	PICS
	Doctor	Acute Medicine	ST2		Yes	PICS
408	Clinical Pharmacologist	ePrescribing	Consultant	Teaching Hospital C	Yes	PICS
409	Pharmacist	Oncology		Teaching Hospital D	No	CIS Healthcare ChemoCare®
410	Pharmacist	Paediatrics and Women's Services		Teaching Hospital D	No	No
411	Pharmacist	Oncology and Haematology	Principle	Teaching Hospital D	Independent	CIS Healthcare ChemoCare, Cerner Millennium® LC1, Local databases and spreadsheets
412	Pharmacy technician	Oncology and Haematology		Teaching Hospital D	No	CIS Healthcare ChemoCare
413	Pharmacist	Renal		Teaching Hospital D	No	Local databases and spreadsheets

Table 15: Interview Participants

All participants were clinical staff who prescribe as part of their role, or monitor prescribing and are aware of related medication safety issues. All participants were from acute secondary care. Eight participants were junior doctors (who carry out the majority of inpatient prescribing). The participants were from four different trusts and nine participants were from trusts in London.

13 out of 14 participants had used some kind of electronic system for prescribing medications, though only those in sessions 405—409, 411 and 412 could be said to have used 'proper' ePrescribing systems. The majority had 'medium' computer experience as they had to use computers as part of their clinical work. Several had 'High' computer experience, which includes items such as being familiar with spreadsheet calculation functions and having an understanding of databases.

B.4.2   Design Areas

Bullet text *in italics* represents researcher recommendations or comments in order to distinguish them from user feedback.

Drug Search

- As the drug search field gets focus automatically, its in-field prompt is never shown thus causing confusion to some users as to where to start:
  - *Therefore, the drug search prompt should remain even when the field is in focus (if technology allows)*

Route Selection

- One participant felt it was not clear enough that the prescriber was selecting an unlicensed route, and that additional actions might be required (such as a justification):
  - *If in scope for CUI, consider how this could be made more obvious and what additional actions might be necessary*
- It was felt that some routes were likely to be unfamiliar to many clinicians:
  - *If in scope for CUI, consider how 'very uncommon' routes might be de-prioritised*

Templates

- One participant felt that in some instances you might want to apply default values even if you have not selected a template prescription (for example, saline strength of 0.9%):
  - *Consider the arguments for use of defaults even off-template*

Prescribing Pane Orientation

- There was no clear preference or concrete safety risks elicited for either orientation (horizontal or vertical box):
  - *Therefore, continue to allow for both approaches: horizontal or vertical orientation*

Authorising

- Opinion was divided as to whether a 'safety-catch' was necessary or would be effective to prevent prescribers from accidentally selecting 'Authorise' before having reviewed the whole prescription:
  - *Do not mandate an extra 'safety-catch' step without harder evidence to its effectiveness at improving the safety of authorising*
  - *Consider other ways to improve chances of reviewing before authorising*

New Prescription Building Up

■ 6 of 12 participants were slightly unclear or felt others might be unclear about the status of the prescription building up (that is, it might be perceived as prescribed when it has not yet been authorised):

  ■ *Consider how the 'not yet prescribed' status could be made clearer*

Prescription Status

■ All five participants asked agreed that a prescription status of 'Started' was ambiguous (as has been seen in previous CUI user feedback):

  ■ *Discuss prescription status options with the ePrescribing team, and ensure examples given in guidance do not include the potentially ambiguous 'Started'*

Medications List

■ Having the Medications List visible while prescribing was seen as favourable but not necessarily essential:

  ■ *Continue to allow the Medications List to be simultaneously viewable while prescribing but not that this is mandatory in all cases*

  ■ *It raises questions about:*

    i. Where the prescription building up is displayed if the Medications List is grouped or sorted so that the new prescription would not appear at the top during prescribing

    ii. Whether there are any limits on interaction with the Medications List after a prescription has started to be written

Access to More Options (Quick Prescribe)

■ One participant did not initially notice the 'More Options' button (though had it not been missing from many of the designs this error might have been more frequent):

  ■ *Explore different positioning of the access to 'More Options' to ensure it is considered by prescribers before authorising*

Adding a 'Stat'

■ All participants were unsure how to 'add a stat'. Numerous requirements were elicited:

  ■ *Assuming 'adding a stat' is out of scope for this CUI release, ensure that example designs are not mistakenly interpreted as providing guidance on adding a stat*

Field Strategy

■ Participants supported the 'dynamic mandatory' approach to presenting fields on the form compared to the 'set fields per page' approach

■ However, it is likely that there are other approaches to presenting fields that are acceptable but not exactly like the CUI 'dynamic mandatory' one:

  ■ *In the absence of more detailed evidence, continue to use a field strategy that:*

    ▪ *Promotes the mandatory fields*

    ▪ *Demotes or hides the inapplicable fields*

- *Does not require the user to choose which template they require UNLESS they are specifying some additional information (for example, a complex schedule)*

- *Does not promote fields that are optional but may mislead the prescriber (for example, presenting an optional strength field before a mandatory dose field)*

- *Reduces the need to navigate when reviewing the prescription before authorisation*

Field Layout (Quick Prescribe)

- There was no clear overall preference or conclusive safety rationale given for either of the three layouts (in the absence of any hard data on the actual safety or performance):

  - *Therefore, there is no user feedback evidence to mandate a particular layout. Though certain 'good' layout principles might be described*

Field Grouping (Full Form)

- All seven participants who commented on the grouping of fields on the full form preferred fields grouped by 'field type' (for example, dose and frequency) rather than by whether they were mandatory or not:

  - *Therefore continue to group fields (on the full form) by 'field type' rather than by 'mandatory-ness'*

- There was no specific feedback on the actual grouping taxonomy to use

Field Layout (Full Form)

- Though a more linear, vertical field layout was generally preferred, feedback was not conclusive (and was not based on actual usage of the form):

  - *Also given the other factors that would influence form layout in a real application (inline error markers, decision support, application conventions on layout, 'reviewability' of the resulting prescription, and so on), the CUI should not mandate an exact form layout*

Access to More Options (Full Form)

- All seven participants asked would prefer 'More Options' to open inline rather than opening a new page. However, one participant felt this addition would have to be balanced against the need to be able to 'review' the page before authorising

  - *Therefore, expand options inline, though there may be exceptions when accessing large 'extra options' such as administration scheduling. However, it should be considered what happens once optional data has been added*

Administration Times

- As has been seen in previous user feedback, several participants suggested that arranging administration times vertically would be preferable to a horizontal arrangement

Duration

- In relation to infusions, one participant was confused by the use of the label 'continuing' for the duration field:

  - *Therefore use 'duration' as opposed to 'continuing'*

  - *Consider the potential confusion between 'duration' and 'dose duration'*

Infusions

- Three participants were confused by the lack of clear field labels for the 'rate' field:
  - *Therefore consider which fields must have explicit labels or prompts*

APPENDIX C   STUDY ID 68: EXECUTIVE SUMMARY

C.1   Abstract

The UK National Health Service (NHS) Common User Interface (CUI) programme is a partnership between Microsoft® and NHS Connecting for Health (NHS CFH), which is part the NHS National Programme for Information Technology (NPfIT).

As part of CUI, the Clinical Applications and Patient Safety (CAPS) project has the goal of ensuring that software applications used by the NHS enhance patient safety. To achieve this, CAPS provides software developers with user interface design guidelines derived through a user-centric development process that includes explicit patient-safety evaluations.

This summary describes key findings from user research carried out in November 2008 by the CUI CAPS team on Course Definition (part of the Search and Prescribe work). These findings are a subset of those in a larger internal report prepared for the CUI CAPS Search and Prescribe team.

Purpose:

To further understand existing hazards and requirements relating to medication course definition.

Method:

Interviews: structured interviews with 14 Healthcare Professionals (HCPs) using paper drug charts and existing CUI designs as a stimulus for discussion.

Requirements analysis: requirements relating to course definition identified from the existing NHS CFH ePrescribing requirements documents.

C.2   Research Objectives

To further understand existing hazards and requirements relating to medication course definition focusing on the areas of:

- Scheduling and 'time' attributes
- Conditions

C.3   Research Design

Interviews were structured, lasted 30—60 minutes and carried out in person, with one to three participants per interview. Participants were shown existing paper drug charts and old CUI course definition designs to help elicit risks and uncover further requirements.

Detailed notes from the interviews were qualitatively analysed using thematic coding.

The NHS CFH ePrescribing requirements were searched for a set of keywords relating to course definition. Once a requirement was flagged, relevance to CUI scope was assessed and the requirement categorised. The output was a spreadsheet of ePrescribing requirements that can be filtered by category relating to course definition thus aiding later analysis and retrieval.

C.4 Results

C.4.1 Participant Description

14 participants were interviewed in 7 sessions. Each participant had either volunteered through the NHS CFH Event Management System (EMS) signup or had been recruited by an HCP who had volunteered. Table 15: Interview Participants Shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Prescriber?	Systems Used	CUI Feedback?	Computer Experience
374	Pharmacist	ENT	?	No	PCIS		Medium
360	EPR Pharmacist		Senior	All deal with ePrescribing and eMAR aspect of system	Customised i.CM (full ePrescribing and eMAR)	No	High
	EPR Nurse		Senior			Yes	Medium
	EPR Nurse		Senior			Yes	Medium
361	Pharmacist	?	Senior	Yes	Electronic TTOs	Yes	Medium
362	Doctor	?	F1	Yes	Electronic TTOs	No	High
363	Doctor	?	F1	Yes	Electronic TTOs	No	High
	Doctor	?	F1	Yes	Electronic TTOs	No	Medium
364	Doctor	Emergency	ST3	Yes	Electronic TTOs	No	Medium
	Nurse Practitioner	Emergency	Senior	PGD	No	No	Medium
	Nurse Practitioner	Emergency	Senior	PGD	No	No	Medium
365	Nurse Practitioner	Emergency	Senior	PGD	No	No	Medium
	Nurse Practitioner	Emergency	Senior	PGD	No	No	Medium
	Nurse Practitioner	Emergency	Senior	PGD	Seen several systems	Yes	High

Table 16: Interview Participants

All interview participants were clinical staff, either prescribers and/or pharmacists. All participants were from acute secondary care and from three different trusts with diverse geographical locations.

Two interview participants had used electronic prescribing before and five others had used an electronic TTO system with very basic prescribing functionality. The majority had medium or high computer experience, where high experience includes items such as being familiar with spreadsheet calculation functions and having an understanding of databases.

C.4.2 Hazards

Table 17 lists and describes the hazards identified:

ID	Keywords	Hazards
1		Cannot specify prescription-specific logic as all orders are treated the same (for example, cannot do different mandatory fields for as-required prescriptions)
2		Cannot specify medication-order-specific logic as medications are treated as just another kind of order (for example, cannot do Adverse Drug Reaction (ADR) checking on medications)
3		Delay in first dose as the doctor is not communicating new (or changed) prescriptions

ID	Keywords	Hazards
4	Additional Instructions	If the prescriber (or verifier) relies on the administerer reading the relevant knowledge support, instead of highlighting it to them by recording notes in 'additional instructions', then the administerer may not attend to these instructions
5	Additional Instructions	If, during prescribing, the prescriber does not have access to the same knowledge support as the administer has, then the prescriber may add information in 'additional instructions' that is contradicted by this knowledge support thereby confusing the administerer
6	Attributes	Prescribers may be confused by the difference between 'strength' and 'dose' at the point of course definition
7	Attributes	Presenting non-mandatory fields by default may be: distracting, confusing, unnecessarily filled in
8	Attributes	Due to the large number of potential optional fields that could be displayed on the course definition form, those that are chosen to be displayed (either by default or on demand) may be suboptimal in some circumstances (for example, how do you choose which optional fields get displayed or are accessible?)
9	Conditions	Administration conditions not documented or not 'formalised' in a system may be missed, misinterpreted, or cannot take advantage of system functions (for example, done through free text, 'additional instructions' or given verbally)
10	Have Sight Of	If the prescriber is not prompted to consider previous prescriptions for the patient for the same medication or class (especially reasons for discontinuation) they may prescribe suboptimally
11	Have Sight Of, Schedule	If prescribers only see the medications and administration schedule for the day of prescribing (or a few days around it) before, during or after prescribing, they may not be aware of all the patient's current medications. Administration views in systems are likely to show a few days by default (though should provide access to the other current medications)
12	Have Sight Of, Schedule	If, during prescribing, prescribers do not have access to current (and past?) medication details, including their schedule, they may not have the necessary information to accurately complete the prescription
13	PRN	PRN has indication recorded rather than the symptom as the condition for giving (for example, asthma not wheeze)
14	PRN	PRN prescription does not record he conditions under which it was given (currently poorly documented on paper)
15	PRN	As most people know what the PRN will be for, being forced to record the reason is unnecessary (unlikely to be a view shared by pharmacists)
16	PRN	Clinicians may expect PRN to have an indication of maximum dose in 24 hours, maximum frequency, and/or minimum interval. A course definition label for 'frequency' associated with PRN may be misinterpreted as one of these rather than as an indicative frequency
17	PRN	Though it may be theoretically correct for a PRN to always have an indicative frequency, prescribers may not want to specify one as long as the eventual administration schedule conforms to the minimum and/or maximum restrictions (that is, the schedule that results from the administerer administering the PRN) For some medications, an indicative frequency might seem odd (for example, nappy rash cream 'apply as required')
18	PRN	A start date and time for PRN is likely to be confusing as the start date and time usually refers to the first intended administration (which is not known with a PRN) (though it could be changed to 'valid from' for PRN?)

ID	Keywords	Hazards
19	PRN	Prescribers may feel they have to provide maximum and/or minimum restrictions on PRN administration if they do not realise that these are provided by the system (if indeed they are, though they should be according to the CUI Drug Administration guidance)
20	Record	Some medications administered in some contexts (for example, entonox or lignocaine in ED) may be written up as part of the documentation of care and not duplicated into the medication's record
21	Record	A patient may self administer in A&E and this is not being recorded or is not recorded in the medications record (perhaps as it is deemed to be irrelevant to the presenting complaint)
22	Review and/or Stop Date	'Review' and/or 'stop' date is missed as it has a 'point' value and is not followed up. That is, it is not 'sticky' or persistent over time if it is not completed (for example, if the review date falls on a weekend)
23	Review and/or Stop Date	No review criteria specified at time of prescribing makes it hard to subsequently review
24	Review and/or Stop Date	Medications stopped rather than reviewed
25	Review and/or Stop Date	The term 'review' is interpreted in different ways (for example, 'review after 2 days of 7 day course' versus 'to be followed by a review at end of 7 days', for example 'let's see how they get on after 5 days' versus 'hard stop after 5 days'). Therefore potential confusion about what it means to schedule 'a review'
26	Review and/or Stop Date	Implied requirement to be able to schedule a review during a course as well as at the end of one
27	Schedule	Scheduling information has to be inferred from chart graphical mark-up 'hieroglyphics' which may be non-standard. Some staff may use more 'certain' mark-up than others (for example, blocking out days not to administer is a pretty clear mark-up)
28	Schedule	Scheduling and frequency information 'trapped' in graphical section of paper chart rather than conveyed in prescription text on the left-hand side of a paper chart can be missed when transcribing for discharge, (and at other times too)
29	Schedule	The prescriber schedules administration at a suboptimal time for that medication (for example, breaking ward conventions to administer warfarin at 18:00 or simvastatin in the morning rather than at night)
30	Schedule	Not clear that the administration time has been changed from standard times when done by crossing out usual time on paper
31	Schedule	Medications that do not have an obvious default schedule (for example, 'bd' and 'tds') are 'automatically' scheduled to times that are either unexpected by the prescriber or do not take into account all the relevant factors. 'od' and 'qds' are more obvious as 'od' is likely to be scheduled at 08:00 or a medication-specific default time and 'qds' will fill the usual four drug-round slots
32	Schedule	Self administered drugs may not be administered according to a schedule that was suggested to the patient at the time of prescribing. Therefore if the system 'schedules' the administration according to this suggestion, and then does not require the actual times to be recorded, the administration record may be misleading
33	Schedule	If the scheduling (either automatic or manual) does not take account of local ward conventions beyond 'normal' drug rounds (such as IV rounds at slightly different times to non-IV rounds), certain medications will systematically be administered 'too early' or 'too late' (according to the system's schedule)

ID	Keywords	Hazards
34	Schedule, Conditions	Non-time dependant conditions scheduled with spurious time specificness and/or and incorrect time (for example, with food in evening, pre-meds) This might be solved by having a long time tolerance administration, plus a conditional 'IF', if it cannot have formalised conditions
35	Schedule, Dose Interval	Double administration as the first dose was given in A&E, but was not recorded on the inpatient chart, then another dose given on admission to the ward. This is solved if all administrations are recorded and A&E and ward have interoperable medication record
36	Schedule, Dose Interval	Dose administered in A&E and to maintain the dose interval the prescriber therefore schedules the next dose at a non-drug round time. Then, on admission to the ward, nurses get another prescriber to alter the time of administration to be more convenient to drug rounds, which may then break the dose interval with the first dose given in A&E
37	Schedule, Dose Interval	Breaking strict dose intervals due to set round times or administration non-compliance with strict dose interval schedule (for example, antibiotic prescribing) has historically never been administered 'correctly' at exact time intervals
38	Schedule, Dose Interval	System does not alert users if they are trying to schedule doses of the same medication (including those in other prescriptions) within a minimum dose interval (especially for 'stat' followed by regular schedule)
39	Schedule, Dose Interval	Prescriber has become used to accepted practice of scheduling certain medications (for example, antibiotics) at standard drug round times, rather than at recommended dose intervals. Another hazard is that prescribers may not realise that in some contexts (for example, serious infection in ITU) they must prescribe at strict dose intervals or they mistakenly do not use the strict dose interval frequency option
40	Schedule, Dose Interval	Prescribers may need to schedule administration such that it breaks a minimum interval. They should probably be forced to record a reason (from CUI Drug Administration Feedback Study ID 40)
41	Schedule, Dose Interval, Once Only	Breaking of dose interval as the 'stat' dose is 'too quickly' followed by the first regular dose
42	Schedule, Duration	Duration is calculated as calendar days (either by system or by user) rather than days of doses (for example, if the first dose of a five day course is given at night, this is not a whole day of treatment so the patient needs to continue onto the sixth day of treatment)
43	Schedule, Have Sight Of	If prescribers do not see the administration schedule represented graphically before authorising a prescription (as on the paper drug chart), they may not notice a scheduling error or suboptimal scheduling as the textual expression of the frequency and schedule is less familiar (and perhaps more open to error) (for example, that the first dose is not due for a longer time than they intended, such as on the next day)
44	Schedule, Once Only	'Double' administration of 'first' dose as 'stat' and the first regular dose both given at same time (especially if 'stat' is added automatically by the system?)
45	Schedule, Once Only	Delay in first dose until the next day as the default schedule is for a time that has already passed that day (so is scheduled for the next day) and no 'stat' created for today (known cause of death from a long delay in the first administration of meningitis medication)
46	Schedule, Once Only	Delay in first dose until the next round as it was not scheduled 'due' until the next round that day and no 'stat' was created for now

ID	Keywords	Hazards
47	Schedule, Once Only	Prescribing a 'stat' followed by a regular schedule may subsequently give a false impression of when that medication started if 'separated' from each other on the chart (that is, medication line identity question)
48	Schedule, Once Only	If prescribers have to prescribe a regular medication, started with a 'stat', as separate prescriptions in two unlinked steps they may: Forget to do one of the steps (probably by being distracted in between) Make a mistake when scheduling them together Not have the correct total duration for that medication (for example, total duration = stat plus four days minus one dose of regular medication)
49	Schedule, Once Only	Correct urgency of a once only prescription is not communicated. Either because of a spurious urgency by treating all once only prescriptions as 'stat' (causing unnecessary disruption) or a genuinely urgent once only is not administered on time (could be a problem for other types as well, for example, once a day medication?)
50	Schedule, Once Only, Time Tolerance	Correct degree of time-specificness of a 'stat' is not communicated. Either because of a spurious specificness by specifying a time when it does not really matter or by being administered outside of a correct narrow time tolerance (could be a problem for other types as well, for example, once a day medication?)
51	Schedule, Review and/or Stop Date	Antibiotic issues: often continued inappropriately as they do not have a stop date (or accurate stop date), prescribed inappropriately as a wrong indication and so on
52	Schedule, Supply	Delay in 'stat' and/or first dose due to supply issues (for example, the prescriber did not know that the product was not in the ward stock)
53	Start Date	CUI design: course 'Start' is ambiguous as to whether it means prescription date or intended first dose date and/or time. All that the Wales chart says is: 'Time to be given' for its once only prescriptions. We could try: 'first dose', 'first administration', 'Start on'.
54	Start Date	CUI Design: The 'Approx' flag on start date and time is confusing. It might imply it is a non-specific way to alter the administration time tolerance (and it might not be). It might also imply that if it is not checked then the start date and/or time has a very low time tolerance (which it might not do). It might also imply that all administration events for this prescription are affected by this control (which they might not be).
55	Supply	Prescribers are often unaware of patients not getting medications due to supply issues
56	Therapeutic Intent	Prescribers may not know the exact reason for prescribing as they are just following the consultant's orders (and they may have not provided the rationale). Also, they may be prescribing some time after the consultant requested the prescription.
57	Therapeutic Intent	If the therapeutic intent and/or rationale for treatment is not recorded by the prescriber, subsequent clinicians may not be able to review the prescription as effectively as the prescriber (especially after discharge or for antibiotics)
58	Therapeutic Intent	A clinician's answer for 'reason' could be described in multiple ways, which may miss out key information for a subsequent reviewer or decision support trying to act on it (for example, 'animal bite' versus 'laceration' versus 'infected wound', where the fact it is an animal that caused the injury is the important factor, and 'for infection' versus 'based on microbiology reports', where the authoritative recommendation is important)

ID	Keywords	Hazards
59	Therapeutic Intent	Treatment goals may not be perceived to be 'necessary' for some medications in some contexts (for example, PDG medications in ED)
60	Variation	Nurses changing heparin dose based on results (is this allowed?)
61	Variation	Warfarin prescription unclear as to whether it is to continue each day as it is prescribed as a separate prescription for every day without a clear indication of the 'overall' course duration
62	Variation	If a medication line identity is such that prescribed variations in dose, frequency and so on (either during a day or over days) are displayed as separate medication lines, there is a chance that: The lines become separated and disassociated It becomes harder for the user (and system?) to perform operations aggregating the lines For example, working out 'how much drug X the patient is getting?' or 'how long have they been getting drug X for?'
63	Variation	If a medication varies either during a day or over days, there is a chance that the variations will get mixed up either at the time of prescribing or of administration (for example, prescribing the dose intended for 22:00 at 8:00 and vice versa)
64	Variation	Prescribers may desire a templated prescription that defines a schedule of varying doses over several days, which cannot be supported by the template UI (for example, '10 mg 1 day, 10 mg 1 day, 5 mg 1 day, then as per INR value')
65	Attributes	Basic dropdowns may not be the most appropriate input mechanism for a field (for example, an ISV may have a very large number of possible frequencies or some fields will require 'other' options to access unlicensed routes) (partially from CUI Search and Prescribe user feedback 2006)
66	Schedule	Some workflows may have the schedule set by the administerer rather than the prescriber (from CUI Search and Prescribe user feedback 2006)
67	Attributes	Different contexts may require different default settings for attributes (for example, the Emergency Department may default its medication frequency to 'stat' (or its equivalent)
68	Attributes	Form design: the user may accidentally scroll a dropdown and be unaware that they have changed one of the values on the form
69	Attributes	After a template has populated a form, the prescriber may make alterations to some fields that imply other fields should be checked and/or changed (for example, if changing route what should happen to a prefilled dose?)

Table 17: Hazards Identified

APPENDIX D   STUDY ID 67: EXECUTIVE SUMMARY

D.1   Abstract

The UK National Health Service (NHS) Common User Interface (CUI) programme is a partnership between Microsoft® and NHS Connecting for Health (NHS CFH), which is part the NHS National Programme for Information Technology (NPfIT).

As part of CUI, the Clinical Applications and Patient Safety (CAPS) project has the goal of ensuring that software applications used by the NHS enhance patient safety. To achieve this, CAPS provides software developers with user interface design guidelines derived through a user-centric development process that includes explicit patient-safety evaluations.

This summary describes key findings from user research carried out in January 2009 by the CUI CAPS team on defining a medication's course (part of the Search and Prescribe work). These findings are a subset of those in a larger internal report prepared for the CUI CAPS Search and Prescribe team.

Purpose:

To gain clinical feedback on design concepts for defining a medication's course in electronic systems.

Method:

Interviews: structured interviews with 16 Healthcare Professionals (HCPs) eliciting HCP preferences and qualitative feedback on design alternatives.

Workshops: two workshops with six HCPs per workshop, eliciting HCP preferences and qualitative feedback on the same design alternatives as used in interview.

Key Results:

Based on clinician preference and rationale:

- First dose, the administration schedule and any extra system or user-defined attributes should be clearly visible to the prescriber before authorising the prescription

- Participant opinion and perception of risk was divided on whether a mandatory preview step would be safer than not having one, though the arguments against having one were made on efficiency rather than safety grounds

- The horizontal administration schedule format was disliked compared to a vertical or 'calendar-style' format

- Even with a 'mandatory only' model of displaying fields on the main prescribing form, some optional fields may also need to be displayed on the main form either for all prescriptions or on a per case basis

D.2   Research Objectives

To gather HCP design preferences, qualitative feedback and possible patient safety hazards of CUI drug search designs focusing on the areas of:

- Information and workflow required before prescription authorisation (also known as 'the Preview')

- Overall design of the course definition form (that is, dealing with mandatory versus optional attributes)

D.3 Research Design

Interviews were structured, lasted one hour and carried out in person. Participants were taken through wireframe design alternatives for each area of investigation and asked for preference based on patient safety criteria. Other qualitative feedback was elicited covering:

- Rationale for preference
- Design fit with current and best practice
- Design understandability
- Any potential hazards resulting from the designs

Workshops lasted 2.5 hours and were similar to the interviews except that they focused on qualitative feedback and involved group discussion.

Detailed notes from the interviews and workshops were qualitatively analysed using thematic coding.

D.4 Results

D.4.1 Participant Description

Interviews

Sixteen participants were interviewed in thirteen sessions. Each participant had either volunteered through the NHS CFH EMS signup or had been recruited by an HCP who had volunteered. Four out of sixteen participants had previously taken part in CUI clinical engagement for other work areas. Table 5 shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Prescriber?	Systems Used	Computer Experience
374	Pharmacist	ENT	?	No	PCIS	Medium
375	Pharmacist and Analyst	Systems	?	?	PCIS	High
376	Pharmacist	Various	?	No	PCIS	Medium
377	Pharmacist	Medication Safety	Senior	Yes	eTTOs – McKesson	Medium/High
378	Pharmacist	Care of Elderly	?	Yes	eTTOs – McKesson	Med
379	Doctor	Endocrine	F1	Yes	eTTOs – McKesson	High
381	Pharmacist	?	Lead	No	eTTOs and seen various	?
382	Doctor	Stroke	Consultant	Yes	PICCS	Medium/High
383	Doctor	Care of Elderly	SpR	Yes	PICCS	?
384	Doctor Doctor	Acute Medicine	ST2 FY2	Yes	PICCS	?
385	Doctor Doctor	Respiratory and Transplant	Consultant Consultant	Yes	PICCS	Medium
386	Doctor Pharmacist	Renal Systems	Consultant Consultant	Yes	PICCS	High

Table 18: Interview Participants

All interview participants were clinical staff, either prescribers and/or pharmacists. All participants were from acute secondary care, from three different trusts with diverse geographical locations.

12 interview participants had used electronic prescribing before, and the remaining 4 had used an electronic To Take Out (TTO) system with very basic prescribing functionality. The majority had medium or high computer experience, where high experience includes items such as being familiar with spreadsheet calculation functions and having an understanding of databases.

Workshops

12 participants were interviewed in 2 workshops (sessions 387 and 388). Each participant had volunteered through the NHS CFH Event Management System (EMS) signup. All 12 participants had previously taken part in CUI clinical engagement. Table 19 shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Prescriber?	Systems Used	Computer Experience
387a	Pharmacist	Systems	?	?	JAC	High
387b	Doctor	Paediatrics	Consultant	Yes	Trust Developed	Medium/High
387c	Midwife and Patient Safety Officer	Midwifery	Senior	Yes	No	Medium/High
387d	Pharmacist	?	Senior	Yes	Lorenzo, JAC, Ascribe®	High
387e	Doctor	General Practice	GP	Yes	Vision	High
387f	Pharmacist	?	Senior	?	Cerner Millennium®	Medium/High
388a	Pharmacist	Systems	Senior	?	Cerner, Lorenzo	High
388b	Pharmacist	Medication Safety	Senior	?	eTTO	Medium/High
388c	Nurse	Mental Health	Senior	?	No	High
388d	Nurse	?	Senior	?	eTTO	?
388e	Pharmacist	Medication Safety	Senior	?	JAC, eTTO	Medium
388f	Pharmacist	Systems	Senior	?	JAC	Medium/High

Table 19: Workshop Participants

The majority of participants were clinical staff, either prescribers and/or pharmacists. 11 participants were from secondary care, from a number of different trusts with diverse geographical locations.

Eight workshop participants had used full electronic prescribing systems before and only two had never used any kind of electronic prescribing. The majority had medium or high computer experience, where high experience includes items such as being familiar with spreadsheet calculation functions and having an understanding of databases.

D.4.2   Design Areas

Information Required Before Authorisation

- Analysis of participant's responses concluded that, as well as the 'main' drug details, before authorising a prescription prescribers should see:

  - The time of the first dose

  - A representation of the schedule defined

  'Type' was not seen as necessary.

- A principle implied from responses was that prescribers should be able to review anything defined by the prescriber or system before authorisation

Format of Information Before Authorisation

- 'Structured' previews were preferred (where the drug name, drug details, first dose and scheduled were all distinct by virtue of their positioning and formatting or labels) rather than a single string of text as a 'sentence'

- Consideration should be given to how to provide consistency of representation so that the format of the prescription before authorisation is not only clear but familiar and consistent with other representations in the application

Workflow – Should There Be a Mandatory Confirmation Step?

- Participants were divided on whether a mandatory confirmation step would be safer. Some felt that an extra step would be ignored anyway and merely served to increase the number of user actions to prescribe. Others felt that an extra step would remind some prescribers to check the prescription and that seeing the information in a different format to that entered would provide additional safety

- With this difference of opinion, it would be highly desirable to gain real usage data on the efficacy of having an extra mandatory step on the accuracy of prescribing (or other similar processes such as ecommerce)

- Whether a preview step is used or not, throughout the process the prescriber must be clear as to the state of the prescription (that is, has it been prescribed or not?)

Administration Schedule Format

- The horizontal format (administration times in a sentence) was negatively commented on by all participants

- Where shown, a vertical format, or 'calendar' format was thought to be more familiar and easier to read than the horizontal format

- Whatever the format, the prescription frequency should have a clear relationship with the schedule

- There is a risk that a 'normal' day's schedule may mislead about the first dose (as this will often not be the normal first dose of the day)

Field Layout

- Though participants provided some feedback on the different layouts, user experience rationale should be applied here. For example:
    - Is it necessary for the fields to be easily scannable in these forms?
    - How consistent does the form layout need to be with other forms in the application?
    - What space will be available in the application to present the form?

Mandatory Versus Optional Fields Model

- Participants felt that some optional fields might need to be 'always' displayed so as to remind the prescriber to consider them (for example, a 'Special Instructions' field)
- Participants pointed out that for certain medications there may be local policy that would recommend use of some fields even if they are not mandatory (for example, 'reason' when prescribing antibiotics):
    - Therefore guidance should allow for non-mandatory 'recommended' fields to be included with mandatory fields on the form
- Though the model of 'demoting' optional attributes by placing them on a different form was generally supported (with the exceptions noted above), some participants felt that a 'consistency' model would be better. That is, that the attributes always retain a consistent placement for all medications, rather than moving depending on whether they are mandatory or not:
    - If guidance recommends not using such a 'consistency' model, then it should provide clear rationale as to why not

Issues with Start/First Dose

- Several participants were keen to have a clear option to 'add a stat' as this is problem in current practice (and suggested that the system might even suggest adding a stat if the first dose is a long time in the future):
    - Adding a stat may have an effect on the label for 'first dose' and the subsequent schedule times
- Making whether the date was 'Today' was seen as useful
- As has been seen in previous feedback, 'Approx' was seen as confusing

Duration/End

- Analysis of participant responses suggests that duration should generally have a default value of 'ongoing' (for inpatients), unless an exception to this default such as for antibiotics:
    - Therefore duration should be displayed on the main form and/or in a preview as a system defined value
- Participants identified risks concerning:
    - What a specific duration means. In that if the prescription is given a duration of '5 days' but the patient only receives two doses during this time, has the duration been completed?
    - Whether the system should automatically stop a prescription if the duration is based on a condition (for example, if based on measurement parameters) and how this is communicated to the prescriber

Product (Form, Strength, Brand)

- On balance, if strength is not mandatory it should be made less prominent during course definition (that is, not be displayed on a 'main' form) due to potential confusion with dose (several participants were confused between the two)

- Though out of scope for this CUI work, participant feedback implies the need for a default for many prescriptions to a strength of 'pharmacist's choice' or 'dispenser to specify'

- Brand should not be displayed unless mandatory

- Participants raised the use case where a prescription is made up of multiple strength products to achieve a dose (for example, 'with 6 mg of warfarin')

Special Instructions

- Analysis of participant feedback suggests that it may be necessary to consider display of a special instructions field on the 'main' prescribing form

- However, it should be clear to prescribers what should and should not be included in a 'Special Instructions' field (as it may facilitate the unstructured recording of information that should be structured)

- The relationship with knowledge support should also be considered

Miscellaneous

- Participants supported the idea of prescribing while the medications list was visible, though several improvements to the design shown were suggested

- Several participants felt that the field for selecting 'form' should come before that for choosing 'strength', as they felt form usually determined strength

- Seven issues were raised with the current design of the medications list or information required per medication

APPENDIX E   STUDY ID 46: EXECUTIVE SUMMARY

E.1   Abstract

The UK National Health Service (NHS) Common User Interface (CUI) programme is a partnership between Microsoft® and NHS Connecting for Health (NHS CFH), which is part the NHS National Programme for Information Technology (NPfIT).

As part of CUI, the Clinical Applications and Patient Safety (CAPS) project has the goal of ensuring that software applications used by the NHS enhance patient safety. To achieve this, CAPS provides software developers with user interface design guidelines derived through a user-centric development process that includes explicit patient-safety evaluations.

This summary describes key findings from user research carried out in October 2008 by the CUI CAPS team on drug search (part of the Search and Prescribe work). These findings are a subset of those in a larger internal report prepared for the CUI CAPS Search and Prescribe team.

Purpose:

To gain clinical feedback on design concepts for drug search in electronic systems.

Method:

Interviews: structured interviews with 14 Healthcare Professionals (HCPs) eliciting HCP preferences and qualitative feedback on design alternatives.

Survey: online survey with 48 HCPs using open and closed questions.

Key Results:

Based on clinician preference and rationale:

- Templating should be used rather than default values

- A tabular template layout should be used

- The number of templates presented to the user should be cut down by a prior selection of route

- Generic versus branded designs require some improvements

E.2   Research Objectives

To gather HCP design preferences, qualitative feedback and possible patient safety hazards of CUI drug search designs focusing on the areas of:

- Template prescriptions

- Generic versus branded issues

- General usability issues

E.3 Research Design

Interviews were structured, lasted one hour and carried out in person. Participants were taken through wireframe design alternatives for each area of investigation and asked for preference based on patient safety criteria. Other qualitative feedback was elicited covering:

- Rationale for preference
- Design fit with current and best practice
- Design understandability
- Any potential hazards resulting from the designs.

The online survey used open and closed questions, generally took 20—40 minutes for respondents to complete and focused only the template prescription issues. As with the interviews, respondents were shown design alternatives and asked for preferences and rationale based on patient safety criteria.

Detailed notes from the interviews were qualitatively analysed using thematic coding.

E.4 Results

E.4.1 Participant Description

Interviews

14 participants were interviewed in 11 sessions. Each participant had either volunteered through the NHS CFH Event Management System (EMS) signup or had been recruited by an HCP who had volunteered. 8 out of 14 participants had previously taken part in CUI clinical engagement for other work areas. Table 5 shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Prescriber?	Systems Used	CUI Feedback?
342	Pharmacy Technician	?	?	Drug history	Discharge	No
	Pharmacist	Cancer Services	Senior	Independent	Discharge	No
343	Pharmacist and Governance	?	Senior	Supplementary	Discharge	Yes
	Pharmacist	Renal	?	Independent	Discharge	No
	Pharmacist	Cancer Services	?	?	Chemotherapy System	No
344	Nurse Analyst	?	Senior	Limited	PCIS	Yes
345	Nurse Analyst	Diabetes	Senior	Limited	PCIS	Yes
346	Doctor	Paediatrics	Consultant	Yes	PCIS	Yes
347	Pharmacist	Paediatrics	Consultant	Independent	PCIS	No
348	Pharmacist and System Manager	?	Senior	Independent	PCIS	Yes
349	Doctor	Psychiatry	SpR	Yes	JAC, HIS	Yes
350	Doctor	Psychiatry	Consultant	Yes	No	Yes
351	Nurse	Oncology	Senior	Limited	No	No
352	Doctor	SpR	Elderly care	Yes	Discharge	Yes

Table 20: Interview Participants

All interview participants were clinical staff and were from five different trusts with diverse geographical locations.

Seven interview participants had used electronic prescribing before and a further five had used an electronic To Take Out (TTO) system with very basic prescribing functionality.

Online Survey

Survey respondents had either volunteered through the NHS CFH EMS signup or had previously participated in a CUI clinical engagement. Responses were anonymous. Table 21 shows a summary of the respondents' job roles:

Job Role	Number of Respondents
Community Nurse	1
Other Nurse	2
Junior Doctor	4
Consultant (Medical)	9
Surgeon	1
Anaesthetist	2
Pharmacist	23
Healthcare Scientist	1
Pharmacy Technicians	2
Healthcare Informatician	1
Healthcare Manager	1
Change Agent	1

Table 21: Online Survey Respondents

The total number of respondents was 48. 70% of respondents described themselves as patient facing and 48% had never used an ePrescribing system before.

E.4.2 Design Areas

Defaults and Templates

- When comparing defaulting values versus template prescriptions:
  - 60% preferred templating
  - 14% preferred defaulting
  - Other respondents answered: 'no preference' (10%), 'it depends' (8%) or 'none are safe'(8%)
- Though disadvantages were raised with both approaches, on balance the rationale given by interview participants and survey respondents suggested that templates were the safer and more scalable solution:
  - For example, when compared with defaulting, templates forced a choice (rather than unconscious acceptance) and the presence of alternatives prompted (though did not ensure) thinking
- If a template approach were to be used, consideration would have to be given as to whether the order of presentation was by 'commoness' or by having the 'lowest' first

- A number of other issues were raised with the approach of suggesting values to prescribers including how to:

  - Handle 'non-normal' groups (such as renal insufficient and paediatric patients)

  - Encourage prescribers to consider whether templates are really appropriate for their patient

  - Ensure full knowledge support is not ignored

  - Prevent mis-selection if the list of templates changes over time

  - Convey what the template is appropriate for and then whether this indication changes the overall prescribing UI workflow

  - Handle different 'commonness' in different clinical contexts

  - Convey trust by provenance

  - Ensure templates are easy to compare

  - Ensure there is a clear path if prescribers do not want a template

Template Layout

- When comparing possible layouts, the clear preference in the survey and interviews was for the tabular layout as this:

  - Allowed comparison of each attribute

  - Had dose as the first attribute

  - Did not repeat attributes previously selected

- Criticism of the tabular layout was that it discouraged 'reading the prescription as a recognisable entity'

- Though a tabular layout was deemed superior in this feedback, consideration should be given to its increased requirements for space

Drug Name in Template

- Though preference was slight, the majority of interview participants and survey respondents said they would prefer not to have the drug name repeated in the template, as long as it was clear elsewhere (such as from a still visible previous selection):

  - *There are other factors that would argue against the name redisplay such as the additional space taken up and distraction when comparing different templates*

Access to Templates

- Before they could see the template prescriptions, design alternatives covered whether prescribers should have to select:

  a. Just the drug

  b. Drug and route

  c. Drug, route and form

  Each additional selection would cut down the number of templates that would be displayed.

- Preferences from the survey are likely to have been distorted by the use of a controlled drug example, as controlled drugs require mandatory specification of the form

- Based on the rationale given for preference, restriction of the visible templates by a selection in addition to drug seems the safer approach:
  - Participants felt that route was appropriate for this selection as it is almost always known
- The NHS CFH ePrescribing team have also specified that mandatory recording of form for each prescription will not be necessary for every prescription under their 'modified marker' scheme:
  - Previous CUI user feedback suggested that mandatory recording of form would be unpopular with secondary care clinicians

Do Not Want a Template?

- Interview participant preference and rationale suggested that there should be an explicit option to not choose a template presented at the same time as the templates. Though it may need to be made distinct from the templates to ensure it is not mistaken for one
- Consideration should also be given to:
  - Retaining the prescriber's existing selections
  - A prompt if the system can tell if the templates are not appropriate for the patient

Modified Release

- Participants suggested that the modified release filter be up-front so that prescribers were not shown templates which mixed modified and non-modified release medications:
  - Also that there could be more explicit differentiation such as 'Immediate release'
- Participants also raised issues around the clarification of exactly how fast the release was: 4, 12, or 24 hours

Generic Versus Branded – Morphine

- Form definition before brand is problematic for morphine as some brands are only available as specific forms
- The heading 'Generic' was seen as very confusing for branded templates

Generic Versus Branded – Tylex

- Participants had difficulty with all four design alternatives
- Recommendations resulting from the issues raised:
  - When switching from a brand to a generic name, the exact equivalent to the brand should be clear (either by only showing it or by marking it up)
  - Consider how to prescribe co-drugs as separate entities
  - Mitigate the issue of combination drug contents in search being obscured after selection
  - Improve encouragement of generic prescribing, perhaps by defaulting selection to the generic option

APPENDIX F STUDY ID 37: EXECUTIVE SUMMARY

F.1 Abstract

The UK National Health Service (NHS) Common User Interface (CUI) programme is a partnership between Microsoft® and NHS Connecting for Health (NHS CFH), which is part the NHS National Programme for Information Technology (NPfIT).

As part of CUI, the Clinical Applications and Patient Safety (CAPS) project has the goal of ensuring that software applications used by the NHS enhance patient safety. To achieve this, CAPS provides software developers with user interface design guidelines derived through a user-centric development process that includes explicit patient-safety evaluations.

This summary describes key findings from user research carried out in July 2008 by the CUI CAPS team on searching for drugs to prescribe. These findings are a subset of those in a larger internal report prepared for the CUI CAPS Search and Prescribe team.

Purpose:

To gain clinical feedback on design concepts for searching for drugs to prescribe in electronic systems.

Method:

Interviews: structured interviews with 15 Healthcare Professionals (HCPs) eliciting HCP preferences and qualitative feedback on design alternatives.

Key Results:

Based on clinician preference and rationale:

- The current method of searching for brands is inappropriate

- The 'Commonly Prescribed' grouping was well received though questions remain about where this is 'common' to

- There are several suggestions for improving aspects of the search interaction

- The number of characters to trigger results display is still unclear. Current preferences are based on speculation of possible error, which might be clarified either with real data or more robust experimentation

F.2 Research Objectives

To gather HCP design preferences, qualitative feedback and possible patient safety hazards of CUI course definition designs focusing on the areas of:

- Character trigger level
- Generic versus brand search

F.3 Research Design

Interviews were structured, lasted on average one hour and carried out in person. Using a variety of prescribing tasks, participants were taken through:

1. An interactive prototype for drug searching

2. Static wireframes for some aspects of design

Participants were then asked for preferences based on patient safety criteria. Other qualitative feedback was elicited covering:

■ Rationale for preference

■ Design fit with current and best practice

■ Design understandability

■ Any potential hazards resulting from the designs.

Design alternatives were order balanced per task.

Detailed notes from the interviews were qualitatively analysed using thematic coding.

F.4 Results

F.4.1 Participant Description

15 participants were interviewed in 11 sessions. Each had either volunteered through the NHS CFH Event Management System (EMS) signup or had been recruited by an HCP who had volunteered. 4 out of 15 respondents had previously taken part in CUI clinical engagement for other work areas. Table 5 shows a summary of the participants' profiles:

Session	Job Role	Specialty	Level	Used a Drug Search before?	System Used	Computer Experience
280	Pharmacist	Systems	Senior	Yes	PCIS	High
	Nurse Analyst	?	? Junior	No (but trains doctors)	?	Medium
281	Doctor	Diabetes and Endocrinology	SpR	Yes	PCIS	Medium
282	Doctor	Paediatrics	Consultant	Yes	PCIS	Medium
284	Nurse Analyst	?	?	Yes (trains doctors)	PCIS	Medium
285	Pharmacist and Analyst	Systems	?	Yes (manages system)	PCIS	High
286	Nurse	Critical Care	Senior	Yes	PICCS	Medium
287	Doctor	Intensive Care	Consultant	Yes	PICCS	Medium
	Doctor	Anaesthetics	Consultant	Yes	PICCS	Medium
	Pharmacist	Systems	Consultant	Yes	PICCS	High
288	Doctor	Elderly Medicine	SpR	No	-	Medium
289	Pharmacist	Paediatric Oncology	Senior	Yes	Chemotherapy one	Medium
290	Nurse	Nephrology	?	A little	Proton	Medium
	Pharmacist	Nephrology	Senior	Yes	Proton	Medium
291	Doctor	Paediatrics	Associate Specialist	No	-	Medium

Table 22: Interview Participants

All participants were clinical staff who prescribe as part of their role, or are involved with prescribing and are aware of related medication safety issues. All participants were from acute secondary care. The participants were from a number of different trusts, with diverse geographical locations.

12 out of 15 participants had used some kind of electronic search to find drugs for prescribing. The majority had medium computer experience as they had to use computers as part of their clinical

work. High experience includes items such as being familiar with spreadsheet calculation functions and having an understanding of databases.

F.4.2 Design Areas

Advantages of Current System Drug Search

- Find a medication through generic or brand name, or local synonym
- Results filtered based on context (for example, filtered to those generally used in current specialty)
- Indication matched to drug selected at start of prescribing process as part of decision support check

'Commonly Prescribed' Grouping

- Participants were supportive of the feature
- Questions were raised about to whom the results were 'common'. That is, if it meant 'commonly prescribed in this trust' is the set of commonly prescribed medications across all contexts in that trust a small enough set to be useful?
- While some participants suggested 'commoness' could be per context (for example, per specialty), this would pose problems for people working cross-speciality such as junior doctors at night
- Some degree of banner blindness observed as four participants did not initially see the group

Co-Drug Search

- All participants struggled to find co-drugs as missing hyphens were not tolerated by the search

Naming Issues

- Due to the search matching on the first word in a term, participants struggled to find results such as 'yellow soft paraffin' and 'aspirin + paracetamol' because their search key was not at the start of the term
- Brands which have the first few letters the same as the generic drug are likely to be promoted, as both would be returned by searches on the first few characters

Insulin

- Participants described insulin prescribing as a difficult problem, with the implication that certain drugs such as insulin and heparin may require special handling in the search (for example, using 'insulin' to return a set of related insulins)

Generic and Brand Search

- All participants felt the current design was incorrect. That is, if you search using a brand, they felt having to re-enter the generic name in order to prescribe the generic drug was too time-consuming
- Suggested solutions were split between:
  - Returning both brand and generic names if searching on a brand name (four sessions)
  - Directly diverting the prescriber to the generic name if searching on a brand name, apart from where branded prescribing is mandatory (four sessions)

Co-Drugs

- All participants liked and understood the idea of displaying the ingredients of co-drugs

- Of 11 participants asked, 9 were confused by the co-drug search and felt it was problematic (consequently, this feature has been removed from CUI designs)

Quick List

- The majority of participants felt the Quick List would be useful, though all assumed it would be a list customised to their clinical context (team, department or specialty) rather than a trust-wide list

- From their explanations of why it would be useful, participants confirmed that for many clinical contexts, or individuals, the number of medications used is small (at least for those that are commonly prescribed)

- Participants raised concerns about mis-selection if the list slowly changed, and also questioned how the Quick List was different to the 'common matches' at the top of the search results

Character Trigger

- After performing a number of prescribing tasks on the prototype using two and four character triggers, participant preference for a character trigger level was very mixed. Preferences were dependant on which risk participants saw as the more serious:

  - Not finding a drug due to an incorrect character being typed (potential issue with four characters)

  - Mis-selecting from a longer list of results (potential issue with two characters)

- Some participants felt four characters relied too much on correct spelling of drug names and might increase the use of free-text prescriptions (which would be dangerous), also that mis-selection error was still possible on four characters

- Some participants felt two characters would continue to allow clinicians to not learn the correct spelling of drug names (a bad thing) and encourage longer results lists, which might lead to longer reading times and mis-selection

- One participant was confused as to why results were not appearing (confirming the utility of the 'type *X* characters' hint)

REVISION AND SIGNOFF SHEET

Change Record

Date	Author	Version	Change Reference
10-Jun-2009	Sarah Parker	3.0.0.1	Initial draft for review/discussion. Version set to v3 to correct v1 numbering wrongly set at previous Baseline.
15-Jun-2009	Sarah Parker	3.0.0.2	Amendments following CRS
29-Jun-2009	Sarah Parker	3.0.0.3	Release 6A guidance added
22-Jul-2009	Sarah Parker	3.0.0.4	Draft for copyedit
29-Jul-2009	Mick Harney	3.0.0.5	Preliminary copyedit
31-Jul-09	Sarah Parker	3.0.0.6	Revisions following copyedit
03-Aug-2009	Manuela Perr	3.0.1.0	Raised to Working Baseline
10-Aug-2009	Mick Harney	3.0.1.1	Went through comments and changes left from 3.0.0.6. Added bookmarks.
04-Sep-2009	Sarah Parker	3.0.1.2	Amendments following CRS
21-Sep-2009	Manuela Perr	3.1.0.0	Raised to Baseline Candidate
28-Sep-2009	Sarah Parker	3.1.0.1	Updated references and made amendments following review
01-Oct-2009	Mick Harney	3.1.0.2	Copyedit of updated and amended version
02-Oct-2009	Sarah Parker	3.1.0.3	Revisions following copyedit
02-Oct-2009	Mick Harney	3.2.0.0	Raised to Baseline Candidate #2
15-Oct-2009	Sarah Parker	3.2.0.1	Revisions following verification comments
15-Oct-2009	Mick Harney	3.3.0.0	Raised to Baseline Candidate #3
28-Oct-2009	Mick Harney	4.0.0.0	Raised to Baseline

Document Status has the following meaning:

■ **Drafts 0.0.0.X** – Draft document reviewed by the Microsoft CUI Project team and the Authority designate for the appropriate Project. The document is liable to change.

■ **Working Baseline 0.0.X.0** – The document has reached the end of the review phase and may only have minor changes. The document will be submitted to the Authority CUI Project team for wider review by stakeholders, ensuring buy-in and to assist in communication.

■ **Baseline Candidate 0.X.0.0** – The document has reached the end of the review phase and it is ready to be frozen on formal agreement between the Authority and the Company

■ **Baseline X.0.0.0** – The document has been formally agreed between the Authority and the Company

Note that minor updates or corrections to a document may lead to multiple versions at a particular status.

Open Issues Summary

Issue	Raised By	Action to Resolve
None		

Audience

The audience for this document includes:

- **Authority CUI Manager / Project Sponsor**. Overall project manager and sponsor for the NHS CUI project within the Authority

- **Authority Clinical Applications and Patient Safety** Project **Project Manager.** Responsible for ongoing management and administration of the Project

- **The Authority Project Team**. Responsible for jointly agreeing with the Company NHS CUI Project Team the approach defined in this document and any necessary redefinition of the Clinical Applications and Patient Safety Project strategy that results from the document or approach agreed

- **Company NHS CUI Team**. Responsible for agreeing with the Authority Project Team the approach defined in this document, including any necessary redefinition of the Clinical Applications and Patient Safety Project strategy that results from the document or approach agreed

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